CANCER IN WATERLOO REGION:
A population health status report
ACKNOWLEDGEMENTS

This report was produced under the direction of Region of Waterloo Public Health’s Cancer Health Status Report Steering Committee comprised of managers and directors in Public Health’s Infectious Disease, Dental and Sexual Health (IDDSH) division and Healthy Living (HL) division. Staff in Public Health’s Epidemiology and Health Analytics (EHA) Team contributed to the cleaning and analysis of cancer, screening and risk factor data used in this report. Staff in Public Health’s IDDSH and HL divisions contributed to the content and also reviewed the report.

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MESSAGE FROM THE MEDICAL OFFICER OF HEALTH

One of the mandates of local public health units in Ontario is to reduce the burden of preventable chronic diseases of public health importance, including cancer.

Region of Waterloo Public Health fulfills this mandate by facilitating an increase in the adoption of behaviours and skills that are in turn associated with a reduction in risk of developing chronic diseases. Our chronic disease-related programs are guided by the Ontario Public Health Standards (OPHS) and the needs of the local population.

Region of Waterloo Public Health monitors cancer incidence, mortality, and screening, as well as the prevalence of modifiable risk factors for cancer, including tobacco use and exposure to second hand smoke, exposure to ultraviolet radiation, alcohol consumption, nutrition, physical activity levels, and risk factors for human papillomavirus (HPV) infection. We are committed to sharing this valuable information with the public, community partners, and health care providers.

In fulfillment of these mandates and commitments, I am pleased to introduce *Cancer in Waterloo Region: A Population Health Status Report*. This report is the first of its kind, providing a detailed picture of the health of Waterloo Region residents specifically as it relates to the occurrence, risk, and prevention of cancer.

I hope that you find the information in this report both useful and meaningful. As always, Region of Waterloo Public Health continually works to improve its programs, services and reporting of chronic diseases, including cancer, in our efforts to build healthy and supportive communities in partnership.

Dr. Liana Nolan
Commissioner/Medical Officer of Health
Region of Waterloo Public Health
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<tr>
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<tr>
<td>APC</td>
<td>Annual per cent change</td>
</tr>
<tr>
<td>BMI</td>
<td>Body mass index</td>
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<tr>
<td>CCHS</td>
<td>Canadian Community Health Survey</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
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<td>CIHI</td>
<td>Canadian Institute for Health Information</td>
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<td>FOBT</td>
<td>Fecal occult blood test</td>
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<td>HIV</td>
<td>Human immunodeficiency virus</td>
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<td>HPV</td>
<td>Human papillomavirus</td>
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<tr>
<td>ICD</td>
<td>International Classification of Diseases</td>
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<td>ICD-O</td>
<td>International Classification of Diseases for Oncology</td>
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<tr>
<td>IRIS</td>
<td>Immunization Records Information System</td>
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<td>MOHLTC</td>
<td>(Ontario) Ministry of Health and Long Term Care</td>
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<tr>
<td>MRI</td>
<td>Magnetic resonance imaging</td>
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<tr>
<td>MVPA</td>
<td>Moderate- to vigorous-intensity physical activity</td>
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<tr>
<td>NACI</td>
<td>National Advisory Committee on Immunization</td>
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<tr>
<td>NEWPATH</td>
<td>Neighbourhood Environment in Waterloo Region: Patterns of Transportation and Health study</td>
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<td>NHL</td>
<td>Non-Hodgkin lymphoma</td>
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<td>Non-small cell lung cancer</td>
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<td>NTS</td>
<td>Nutrition Tools for Schools</td>
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<td>OBSP</td>
<td>Ontario Breast Screening Program</td>
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<td>Rapid Risk Factor Surveillance System</td>
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<td>SHS</td>
<td>Second-hand smoke</td>
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<tr>
<td>SIR</td>
<td>Standardized incidence ratio</td>
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<tr>
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EXECUTIVE SUMMARY

This report provides a comprehensive overview of the epidemiology of cancer in Waterloo Region. It examines cancer incidence, mortality and survival trends from 1986 to 2009, which was the most recent available data at the time of report production, and compares local data to that for the province of Ontario as a whole.

Thirteen major cancer sites are described in detail, specifically: lung, colorectal, female breast, prostate, melanoma (skin), cervical, ovarian, uterine, oral, bladder, leukemia, non-Hodgkin lymphoma, and cancers of the head and neck. An additional eight rare cancer sites are also discussed, specifically: anal, kidney, liver, pancreatic, stomach, testicular, and thyroid. For the purposes of this report, a cancer site is defined as rare when there were fewer than 1,000 cases or fewer than 500 cases for sex-specific cancers, in Waterloo Region from 1986 to 2009.

Modifiable risk factors with a strong association for one or more types of cancer are also examined in this report, specifically: tobacco use, sun and ultraviolet radiation exposure, alcohol consumption, nutrition, physical activity and sedentary behaviours, and human papillomavirus (HPV) infection. Organized cancer screening programs exist in Ontario for breast, cervical and colorectal cancer, and local screening behaviours for these three types of cancer are also discussed.

BACKGROUND ON CANCER IN CANADA

The impact of cancer is far-reaching. Nearly half of all Canadians (41 per cent of females and 46 per cent of males) will develop cancer at some point in their lifetime. It is the leading cause of death in Canada, accounting for nearly 30 per cent of all deaths. The vast majority (88 per cent) of Canadians who develop cancer are over the age of 50; however, cancer can occur at any age. The number of new cancer cases in Canada has been increasing over the past 30 years; however, these increases can largely be attributed to the aging and growing populations, with improvements in diagnostic screening and detection also playing a role.

Four types of cancer account for more than half of all new cancer cases diagnosed in Canada: lung, breast, colorectal, and prostate cancer. Prostate is the most common cancer diagnosis in men, while breast is the most common diagnosis in women.

Lung cancer is the leading cause of cancer death in Canada. Lung, colorectal, breast and prostate cancer together account for approximately 50 per cent of all cancer deaths. Although it is much rarer, pancreatic cancer is the fourth leading cause of cancer death in both males and females, due to its low survival ratio. The vast majority of cancer deaths in Canada occur in people over the age of 50 years.
The five-year relative survival ratio, a measure of the proportion of people with cancer who survive for five years after their diagnosis relative to the survival rate of the general population, is higher today in Canada than it was two decades ago. The relative survival ratio increased from 56 to 63 per cent between 1992 to1994 and 2006 to 2008. Relative survival ratios vary widely by type of cancer, with thyroid (98 per cent), testicular (97 per cent) and prostate (96 per cent) cancers having very high five-year relative survival ratios, and pancreatic (eight per cent) and lung (17 per cent) cancers having consistently low five-year relative survival ratios.

OVERALL TRENDS IN WATERLOO REGION

In Waterloo Region, female breast cancer was the most common type of cancer diagnosis, followed by prostate, colorectal, and lung. This differed from Ontario as a whole, where lung cancer was the most common diagnosis, followed by female breast, prostate, and then colorectal. The most common type of cancer deaths were lung, colorectal, and female breast cancer for both Waterloo Region and Ontario.

The incidence of all cancers combined increased from 1986 to 2009 in Waterloo Region and Ontario, primarily among females. Mortality rates from all cancers combined decreased from 1986 to 2009 for both males and females in Waterloo Region and Ontario. Males had significantly higher incidence and mortality rates for all cancers, compared to females.

The five-year relative survival ratio in Waterloo Region for 1998 and 2002 was 62 per cent, an increase from 53 per cent in 1986 to 1990. These overall relative survival ratios for all cancers in Waterloo Region were similar to those for Ontario.

TRENDS BY MAJOR CANCER SITE

Lung cancer was the fourth most common cancer diagnosis in Waterloo Region, accounting for 12 per cent of all cancer cases from 1986 to 2009. There were 268 new local cases in 2009. It was most frequently diagnosed among older adults over the age of 65 years. While lung cancer incidence and mortality rates have decreased among men, rates have increased among women. Lung cancer incidence and mortality rates were lower in Waterloo Region than in Ontario. Lung cancer survival ratios were lower in Waterloo Region compared to Ontario. Relative survival in both Waterloo Region and Ontario were poor, although there were slight improvements over time. Approximately 15 per cent of people diagnosed with lung cancer in 1998 to 2002 were expected to survive for five years compared to people in the general population.
Colorectal cancer was the third most common cancer diagnosis in Waterloo Region, accounting for 13 per cent of all cancer cases from 1986 to 2009. There were 288 new local cases in 2009. It was more frequently diagnosed in men than women. Men were more likely to die from colorectal cancer than women. Colorectal cancer incidence and mortality rates were similar in Waterloo Region and Ontario, and slowly declined since 1986. Colorectal cancer survival ratios in Waterloo Region and Ontario were similar, and both improved over the last two decades. Over 60 per cent of people in 1998 to 2002 diagnosed with colorectal cancer were expected to survive for five years compared to people in the general population.

Female breast cancer was the most commonly diagnosed cancer in Waterloo Region, accounting for 14 per cent of all local cancer cases from 1986 to 2009. There were 310 new local cases in 2009. Incidence rates in Waterloo Region remained fairly stable since the early 1990s. There were considerable reductions in female breast cancer mortality in Waterloo Region between 1986 and 2009. There were no significant differences between either female breast cancer incidence or mortality rates when comparing Waterloo Region to Ontario. Survival ratios for female breast cancer were similar between Waterloo Region and Ontario, although local longer-term survival ratios were not quite as high as those for the province as a whole. More than 83 per cent of women diagnosed with female breast cancer in Waterloo Region in 1998-2002 were expected to survive for five years compared to women in the general population.

Prostate cancer was the most commonly diagnosed cancer among men in Waterloo Region, accounting for 13 per cent of all cancer cases from 1986 to 2009. There were 298 new local cases in 2009. Incidence rates increased sharply in the early 1990s, primarily due to the introduction of the PSA test. Mortality rates of prostate cancer declined since the mid-1990s. Males aged 70 years or older were most likely to die from prostate cancer, with very few deaths among men younger than 50 years of age. Survival ratios in Waterloo Region and Ontario were similar, with dramatic improvements in longer-term survival over the last two decades. Over 93 per cent of men diagnosed with prostate cancer in 1998 to 2002 were expected to survive for five years compared to men in the general population.

Melanoma was the sixth most common cancer diagnosis in Waterloo Region, accounting for four per cent of all cancer cases from 1986 to 2009. There were 79 new local cases in 2009. Incidence rates have increased over time since 1986; however, Waterloo Region experienced a recent decline in the rate of new cases, a trend that did not occur provincially. While deaths due to melanoma were rare, mortality rates have slowly increased. Males experienced higher incidence and mortality rates than females. Survival ratios for melanoma were high, with local ratios slightly exceeding provincial ratios. Over 90 per cent of people in Waterloo Region diagnosed in 1998 to 2002 with melanoma were expected to survive for five years compared to people in the general population.

Cervical cancer accounted for just over one per cent of all cancer cases in Waterloo Region from 1986 to 2009. There were 15 new local cases in 2009. Incidence fluctuated
Cancer in Waterloo Region since 1986 due to normal variation seen with small numbers of cases; however, provincial rates have steadily declined. Cervical cancer incidence rates were highest among women aged 40 to 49 years. Both the number of deaths due to cervical cancer and the age-standardized mortality rate have decreased over time. Survival ratios for cervical cancer improved slightly over the past few decades, although these improvements were more pronounced provincially than locally. Over 72 per cent of women in Waterloo Region diagnosed in 1998 to 2002 with cervical cancer were expected to survive for five years compared to women in the general population.

**Ovarian cancer** was the fifth most commonly diagnosed cancer among women in Waterloo Region, accounting for approximately four per cent of all female cancer cases from 1986 to 2009. There were 57 new local cases in 2009. Incidence rates for Ontario gradually increased between 1986 and 2002, with rates levelling off afterward. There was a gradual decline in ovarian cancer mortality since 1986, with mortality rates decreasing more rapidly since the early 2000s. Ovarian cancer incidence and mortality rates were highest among women 70 years of age and older. Long-term survival ratios for ovarian cancer remained mediocre in both Waterloo Region and Ontario, although local survival ratios were slightly higher than those seen provincially. Just under 50 per cent of women in Waterloo Region diagnosed in 1998 to 2002 with ovarian cancer were expected to survive for five years compared to women in the general population.

**Uterine cancer** was the fourth most common cancer diagnosis among women in Waterloo Region, accounting for six per cent of all female cancer cases from 1986 to 2009. There were 55 new local cases in 2009. Incidence rates were relatively stable between 1986 and 2009. Deaths from uterine cancer were rare in Waterloo Region, with a majority occurring in women over the age of 70 years. Long-term survival ratios for uterine cancer were similarly high in both Waterloo Region and Ontario. Over 87 per cent of women in Waterloo Region diagnosed with uterine cancer in 1998 to 2002 were expected to survive for five years compared to women in the general population.

**Oral cancer** accounted for approximately two per cent of all cancer cases in Waterloo Region from 1986 to 2009. There were 45 new local cases in 2009. Incidence and mortality rates have decreased since 1986, driven primarily by a decline in incidence rates among men; rates among women remained fairly stable during this time period. Oral cancer incidence and mortality increased with age, with more new cases and deaths reported among men than women. Long-term oral cancer survival ratios were slightly higher for Ontario than for Waterloo Region. Both local and provincial survival ratios had only modest improvements over the last few decades. Nearly 60 per cent of people in Waterloo Region diagnosed with oral cancer in 1998 to 2002 were expected to survive for five years compared to people in the general population.

**Bladder cancer** was the eighth most common cancer diagnosis in Waterloo Region from 1986 to 2009, accounting for approximately three per cent of all cancer cases. There were 84 new local cases in 2009. Incidence rates decreased from 1986 to 2009. Bladder cancer incidence and mortality rates were significantly higher in men than women, particularly among men aged 75 years or older. Survival ratios in Waterloo
Region were lower than those for all of Ontario. Both locally and provincially, there were slight declines in short and long-term survival ratios from bladder cancer over the last few decades; however these declines may be due more to a change in coding practices than a true decline in survival. Approximately 65 per cent of people in Waterloo Region diagnosed with bladder cancer in 1998 to 2002 were expected to survive for five years compared to people in the general population.

**Leukemia** accounted for approximately three per cent of all cancer cases in Waterloo Region from 1986 to 2009. There were 74 new local cases in 2009. Incidence rates were relatively constant since 1986, despite some year-to-year fluctuations. Unlike many other types of cancer, incidence rates of leukemia were moderately high among children and adolescents. Leukemia mortality rates slowly decreased over time among both males and females. Males experienced higher incidence and mortality rates than females. Survival ratios for leukemia were modest, with similar or slightly lower rates in Waterloo Region compared to those for the province as a whole. Approximately 50 percent of people in Waterloo Region diagnosed in 1998 to 2002 with leukemia were expected to survive for five years compared to people in the general population.

**Non-Hodgkin lymphoma (NHL)** was the fifth most common cancer diagnosis in Waterloo Region, accounting for approximately four per cent of all cancer cases from 1986 to 2009. There were 99 new local cases in 2009. Incidence rose steadily from 1986 to 2009. NHL mortality increased through the 1980s and 1990s, but has declined since that time. Males experienced higher incidence and mortality rates than females. Survival ratios were similar in Waterloo Region and Ontario. Both short and long-term NHL survival ratios improved over the last few decades. Sixty per cent of Waterloo Region residents diagnosed in 1998 to 2002 with NHL were expected to survive for five years compared to people in the general population.

**Cancers of the head and neck** accounted for approximately three per cent of all cancer cases diagnosed in Waterloo Region from 1986 to 2009. There were 62 new local cases in 2009. Incidence rates decreased through the 1990s, but were relatively stable since that point. Mortality rates decreased, driven primarily by a decline in rates among men. Males experienced higher incidence and mortality than females. Survival ratios for cancers of the head and neck were moderate overall, although ratios were slightly lower in Waterloo Region compared to those for all of Ontario. Approximately 60 per cent of people in Waterloo Region diagnosed with cancer of the head or neck in 1998 to 2002 were expected to survive for five years compared to people in the general population.

**RARE CANCERS**

There were approximately locally ten cases of **anal cancer** diagnosed per year. Incidence and mortality rates in Ontario fluctuated but otherwise did not change greatly.
over time. Two-thirds of individuals in Ontario were expected to survive for five years compared to people in the general population.

There were 50 or fewer local cases of kidney cancer per year. Locally and provincially, the incidence rate slowly increased over time. Rates were higher in men than women, and most cases occurred in individuals over age 60.

There were approximately ten cases of liver cancer diagnosed in Waterloo Region per year, the majority of which were in men. Incidence rates steadily increased in Ontario. Survival ratios remained poor, with less than a quarter expected to survive for five years compared to people in the general population.

There were typically 50 or fewer local cases of pancreatic cancer per year. There was a modest decline in mortality rates over time. Survival ratios remained quite poor; less than ten per cent were expected to survive for five years compared to people in the general population.

There were typically 40 or fewer local cases of stomach cancer diagnosed per year, the majority of which were in men. Incidence and mortality rates decreased over time both locally and provincially. Approximately one quarter were expected to survive for five years compared to people in the general population.

There were typically fewer than 20 local cases of testicular cancer per year. Provincially incidence rates slowly increased over time. Two-thirds of cases were diagnosed in men between the ages of 20 to 39 years. Survival ratios were excellent with more than 96 per cent expected to survive for five years compared to people in the general population.

There were typically fewer than 50 local cases of thyroid cancer per year, eighty per cent of which were diagnosed among females. Provincial incidence rates more than quadrupled over time. Survival ratios were excellent with more than 97 per cent expected to survive for five years compared to people in the general population.

MODIFIABLE RISK FACTORS FOR CANCER

For tobacco use, in 2011/2012 twenty per cent of the population in Waterloo Region currently smoked; a similar proportion to Ontario. Current smoking rates decreased with age, higher household income, and higher levels of education.

For second-hand smoke exposure, nearly 17 per cent of the population in Waterloo Region were regularly exposed to second-hand smoke, similar to Ontario.
For **sun and ultraviolet (UV) radiation exposure**, over one-third of adults in Waterloo Region got sunburnt within the past 12 months. Younger adults, those with higher incomes and those with more education were more likely to have been sunburnt. Two-thirds of adults wore sunglasses with UV protection, the most commonly reported sun protective behaviour.

For **alcohol consumption**, 62 per cent of the population aged 12 years and older in Waterloo Region regularly drank, similar to Ontario. Seventeen per cent of the population had one or more heavy drinking episodes in the past 12 months, similar to Ontario. Men were more likely to have heavy drinking episodes than women. Women used to be less likely than men to be regular drinkers, but now they are equally likely to regularly drink. Regular drinking rates were higher in young adults, and in those with higher household income or higher education.

For **nutrition**, over one-third of the population aged 12 years and older in Waterloo Region consumed vegetables and fruit five or more times per day, similar to Ontario. The prevalence of consuming vegetables and fruit five or more times per day decreased from 2009/2010 to 2011/2012 both locally and provincially. Just over 40 per cent of Waterloo Region adults reported being at a healthy weight, similar to Ontario.

For **physical activity**, the proportion of the population who were active during leisure time was lower in Waterloo Region than Ontario. Physical inactivity increased with age. There were slight increases over time in moderately active and active physical activity both locally and provincially.

For **sedentary behaviour**, nearly two-thirds of people were sedentary for 15 hours or more per week during leisure time, a significant increase in proportion over time, both locally and provincially. Older adults were more likely to watch TV or videos compared to young adults.

For **HPV infection**, two-thirds of the population aged 15 to 49 years in Waterloo Region reported their age of sexual debut was less than 20 years old, similar to Ontario. The proportion of the population aged 15 to 49 years in Waterloo Region who reported having two or more sexual partners in the past 12 months was lower compared to all of Ontario. Men were more likely to have had multiple partners in the past 12 months compared to women.

**CANCER SCREENING AND PREVENTION**

For **breast cancer screening**, just over 60 per cent of eligible women in Waterloo Region had up to date screening, similar to Ontario. Local and provincial mammogram rates increased from 2004/2005 to 2008/2009 and then leveled off.
For **cervical cancer screening**, two-thirds of eligible women in Waterloo Region had up to date screening, slightly higher than Ontario. Local and provincial Pap test rates increased slightly from 2000/2002 to 2009/2011. Just over half of grade eight girls were vaccinated for HPV in 2010/2011.

For **colorectal cancer screening**, just over one-third of eligible adults in Waterloo Region had up to date colorectal cancer screening, slightly higher than Ontario. Local and provincial fecal occult blood test (FOBT) screening rates increased from 2004/2005 to 2010/2011.

**CONCLUSION**

One of the mandates of local public health units in Ontario is to work in partnership with other health care partners to reduce the burden of preventable chronic diseases of public health importance, including cancer. Region of Waterloo Public Health fulfills this mandate by supporting an increase in the adoption of behaviours and skills that are, in turn, associated with a reduction in risk of developing chronic diseases. Our chronic disease-related programs are guided by the Ontario Public Health Standards (OPHS) and the needs of the local population.

Region of Waterloo Public Health assesses cancer incidence, mortality, cancer screening, and the prevalence of modifiable risk factors for cancer, including tobacco use and exposure to second hand smoke, exposure to ultraviolet radiation, alcohol consumption, nutrition, physical activity levels, and human papillomavirus (HPV) infection. Region of Waterloo Public Health is committed to sharing this valuable information with the public, community partners, and health care providers.

This report helps to fulfill Region of Waterloo Public Health’s mandate by providing enhanced population health assessment in accordance with the Ontario Public Health Standards. The findings from this report will be shared with health care providers and the public, and used to inform local cancer prevention efforts and public health programming as it relates to cancer prevention.
INTRODUCTION

Region of Waterloo Public Health is mandated to provide programs in chronic disease prevention and the early detection of cancer. These programs aim to increase the length and quality of life by reducing morbidity and mortality associated with chronic diseases, such as cancer. Region of Waterloo Public Health also aims to reduce mortality from cancer, particularly breast, cervical and colorectal cancers, by increasing early detection through screening and preventing cervical cancer through vaccination.

The objective of this report is to provide a comprehensive overview of the epidemiology of cancer in Waterloo Region. Using the most recent available data, this report describes cancer incidence, mortality and survival ratios in Waterloo Region as compared to those in Ontario. Trends over time for each of these indicators are described as well. Measuring the cancer burden in Waterloo Region is foundational for both primary and secondary prevention efforts, allowing more effective treatment of certain cancers through earlier detection. It is also useful for prioritizing services to help Waterloo Region residents and their families who have been affected by cancer.

Major cancer sites are commonly used in the reporting of cancer incidence data. From 1986 to 2009, cancer sites were coded using the Third Edition of the International Classification of Diseases for Oncology (ICD-O-3) and grouped according to major cancer sites. This report focuses on major cancer sites which are prevalent, modifiable, and/or in accordance with the Ontario Public Health Standards (OPHS) under Chronic Disease Prevention.

Analyses were conducted for all cancers combined, as well as for the following major cancer sites: lung, colorectal, female breast, prostate, melanoma (skin), cervical, ovarian, uterine, oral, bladder, leukemia, non-Hodgkin lymphoma, and cancers of the head and neck. Each major cancer site is addressed in a separate chapter.

Some additional cancers that are considered rare are also described in this report. Rare cancers are defined as those with fewer than 1,000 cases, or fewer than 500 cases for sex-specific cancers, in Waterloo Region during the time period of interest (1986 to 2009). On average, these rare cancers had fewer than 50 cases reported annually in Waterloo Region, which made interpretation of trends difficult. In some cases, only provincial figures are described due to very small numbers. The following cancers were considered rare for the purposes of this report: anal, kidney, liver, pancreatic, stomach, testicular, and thyroid.

There are several measures of cancer burden, including incidence, mortality, survival and prevalence. The number of new cases of cancer (incidence) and deaths (mortality) are important measures of cancer burden. Trends in incidence and mortality rates are used to assess the present burden and can help predict the future burden of cancer, which assist in ensuring adequate testing, diagnostic and treatment services, as well as directing future cancer prevention and control efforts. Relative survival ratios provide a measure of disease severity and prognosis. For example, a person diagnosed with a
cancer that has a poor five-year relative survival has a small probability of living until the fifth anniversary of his or her diagnosis when compared to people in the general population. Relative survival estimates can be used to establish priorities for improving prognosis. Examining these estimates over time, and in conjunction with cancer incidence and mortality trends, can also give information about progress in cancer treatment and control.

In this report, cancer incidence and mortality data is presented for Waterloo Region from 1986 through 2009 (the most recent data available) with comparisons to provincial data where available. Cancer survival data is presented for Waterloo Region and Ontario from 1986 through 2007 (the most recent survival data available). Age, sex, and time trends are highlighted, with more analyses where greater detail would be of interest.

Primary analyses for all cancers combined and for each cancer site include:
- Number of cases and deaths by sex, age group, and year
- Per cent distribution of cases and deaths by sex and age group
- Age-specific incidence and mortality rates by sex
- Age-standardized incidence and mortality rates by sex and year
- Annual per cent change in incidence and mortality rates by sex
- Age-standardized incidence and mortality ratios by sex
- Five-year relative survival ratios by sex

Risk factor, screening, and prevention data is presented in a separate chapter of the report, including local and provincial data where available. Modifiable risk factors with a strong association to one or more types of cancer are examined with a social determinant of health lens where possible, including analysis by age group, sex, income, and level of education.

Cancer screening rates are also described for both Waterloo Region and Ontario where available, since early detection of cancer can influence incidence rates and lead to better treatment outcomes resulting in decreased mortality rates. High-level public health programming information is also included where relevant to highlight Region of Waterloo Public Health’s role in cancer prevention and early detection.

It is important to note that the time between exposure to a risk factor and the clinical diagnosis of cancer is usually 15 to 20 years, depending on the type of cancer. While past exposures are usually more important than current exposures in understanding disease trends, these are often difficult to document. While some references are made to past exposures in this report, current risk factor data is presented in most cases. Current risk factor data is useful for projecting future cancer trends and for focusing prevention efforts.
1.0 BACKGROUND

Cancer is not a single disease. It is a general term for diseases in which abnormal cells divide without control and are able to invade other tissues. There are more than 100 different types of cancer. Other terms that are commonly used to describe cancers include malignant neoplasms or tumors. Cancers are typically named after the part of the body where the disease originates, and are characterized by uncontrolled growth and spread of abnormal cells in the body.\(^1\) Cancers can be classified according to their topography and morphology. Topography indicates the site of origin of a neoplasm, whereas morphology describes the type of cell affected and its biologic activity.\(^2\)

Close to half of all Canadians (41 per cent of females and 46 per cent of males) will develop cancer in their lifetime and about one in four Canadians will die of cancer (Figure 1.1).

**Figure 1.1. Lifetime probability of developing cancer, Canada, 2007**

Cancer is the leading cause of death in Canada, responsible for nearly 30 per cent of all deaths. It was estimated that 187,600 Canadians would develop cancer and 75,500 would die of cancer in 2013.\(^3\)

Four types of cancer account for more than half (52 per cent) of all new cancer cases diagnosed in Canada: lung, breast, colorectal and prostate cancer (Table 1.1). Men make up slightly more than half of all cancer cases in Canada (51 per cent versus 49 per cent in women). The vast majority (88 per cent) of Canadians who develop cancer are over the age of 50; however, cancer can occur at any age.\(^3\) The median age of cancer diagnosis is between 65 and 69 years of age for both males and females.\(^3\) Increases in the number of new cancer cases in Canada over the past 30 years can largely be attributed to the aging and growing population, while improvements in diagnostic screening and detection also play a role.
Table 1.1. Per cent distribution of estimated new cancer cases, by sex, Canada, 2013

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<th>Cancer Site</th>
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Lung cancer is the most common cause of cancer deaths in Canadian males and females. Lung, colorectal, breast and prostate cancer together account for approximately 50 per cent of all cancer deaths in each sex. Although it is a much rarer type of cancer, pancreatic cancer is the fourth leading cause of cancer death in both sexes due to its low survival ratio.3

The chance of dying from cancer differs slightly by sex. Males have a 28 per cent chance of dying from cancer and females have a 24 per cent chance of dying from cancer. It was estimated that 52 per cent of all cancer deaths would occur among males and 48 per cent among females in 2013.3 Older age is also associated with an increased risk of death due to cancer. In 2013, almost all cancer deaths in Canada (95 per cent) were expected to occur in people over the age of 50 years. Most of these deaths (61 per cent) would occur in people aged 70 years and older.3

Survival is the percentage of people who are alive at some point in time after their cancer diagnosis. People diagnosed with cancer today have a better five-year relative survival than they did two decades ago. Between 1992 to 1994 and 2006 to 2008, the five-year relative survival for all cancers combined increased from 56 to 63 per cent; however, survival ranges widely by the type of cancer. Some cancers have very high
five-year relative survival ratios, including thyroid (98 per cent), testicular (97 per cent) and prostate (96 per cent) cancers. Other cancers have consistently low five-year relative survival ratios, such as pancreatic (eight per cent) and lung (17 per cent) cancers.³

It is usually unknown why one person develops cancer and another does not, but research shows that certain factors increase one's risk. Each type of cancer is caused by genetic, lifestyle or environmental influences, or a combination of the three. The most common risk factors for cancer include:

- Growing older
- Family history of cancer
- Tobacco smoking and exposure to second-hand tobacco smoke
- Sunlight and artificial ultraviolet (UV) radiation
- Ionizing radiation
- Alcohol consumption
- Poor diet, lack of physical activity, or being overweight
- Certain chemicals (both human-made and naturally occurring)
- Some viruses and bacteria
- Certain hormones

Some of these risk factors can be avoided (modifiable risk factors). It is estimated that nearly one-third of cancer cases may be prevented through a combination of changes in behaviour and lifestyle, such as a healthy diet, drinking less alcohol, regular physical activity and maintaining a healthy body weight.³,⁴ Others risk factors, such as family history and age, cannot be avoided (non-modifiable risk factors). Many risk factors for cancer are unknown, and the complex interactions between genetic, lifestyle and environmental factors are the subject of on-going investigations.
2.0 ALL CANCERS

Highlights

- Prostate, colorectal, and lung cancers were the most commonly diagnosed cancers among males in Waterloo Region
- Breast, lung, and colorectal cancers were the most commonly diagnosed cancers among females in Waterloo Region
- The incidence of all cancers combined increased from 1986 to 2009 in Waterloo Region and Ontario, primarily among females
- The mortality rate from all cancers combined decreased from 1986 to 2009 for both males and females in Waterloo Region and Ontario
- Males had higher incidence and mortality rates for all cancers, compared to females
- Incidence rates for bladder, breast, lung, and oral cancers were lower in Waterloo Region compared to the province
- Mortality rates for lung cancer were lower in Waterloo Region compared to the province
- Approximately 62 per cent of people diagnosed with cancer in Waterloo Region between 1998 and 2002 were expected to survive for five years compared to people in the general population

2.1 Overview

Cancers are named after the part of the body where they originate, or the site of the cancer. There are numerous forms of cancer, each with their own unique characteristics and adverse health effects. Therefore, information on all types of cancers combined was analyzed and interpreted to provide a comprehensive picture of the influence and impact of cancer as a whole on the Waterloo Region population.

There are many types of cancers that are captured under the category of ‘all cancers’. A list of all cancer sites and how they are classified is provided in Appendix B.

Among all cancers, the top ten leading cancers and cancer deaths in Waterloo Region and Ontario for the period 1986 to 2009 are shown in Tables 2.1 and 2.2, respectively.
The most common cancer diagnosis in Waterloo Region during this time period was female breast cancer, followed by prostate and colorectal cancers. In Ontario, lung cancer was most commonly diagnosed, followed by female breast and prostate cancers. Together, the top three leading cancers comprised 39.7 per cent of all cases in Waterloo Region and 40.4 per cent of all cases in Ontario between 1986 and 2009 (Table 2.1).

The most common cancer deaths were lung, colorectal and female breast cancers for both Waterloo Region and Ontario. Between 1986 and 2009, the top three cancer deaths comprised 37.3 per cent of all cancer-related deaths in Waterloo Region and 46.1 per cent of all cancer-related deaths in Ontario (Table 2.2).

The number of cancer cases and cancer deaths varies by sex, as seen in Tables 2.3 and 2.4.
In Waterloo Region during the period 1986 to 2009, the top three cancer diagnoses among males were prostate, lung and colorectal cancers, comprising 53.0 per cent of all cases. During the same period, the top three cancer diagnoses among females were breast, colorectal and lung cancers, comprising 51.1 per cent of all cases (Table 2.3).

Table 2.3. Top ten cancer diagnoses, by sex, Waterloo Region, 1986-2009

<table>
<thead>
<tr>
<th>Males</th>
<th>Number</th>
<th>Rank</th>
<th>Females</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>5,235</td>
<td>1</td>
<td>Female Breast</td>
<td>5,397</td>
</tr>
<tr>
<td>Lung</td>
<td>2,929</td>
<td>2</td>
<td>Colorectal</td>
<td>2,587</td>
</tr>
<tr>
<td>Colorectal</td>
<td>2,600</td>
<td>3</td>
<td>Lung</td>
<td>1,989</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>932</td>
<td>4</td>
<td>Uterine</td>
<td>1,138</td>
</tr>
<tr>
<td>Bladder</td>
<td>878</td>
<td>5</td>
<td>Ovarian</td>
<td>844</td>
</tr>
<tr>
<td>Melanoma of the Skin</td>
<td>805</td>
<td>6</td>
<td>Non-Hodgkin Lymphoma</td>
<td>797</td>
</tr>
<tr>
<td>Leukemia</td>
<td>791</td>
<td>7</td>
<td>Melanoma of the Skin</td>
<td>776</td>
</tr>
<tr>
<td>Oral Cavity and Pharynx</td>
<td>644</td>
<td>8</td>
<td>Thyroid</td>
<td>623</td>
</tr>
<tr>
<td>Kidney</td>
<td>558</td>
<td>9</td>
<td>Leukemia</td>
<td>574</td>
</tr>
<tr>
<td>Stomach</td>
<td>534</td>
<td>10</td>
<td>Pancreas</td>
<td>458</td>
</tr>
</tbody>
</table>


The most common cancer deaths among males in Waterloo Region were lung, colorectal, and prostate cancers, comprising 50.5 per cent of all male cancer deaths. Among females, the top three cancer deaths were breast, lung, and colorectal, comprising 50.0 per cent of all female cancer deaths in Waterloo Region between 1986 and 2009 (Table 2.4).

Table 2.4. Top ten cancer deaths, by sex, Waterloo Region, 1986-2009

<table>
<thead>
<tr>
<th>Males</th>
<th>Number</th>
<th>Rank</th>
<th>Females</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>2,451</td>
<td>1</td>
<td>Female Breast</td>
<td>1,591</td>
</tr>
<tr>
<td>Colorectal</td>
<td>1,189</td>
<td>2</td>
<td>Lung</td>
<td>1,578</td>
</tr>
<tr>
<td>Prostate</td>
<td>986</td>
<td>3</td>
<td>Colorectal</td>
<td>1,098</td>
</tr>
<tr>
<td>Pancreas</td>
<td>411</td>
<td>4</td>
<td>Ovarian</td>
<td>474</td>
</tr>
<tr>
<td>Leukemia</td>
<td>406</td>
<td>5</td>
<td>Pancreas</td>
<td>444</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>372</td>
<td>6</td>
<td>Non-Hodgkin Lymphoma</td>
<td>355</td>
</tr>
<tr>
<td>Stomach</td>
<td>337</td>
<td>7</td>
<td>Leukemia</td>
<td>281</td>
</tr>
<tr>
<td>Bladder</td>
<td>329</td>
<td>8</td>
<td>Uterine</td>
<td>255</td>
</tr>
<tr>
<td>Kidney</td>
<td>233</td>
<td>9</td>
<td>Stomach</td>
<td>188</td>
</tr>
<tr>
<td>Oral Cavity and Pharynx</td>
<td>201</td>
<td>10</td>
<td>Bladder</td>
<td>143</td>
</tr>
</tbody>
</table>


The distribution of cancer cases and deaths varies by sex, as shown in Figures 2.1 and 2.2.
Sex-specific cancers are not shown in these figures, including female breast, cervical, uterine, prostate, and testicular cancer, as they are experienced almost exclusively by one of the sexes. Instead, a selected variety of the top cancers which afflict both sexes is presented.

Figure 2.1 shows that the distribution of all cancers combined is approximately equal across both sexes, with females experiencing 49.0 per cent of all cancers and males experiencing 51.0 per cent of all cancers in Waterloo Region between 1986 and 2009.

**Figure 2.1. Distribution of cancer cases for selected cancer sites, by sex, Waterloo Region, 1986-2009**

As Figure 2.1 shows, bladder, liver, oral, and stomach cancers were more likely to be diagnosed among males in Waterloo Region, while thyroid and anal cancers were more likely to be diagnosed among females. Colorectal cancer, pancreatic cancer, and
melanomas of the skin were fairly equally distributed across both males and females in Waterloo Region for the period 1986 to 2009.

The distribution of cancer deaths by sex is shown in Figure 2.2. Again, the distribution of cancer deaths in Waterloo Region for the period 1986 to 2009 is fairly equitable between males and females, with 48.2 per cent of deaths among females and 51.8 per cent among males.

Figure 2.2. Distribution of cancer deaths for selected cancer sites, by sex, Waterloo Region, 1986-2009

However, there were some sex-specific differences for cancer deaths. Most notably, there were a greater proportion of thyroid cancer deaths among females, while there were more bladder, oral, liver and stomach cancer deaths among males.

2.2 Local Picture

2.2.1 Incidence

In Waterloo Region, there were 2,232 cases of cancer diagnosed in 2009 (the most recent year of data available). For the period 1986 through 2009, there was a total of 39,827 cases of cancer diagnosed (see also Appendix C, which presents the number of cases reported each year for the period 1986 to 2009 in Waterloo Region).

Figure 2.3 shows the annual number of cases diagnosed and age-standardized incidence rate from 1986 to 2009 in Waterloo Region. While the number of cases has been steadily increasing over this time period, the age-standardized incidence rate has increased only marginally.

Figure 2.3. Number of cases and age-standardized incidence rate per 100,000 people for all cancers combined, Waterloo Region, 1986-2009


The age-standardized incidence rate has increased from a low of 356.3 cases per 100,000 people in 1986 to a high of 418.3 cases per 100,000 people in 2006. However, the incidence rate has begun to decline over the last few years, dropping to 391.9 cases per 100,000 people in 2009.
While the number of cases may be increasing each year, the age-standardized incidence rate is a better reflection of the burden of cancer in Waterloo Region as it accounts for population growth and changes in the age distribution of the population, such as a growing proportion of adults aged 50 years and older. This adjustment is important, as most cancers afflict older adults more frequently than children and younger adults.

Figure 2.4 compares the incidence of cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, the trend in cancer incidence in Waterloo Region has been very similar to that of Ontario, with both showing a slight, yet steady increase between 1986 and 2006, followed by a slight decline through 2009.

**Figure 2.4. Age-standardized incidence rate per 100,000 people for all cancers combined, Waterloo Region and Ontario, 1986-2009**

Incidence rates in Waterloo Region, for the most part, remained slightly lower than or on par with those observed in the province as a whole.
As Figure 2.5 shows, incidence rates of cancer among males and females in Waterloo Region and Ontario have varied over time.

**Figure 2.5. Age-standardized incidence rate per 100,000 people for all cancers combined, by sex, Waterloo Region and Ontario, 1986-2009**

![Graph showing age-standardized incidence rate per 100,000 people for all cancers combined, by sex, Waterloo Region and Ontario, 1986-2009.](image)


As shown above, there were more cancers experienced among males (overall rate of 457.1 cases per 100,000 people from 1986-2009) than females (overall rate of 363.8 cases per 100,000 people from 1986-2009). This trend was consistent across the last few decades, and was observed in both Waterloo Region and Ontario.
Figure 2.6 shows that the incidence of cancer generally increases with age. Both Waterloo Region and Ontario experienced similar age-specific incidence rates for all cancers.

Figure 2.6. Age-specific incidence rate per 100,000 people for all cancers combined, by sex, Waterloo Region and Ontario, 1986-2009

The greatest rate of increase was seen between the 45 to 64 year and 65 to 74 year age groups. In the oldest age group, age-specific incidence rates continued to increase, but less dramatically. This slower rate of increase is likely attributed to non-cancer related deaths and co-morbidity factors in the 75 year and older age group.

Figure 2.7 shows the average age-standardized incidence ratio for selected cancers in Waterloo Region between 1986 and 2009.

The age-standardized incidence ratios below quantify the difference in cancer incidence between Waterloo Region and the reference population (Ontario). The 95 per cent confidence intervals are depicted as vertical bars extending from each data point in the figure below. When the 95 per cent confidence intervals do not overlap with 1.0, the horizontal line through the middle of the figure, Waterloo Region’s cancer incidence rate is considered statistically different from that of Ontario.

Compared to Ontario, Waterloo Region had significantly lower incidence rates for all cancers combined (four per cent lower), bladder (six per cent lower), breast (four per cent lower), lung (12 per cent lower), and oral cancers (ten per cent lower).

Figure 2.7. Age-standardized incidence ratios for selected cancers, Waterloo Region, 1986-2009 average

Incidence rates were significantly higher in Waterloo Region relative to Ontario for melanoma (16 per cent higher) and uterine cancers (seven per cent higher). There were no significant differences in incidence rates between Waterloo Region and Ontario for other major cancer sites, including colorectal, leukemia, non-Hodgkin lymphoma, and prostate cancers.

2.2.2 Mortality

In Waterloo Region, there were 938 deaths due to cancer in 2009 (the most recent year of data available). For the period 1986 through 2009, there were a total of 17,701
deaths due to cancer (see also Appendix C, which presents the number of deaths reported each year for the period 1986 to 2009 in Waterloo Region).

Figure 2.8 shows the annual number of deaths and age-standardized mortality rate from 1986 to 2009 in Waterloo Region. While the number of deaths steadily increased over this time period, the age-standardized mortality rate decreased for all cancers.

Figure 2.8. Number of deaths and age-standardized mortality rate per 100,000 people for all cancers combined, Waterloo Region, 1986-2009

The age-standardized mortality rate ranged from a high of 190.9 deaths per 100,000 people in 1987 to a low of 154.4 deaths per 100,000 people in 2008. While the number of deaths increased each year, the age-standardized mortality rate is a better reflection of the burden of cancer in Waterloo Region as it accounts for population growth and changes in the age distribution of the population, particularly the growing proportion of adults aged 50 years and older. This adjustment is important, as most cancer deaths occur among older adults, and less commonly among children and younger adults.

Figure 2.9 compares the cancer mortality rate in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, mortality due to all cancers combined has decreased, and the trend for Waterloo Region was very similar to that of Ontario.

Mortality rates in Waterloo Region, for the most part, remained on par with those observed in the province as a whole each year between 1986 and 2009.
Between 1986 and 2009, there were slightly more cancer deaths among Waterloo Region males than females (n=9,165 or 51.8 per cent versus n=8,536 or 48.2 per cent, respectively). There was much greater variation in mortality rates by sex in Waterloo Region, with rates approximately 30 per cent higher among males than females over the period 1986 to 2009 (Figure 2.10).

Figure 2.10. Age-standardized mortality rate per 100,000 people for all cancers combined, by sex, Waterloo Region and Ontario, 1986-2009


While mortality rates have been decreasing for both sexes, the rate of decline has been more pronounced in males than females. This trend was observed in both Waterloo Region and Ontario, and local mortality rates were comparable to provincial rates each year over this time period.
Figure 2.11 shows that the cancer mortality rate increased with age. Between 1986 and 2009, both Waterloo Region and Ontario experienced similar age-specific mortality rates by sex for each age group.

**Figure 2.11. Age-specific mortality rate per 100,000 people for all cancers combined, by sex, Waterloo Region and Ontario, 1986-2009**

The highest mortality rates were experienced by men and women aged 75 years and older (2,005 deaths per 100,000 people and 1,164 deaths per 100,000 people, respectively). Cancer-related deaths are rare among children, adolescents and young adults. In Waterloo Region, between 1986 and 2009, less than ten per cent of cancer deaths occurred in people younger than 50 years of age. Similarly, mortality rates for these age groups were also low.

Figure 2.12 shows the average age-standardized mortality ratio for selected cancers in Waterloo Region between 1986 and 2009.

The age-standardized mortality ratios below quantify the difference in cancer mortality between Waterloo Region and the reference population (Ontario). The 95 per cent confidence intervals are depicted as vertical bars extending from each data point in the figure below. When the 95 per cent confidence intervals do not overlap with 1.0, the horizontal line through the middle of the figure, Waterloo Region’s cancer mortality rate is considered statistically different from that of Ontario.

Compared to Ontario, Waterloo Region had significantly lower incidence rates for all cancers combined (two per cent lower) and lung cancer (ten per cent lower).

Figure 2.12. Age-standardized mortality ratios for selected cancers, Waterloo Region, 1986-2009 average

Incidence rates were significantly higher in Waterloo Region relative to Ontario for uterine cancers (25 per cent higher). There were no significant differences in incidence rates between Waterloo Region and Ontario for other major cancer sites, including bladder, breast, colorectal, leukemia, melanoma, non-Hodgkin lymphoma, oral, and prostate cancers.

2.2.3 Survival

Five-year relative survival ratios measure the impact of cancer on life expectancy by comparing the survival of people diagnosed with cancer to the survival of a comparable
group of people in the general population. Figure 2.13 highlights the variation in relative survival ratios in Waterloo Region and Ontario over the last few decades from 1986 to 1990 and 1998 to 2002. The graph presents the five-year relative survival ratio in one year intervals following diagnosis for all cancers.

Overall, relative survival ratios were similar for Waterloo Region and Ontario, with notable improvements between 1986 to 1990 and 1998 to 2002 both locally and provincially.

**Figure 2.13. Age-standardized relative survival ratios for all cancers combined, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1986-1990</td>
<td>71.2%</td>
<td>62.4%</td>
<td>56.0%</td>
<td>55.0%</td>
<td>53.0%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>77.2%</td>
<td>65.6%</td>
<td>60.2%</td>
<td>63.3%</td>
<td>62.4%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>71.5%</td>
<td>62.0%</td>
<td>58.1%</td>
<td>55.2%</td>
<td>58.1%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>76.7%</td>
<td>70.0%</td>
<td>66.7%</td>
<td>64.6%</td>
<td>63.3%</td>
</tr>
</tbody>
</table>


In Waterloo Region, the one-year relative survival ratio for people diagnosed with cancer in 1986 to 1990 was over 70 per cent. A decade later, among people diagnosed from 1998 to 2002, the one-year relative survival ratio was 77 per cent. In Waterloo Region, the five-year relative survival ratio was 53 per cent for those diagnosed in 1986 to 1990, and a decade later in 1998 to 2002, it was 62 per cent. Relative survival ratios for Ontario were similar to those for Waterloo Region at one and five years post-diagnosis, and for each time period.
Figure 2.14 shows changes in the five-year relative survival ratio in Waterloo Region by type of cancer between 1986 to 1990 and 1998 to 2002. Five-year relative survival ratios were highest (at more than 90 per cent) for thyroid, prostate, and melanoma skin cancers during the most recent diagnosis period from 1998 to 2002.

Figure 2.14. Age-standardized five-year relative survival ratios for selected cancers, Waterloo Region, 1986-1990 versus 1998-2002

Conversely, five-year survival ratios for lung and pancreatic cancer were very poor (13.6 per cent and 5.4 per cent, respectively). There were significant improvements in five-year survival ratios for all cancers combined in Waterloo Region, increasing from 53.0 per cent in 1986-1990 to 59.8 per cent in 1998-2002. Significant improvements in survival ratios were also observed for prostate cancer, with five-year relative survival ratios increasing from 69.4 per cent among men diagnosed between 1986 and 1990 to 93.9 per cent among men diagnosed between 1998 and 2002. There were apparent, although non-significant, improvements in five-year relative survival ratios for almost all other major cancers in Waterloo Region over this time period, except for cancers of the bladder and pancreas.
2.2.4 Time Trends in Incidence and Mortality

Table 2.5 presents the annual per cent change in age-standardized incidence rates by cancer site and sex for Waterloo Region and Ontario between 1986 and 2009. Over this time period, the incidence rate of cancer showed a statistically significant increase in both Waterloo Region (0.4 per cent per year) and Ontario (0.3 per cent per year).

Table 2.5. Annual per cent change in age-standardized incidence rates for selected cancers, by sex, Waterloo Region and Ontario, 1986-2009

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Waterloo Region</th>
<th>Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>All cancers combined</td>
<td>0.3</td>
<td>0.4**</td>
</tr>
<tr>
<td>Bladder</td>
<td>-1.3**</td>
<td>0.6</td>
</tr>
<tr>
<td>Breast</td>
<td>N/A</td>
<td>0.2</td>
</tr>
<tr>
<td>Cervical</td>
<td>N/A</td>
<td>-0.8</td>
</tr>
<tr>
<td>Colorectal</td>
<td>-0.1</td>
<td>-0.5</td>
</tr>
<tr>
<td>Kidney</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Leukemia</td>
<td>-0.4</td>
<td>-0.1</td>
</tr>
<tr>
<td>Lung</td>
<td>-1.7**</td>
<td>1.5**</td>
</tr>
<tr>
<td>Melanoma</td>
<td>1.6*</td>
<td>1.6*</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1.9**</td>
<td>0.8</td>
</tr>
<tr>
<td>Oral</td>
<td>-1.6*</td>
<td>-0.9</td>
</tr>
<tr>
<td>Ovarian</td>
<td>N/A</td>
<td>-0.3</td>
</tr>
<tr>
<td>Pancreatic</td>
<td>-2.0*</td>
<td>-0.2</td>
</tr>
<tr>
<td>Prostate</td>
<td>2.2**</td>
<td>N/A</td>
</tr>
<tr>
<td>Stomach</td>
<td>-1.6**</td>
<td>NR</td>
</tr>
<tr>
<td>Testicular</td>
<td>1.6*</td>
<td>N/A</td>
</tr>
<tr>
<td>Uterine</td>
<td>N/A</td>
<td>-0.5</td>
</tr>
</tbody>
</table>

* Significant, p<0.05
** Significant, p<0.01
N/A = Not applicable
NR = Not reportable due to insufficient number of cases

This observed increase in incidence was experienced primarily by females; by contrast, incidence rates in males remained relatively stable. There were also statistically significant increases in incidence rates for melanoma (1.7 per cent per year), non-Hodgkin lymphoma (1.4 per cent per year), prostate (2.2 per cent per year), and testicular cancers (1.6 per cent per year) in Waterloo Region from 1986 to 2009. For the same time period, there were statistically significant decreases in incidence rates for
cancers of the bladder (-1.0 per cent per year), stomach (-1.4 per cent per year), and oral cancers (-1.3 per cent per year) in Waterloo Region.
Table 2.6 presents the annual per cent change in age-standardized mortality rates by cancer site and sex for Waterloo Region and Ontario between 1986 and 2009. The mortality rate of cancer showed a statistically significant decrease in both Waterloo Region (-0.7 per cent per year) and Ontario (-0.9 per cent per year) over this time period.

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Waterloo Region</th>
<th>Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>All cancers combined</td>
<td>-1.0**</td>
<td>-0.5*</td>
</tr>
<tr>
<td>Bladder</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Breast</td>
<td>N/A</td>
<td>-1.6**</td>
</tr>
<tr>
<td>Cervical</td>
<td>N/A</td>
<td>NR</td>
</tr>
<tr>
<td>Colorectal</td>
<td>-1.9**</td>
<td>-1.9**</td>
</tr>
<tr>
<td>Kidney</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Leukemia</td>
<td>-0.2</td>
<td>NR</td>
</tr>
<tr>
<td>Lung</td>
<td>-1.9**</td>
<td>1.0</td>
</tr>
<tr>
<td>Melanoma</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>0.4</td>
<td>NR</td>
</tr>
<tr>
<td>Oral</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Ovarian</td>
<td>N/A</td>
<td>-1.7**</td>
</tr>
<tr>
<td>Pancreas</td>
<td>-1.3</td>
<td>-0.3</td>
</tr>
<tr>
<td>Prostate</td>
<td>-1.7**</td>
<td>N/A</td>
</tr>
<tr>
<td>Stomach</td>
<td>-1.9*</td>
<td>NR</td>
</tr>
<tr>
<td>Testicular</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Uterine</td>
<td>N/A</td>
<td>NR</td>
</tr>
</tbody>
</table>

* Significant, p<0.05  
** Significant, p<0.01  
N/A = Not applicable  
NR = Not reportable due to insufficient number of cases


This declining mortality was observed for both males and females. There were also significant decreasing trends in mortality rates for cancers of the breast (-1.6 per cent per year), colorectal (-1.8 per cent per year), lung (-0.7 per cent per year), ovarian (-1.7 per cent per year), and prostate cancers (-1.7 per cent per year) in Waterloo Region from 1986 to 2009. There were no significant increasing trends in mortality rates for any major cancer site in Waterloo Region over this time period.
3.0 LUNG CANCER

Highlights

- There were 268 new lung cancer cases in Waterloo Region in 2009
- Lung cancer was the fourth most common cancer diagnosis in Waterloo Region, accounting for 12 per cent of all cancer cases from 1986 to 2009
- Lung cancer was most frequently diagnosed among older adults over the age of 65 years
- While lung cancer incidence and mortality rates decreased among men, rates increased among women
- Lung cancer incidence and mortality rates were lower in Waterloo Region than in Ontario
- Lung cancer survival ratios in both Waterloo Region and Ontario were poor, although there were slight improvements over time
- Approximately 15 per cent of people diagnosed with lung cancer in Waterloo Region survived beyond five years

3.1 Overview

Lung cancer starts in the tissues of the lung, usually in the cells lining the air passages. It is characterized by the development of abnormal cells in one or both of the lungs that grow out of control to form a tumour. There are two main types of lung cancer: non–small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). NSCLC grows more slowly than SCLC and is the most common type of lung cancer, affecting nearly 75 per cent of those diagnosed. SCLC occurs almost exclusively in people who smoke heavily, grows quickly and often spreads to distant parts of the body.\(^5,6\)

It is estimated that in 2013, lung cancer would be the most commonly diagnosed cancer among Canadians, accounting for 25,500 cases overall (13,300 cases in males and 12,200 cases in females). Overall, men develop lung cancer slightly more often than women.\(^3\) Over the last decade, lung cancer incidence rates have been climbing among Canadian females while decreasing among males. Among males, the incidence rate of lung cancer has declined significantly at 1.8 per cent per year since 1998. Among females, the rate has been increasing since 1982, with a significant upward trend of 1.1 per cent per year between 1998 and 2007.\(^3\)

The differences in lung cancer incidence rates among the sexes reflect past differences in tobacco use.\(^3\) Like many other types of cancer, the risk of lung cancer increases with
age. More than half of all newly diagnosed lung cancer cases occur among people aged 70 years or older.

Lung cancer is the leading cause of cancer death in Canada, accounting for an estimated 20,200 deaths overall in 2013 (10,700 deaths in males and 9,500 deaths in females).³ In Canadian males, the mortality rate of lung cancer began to level off in the late 1980s and has been declining ever since. The mortality rate for Canadian females exhibited a slight but significant increase of 0.6 per cent per year since 2000. However, the rate of increase is slowing, and the death rate in females is expected to begin to decline in the future.³

The most important risk factor for developing lung cancer is smoking tobacco and exposure to second-hand smoke. Risk increases with longer duration and greater frequency of smoking. Other risk factors include exposure to radon gas and asbestos.⁵ Recent studies show exposure to indoor radon as the second leading cause of lung cancer after tobacco smoking, accounting for about ten per cent of all lung cancers.⁷

### 3.2 Local Picture

#### 3.2.1 Incidence

Lung cancer was the fourth leading cancer diagnosed in Waterloo Region from 1986 to 2009, accounting for 4,918 cases, or 12 per cent of all cancer cases. In 2009, there were 268 lung cancer cases diagnosed in Waterloo Region.

Figure 3.1 shows the annual number of cases diagnosed and age-standardized lung cancer incidence rate from 1986 to 2009 in Waterloo Region.
While the number of cases steadily increased over this time period, the age-standardized incidence rate very gradually declined, with lower rates most evident during the past ten years. The incidence rate reached a low of 44.6 cases per 100,000 people in 2000, and has remained at or below 50 cases per 100,000 people since that time.
Figure 3.2 compares the incidence of lung cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, trends in Waterloo Region have been very similar to that of Ontario, with both showing a slight, yet steady decline.

Figure 3.2. Age-standardized incidence rate per 100,000 people for lung cancer, Waterloo Region and Ontario, 1986-2009


Incidence rates in Waterloo Region remained slightly lower than those observed in the province during this time period (overall incidence of 49.0 per 100,000 people, compared to 55.0 per 100,000 people, respectively).
Incidence rates of lung cancer are significantly higher for males than females in Waterloo Region (Figure 3.3).

Figure 3.3. Age-standardized incidence rate per 100,000 people for lung cancer, by sex, Waterloo Region and Ontario, 1986-2009


This gender gap has been narrowing, however; rates have been decreasing among males and increasing among females between since 1986. In particular, rates among females have more closely approached those for males during the last ten years. In 2009, the lung cancer incidence rate in Waterloo Region males was 59.4 cases per 100,000 people compared to 39.7 cases per 100,000 people among females. Similar trends have been observed for Ontario as a whole.
Figure 3.4 shows that older adults aged 65 years and older accounted for the majority of lung cancer cases in both Waterloo Region and Ontario between 1986 and 2009.

Figure 3.4. Age-specific incidence rate per 100,000 people for lung cancer, by sex, Waterloo Region and Ontario, 1986-2009

The greatest rate of increase was seen between the 45 to 64 year and 65 to 74 year age groups, with lung cancers rarely diagnosed in adults younger than 45 years of age. Among males, the age-specific incidence rate increased from 102.2 cases per 100,000 people aged 45 to 64 years to 367.3 cases per 100,000 people aged 65 to 74 years in Waterloo Region. A similar increase was evident among females, with rates increasing from 66.9 cases per 100,000 people aged 45 to 64 years to 194.8 cases per 100,000 people aged 65 to 74 years. In the oldest age group, those aged 75 years or older, age-specific incidence rates continued to increase, but less dramatically.

3.2.2 Mortality

Lung cancer was the leading cause of cancer deaths in Waterloo Region from 1986 to 2009, accounting for over 4,000 deaths, or 23 per cent of all cancer deaths. In 2009, there were 220 deaths attributed to lung cancer in Waterloo Region.

Figure 3.5 shows the annual number of deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region. While the number of lung cancer deaths steadily
increased over this time period, the age-standardized mortality rate remained relatively stable with an overall rate of 40.1 deaths per 100,000 people between 1986 and 2009.

Figure 3.5. Number of deaths and age-standardized mortality rate per 100,000 people for lung cancer, Waterloo Region, 1986-2009

The mortality rate peaked in 1991 at 51.9 deaths per 100,000 people, but typically ranged between 35 and 45 deaths per 100,000 people during the observed time period.
Figure 3.6 compares lung cancer mortality in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, trends in Waterloo Region were very similar to that of Ontario, with both showing a slight, yet steady decline in lung cancer mortality.

Figure 3.6. Age-standardized mortality rate per 100,000 people for lung cancer, Waterloo Region and Ontario, 1986-2009


For most years, lung cancer mortality rates in Waterloo Region remained slightly lower than those observed in the province (overall mortality of 40.1 per 100,000 compared to 43.9 per 100,000, respectively).
Lung cancer mortality rates remained consistently higher for males than females in Waterloo Region from 1986 through 2009 (Figure 3.7).

**Figure 3.7. Age-standardized mortality rate per 100,000 people for lung cancer, by sex, Waterloo Region and Ontario, 1986-2009**

Mortality rates in males more closely approached those in females over the last ten years, as rates decreased among males and increased among females. From 1986 to 2009, the lung cancer mortality rate in Waterloo Region males decreased from 64.2 deaths per 100,000 people to 50.5 deaths per 100,000 people. Among females, the lung cancer mortality rate increased from 23.5 deaths per 100,000 people in 1986 to 30.3 deaths per 100,000 people in 2009.

Figure 3.8 shows that older adults, particularly those aged 65 years and older, accounted for the majority of lung cancer deaths in both Waterloo Region and Ontario between 1986 and 2009.

**Figure 3.8. Age-specific mortality rate per 100,000 people for lung cancer, by sex, Waterloo Region and Ontario, 1986-2009**

The greatest rate of increase was seen between the 45 to 64 year and 65 to 74 year age groups, with very few lung cancer deaths among adults younger than 45 years of age. Among males, the age-specific mortality rate increased from 78.0 deaths per 100,000 people aged 45 to 64 years to 307.9 deaths per 100,000 people aged 65 to 74 years in Waterloo Region.

A similar trend was also evident among females, with rates increasing from 47.3 deaths per 100,000 people aged 45 to 64 years to 153.3 deaths per 100,000 people aged 65 to 74 years. In the oldest age group, those aged 75 years or older, age-specific mortality continued to increase, but at a less dramatic rate.

### 3.2.3 Survival

Figure 3.9 presents the five-year relative survival ratio in one year intervals following a diagnosis of lung cancer, and highlights the variation in rates for Waterloo Region and Ontario over the last few decades from 1986 to 1990 and 1998 to 2002.
Overall, relative survival ratios for lung cancer were very poor, both for Waterloo Region and Ontario as a whole.

**Figure 3.9. Age-standardized relative survival ratios for lung cancer, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

![Graph showing relative survival ratios](image)

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
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<td>12.0%</td>
<td>10.7%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
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<td>18.4%</td>
<td>15.3%</td>
<td>13.6%</td>
</tr>
<tr>
<td>CN 1986-1990</td>
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<td>24.1%</td>
<td>19.4%</td>
<td>16.9%</td>
<td>15.4%</td>
</tr>
<tr>
<td>CN 1998-2002</td>
<td>40.2%</td>
<td>26.2%</td>
<td>21.1%</td>
<td>18.5%</td>
<td>16.9%</td>
</tr>
</tbody>
</table>


In Waterloo Region, the relative survival ratio for one year was 34.0 per cent for people diagnosed with cancer in 1986 to 1990. A decade later, among people diagnosed from 1998 to 2002, the relative survival ratio for one year was 37.7 per cent. At five years post-diagnosis, the relative survival ratio was less than 15 per cent for people diagnosed with lung cancer. Relative survival ratios for Ontario followed a similar trend, but were slightly higher compared to those for Waterloo Region at one and five years post-diagnosis, and for each time period.
4.0 COLORECTAL CANCER

Highlights

- There were 288 new colorectal cancer cases in Waterloo Region in 2009
- Colorectal cancer was the third most common cancer diagnosis, accounting for 13 per cent of all cancer cases from 1986 to 2009
- Colorectal cancer was more frequently diagnosed in men than women
- Men were more likely to die from colorectal cancer than women
- Colorectal cancer incidence and mortality rates were similar in Waterloo Region and Ontario, and have slowly declined since 1986
- Colorectal cancer survival ratios in Waterloo Region and Ontario were similar, and both improved over the last two decades
- Over 60 per cent of people diagnosed with colorectal cancer survived more than five years following their diagnosis

4.1 Overview

Colon and rectal cancers arise from the same type of cell and have many similarities and are often referred to collectively as “colorectal cancer”. The cells lining the colon or rectum can sometimes become abnormal and divide rapidly, forming benign tumours or growths called polyps. Not all polyps will develop into colorectal cancer; however, colorectal cancer almost always develops from a polyp.

Colorectal cancer was the third most commonly diagnosed cancer among Canadians in 2013, accounting for an estimated 29,300 cases overall (13,200 cases in males and 10,600 cases in females). Starting from the mid-1980s, colorectal cancer incidence rates declined for both sexes until the mid-1990s. Incidence rates then rose through 2000, only to decline significantly thereafter. Among both males and females in Canada, the incidence rate of colorectal cancer has declined significantly at 0.8 per cent per year between 1998 and 2007.

In addition, colorectal cancer was also the second leading cause of cancer death in Canada, accounting for an expected 9,200 deaths in 2013. The mortality rate of colorectal cancer has been declining in both males and females since the early 2000s, likely due to improvements in treatment, particularly chemotherapy.

Most cases of colorectal cancer are the result of the interaction of many factors, and no single risk factor alone is known to cause the disease. Increased risks of colorectal cancer have been associated with older age, a family history of colorectal cancer,
polyps in the colon or rectum, physical inactivity, being overweight or obese, eating a
diet high in red or processed meat and/or low in fibre, smoking, and alcohol use.²

There are recognized screening programs for colorectal cancer in Canada. In Ontario,
Cancer Care Ontario recommends that all people aged 50 to 74 years of age be
screened for colorectal cancer by fecal occult blood test (FOBT) at least every two
years. Positive FOBTs should then be followed up by colonoscopy or sigmoidoscopy.⁸ It
is estimated that colorectal cancer deaths in Canada could be reduced by 17 per cent if
70 per cent of people aged 50 and 74 years had a FOBT every two years.⁹

4.2 Local Picture

4.2.1 Incidence

Colorectal cancer was the third leading cancer diagnosed in Waterloo Region from 1986
to 2009, accounting for 5,187 cases, or 13 per cent of all cancer cases. In 2009, there
were 288 colorectal cancer cases diagnoses in Waterloo Region.

Figure 4.1 shows the annual number of cases diagnosed and age-standardized
colorectal cancer incidence rate from 1986 to 2009 in Waterloo Region. While the
number of cases steadily increased over this time period, the age-standardized
incidence rate remained relatively stable, with some year-to-year fluctuation.

Figure 4.1. Number of cases and age-standardized incidence rate per 100,000 people for
colorectal cancer, Waterloo Region, 1986-2009
The incidence rate ranged from a low of 43.4 cases per 100,000 people in 1996 to a high of 57.3 cases per 100,000 people in 1994.

Figure 4.2 compares the incidence of colorectal cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Incidence rates in Waterloo Region showed a small yet steady declined during this period, similar to trends reported for Ontario.

The overall incidence rate in Waterloo Region (51.0 cases per 100,000 people) was comparable to the province overall (50.4 cases per 100,000 people) between 1986 and 2009.
Incidence rates of colorectal cancer were consistently higher for males than females in Waterloo Region between 1986 and 2009 (Figure 4.3).

**Figure 4.3. Age-standardized incidence rate per 100,000 people for colorectal cancer, by sex, Waterloo Region and Ontario, 1986-2009**

For this time period, the incidence rate in males was 59.0 cases per 100,000 people, compared to 44.6 cases per 100,000 people among females. Rates showed a slight, yet steady decline among both males and females during this period, with similar trends observed for Ontario as a whole.

Figure 4.4 shows colorectal cancer incidence rates in Waterloo Region and Ontario increased with age, with adults aged 74 years and older experiencing the highest rates of disease.

**Figure 4.4. Age-specific incidence rate per 100,000 people for colorectal cancer, by sex, Waterloo Region and Ontario, 1986-2009**

![Chart showing age-specific incidence rate per 100,000 population for colorectal cancer](chart.png)

Note: Blank cells represent suppressed data when there were 1 to 5 cases.

Among males, the age-specific incidence rate increased from 85.0 cases per 100,000 people aged 45 to 64 years to 438.1 cases per 100,000 people aged 75 years and older in Waterloo Region. A similar increase was evident among females, with rates increasing from 63.9 cases per 100,000 people aged 45 to 64 years to 349.4 cases per 100,000 people aged 75 years and older.

### 4.2.2 Mortality

Colorectal cancer was the second leading cause of cancer death in Waterloo Region from 1986 to 2009, accounting for 2,287 deaths, or 13 per cent of all cancer deaths. In 2009, there were 124 deaths attributed to colorectal cancer in Waterloo Region.
Figure 4.5 shows the annual number of deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region. While the number of colorectal cancer deaths fluctuated year-to-year over this time period, the age-standardized mortality rate decreased since 1986, with the exception of two peaks in 1989 and 1995 when the mortality rate reached 30.8 and 31.7 deaths per 100,000 people, respectively.

**Figure 4.5. Number of deaths and age-standardized mortality rate per 100,000 people for colorectal cancer, Waterloo Region, 1986-2009**

Since the early 2000s, mortality due to colorectal cancer has been at or below 25 deaths per 100,000 people.

Figure 4.6 compares colorectal cancer mortality in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, trends in Waterloo Region were very similar to that of Ontario; both showed a steady decline in colorectal cancer mortality.

**Figure 4.6. Age-standardized mortality rate per 100,000 people for colorectal cancer, Waterloo Region and Ontario, 1986-2009**

In both Waterloo Region and Ontario, there were close to 30 deaths per 100,000 people in 1986, compared to 20 or fewer deaths per 100,000 people in 2009.

Colorectal cancer mortality rates declined in both males and females from 1986 through 2009 (Figure 4.7). In both Waterloo Region and Ontario, mortality rates remained higher in males than females during this period.

Figure 4.7. Age-standardized mortality rate per 100,000 people for colorectal cancer, by sex, Waterloo Region and Ontario, 1986-2009


Male colorectal cancer mortality rates decreased at a faster rate, however. Between 1986 and 2009, the colorectal cancer mortality rate in Waterloo Region males decreased from a high of 43.1 deaths per 100,000 people in 1989 to a low of 18.4 deaths per 100,000 people in 2008. Among females, the colorectal cancer mortality rate decreased from a high of 26.9 deaths per 100,000 people in 1990 to 15.1 deaths per 100,000 people in 2009.
Figure 4.8 shows that older adults, particularly those aged 60 years and older, accounted for the majority of colorectal cancer deaths in both Waterloo Region (84.9 per cent) and Ontario (85.1 per cent) between 1986 and 2009.

**Figure 4.8. Age-specific mortality rate per 100,000 people for colorectal cancer, by sex, Waterloo Region and Ontario, 1986-2009**

Age-specific mortality rates were higher among males than females for each age group, and were similar in Waterloo Region and Ontario across all age groups and for both sexes. The age-specific mortality rate peaked among males at 75 years and older at 284.2 deaths per 100,000 people compared to 187.5 deaths per 100,000 people aged 75 years and older among females in Waterloo Region.

### 4.2.3 Survival

Figure 4.9 presents the five-year relative survival ratio in one year intervals following a diagnosis of colorectal cancer, and highlights the variation in rates for Waterloo Region and Ontario over the last few decades, between 1986 to 1990 and 1998 to 2002.
Relative survival ratios showed some improvement over this period. In Waterloo Region, the one year relative survival ratio for people diagnosed with colorectal cancer in 1986 to 1990 was 75.8 per cent. A decade later, among people diagnosed from 1998 to 2002, the one year relative survival ratio was 81.5 per cent.

**Figure 4.9. Age-standardized relative survival ratios for colorectal cancer, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
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<tr>
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<td>75.8%</td>
<td>66.9%</td>
<td>60.7%</td>
<td>58.5%</td>
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<td>WR 1998-2002</td>
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<td>72.4%</td>
<td>68.1%</td>
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<tr>
<td>CN 1986-1990</td>
<td>76.0%</td>
<td>65.8%</td>
<td>59.8%</td>
<td>56.1%</td>
<td>55.6%</td>
</tr>
<tr>
<td>CN 1998-2002</td>
<td>80.1%</td>
<td>71.8%</td>
<td>66.8%</td>
<td>63.4%</td>
<td>61.5%</td>
</tr>
</tbody>
</table>


The five year relative survival ratio for people diagnosed in 1998 to 2002 was 62.4 per cent. Relative survival ratios for Ontario followed a similar trend, but were slightly lower than survival for Waterloo Region at one and five years post-diagnosis, and for each time period.
5.0 FEMALE BREAST CANCER

**Highlights**

- There were 310 new local female breast cancer cases in 2009
- Breast cancer was the most commonly diagnosed cancer in Waterloo Region, accounting for 14 per cent of all cancer cases from 1986 to 2009
- Breast cancer incidence rates in Waterloo Region remained fairly stable since the early 1990s
- There were considerable reductions in breast cancer mortality in Waterloo Region between 1986 and 2009
- There were no significant differences between breast cancer incidence or mortality rates when comparing Waterloo Region to Ontario
- More than 83 per cent of women diagnosed with breast cancer in Waterloo Region in 1998 to 2002 were expected to survive for five years compared to women in the general population

5.1 Overview

There are many types of breast cancer, with the most common forms beginning in the milk ducts, lobules or glandular tissue of the breast. Ductal carcinoma is the most common type, accounting for approximately 90 per cent of all in situ breast cancers and 70 per cent of all invasive breast cancers. While breast cancers can occur in men, they are very rare. This report focuses only on female breast cancers.

Breast cancer is the most frequently diagnosed cancer in females, and the second leading cause of cancer in all Canadians. In Canada, there was expected to be 23,800 new cases and 5,000 deaths attributed to female breast cancer in 2013. Mortality due to breast cancer was second only to lung cancer among Canadian women.

Female breast cancer incidence rates rose through the early 1990s, due in part to opportunistic mammography screening that was done before organized provincial screening programs were implemented. Since that time, female breast cancer incidence rates have fluctuated in Canada. While the reason for this trend is unknown, it may be due to continued participation in mammography screening and long-term changes in hormonal factors, such as earlier age at menarche, later age at menopause, oral contraceptive use, duration of breastfeeding, and later age at pregnancy. A sudden drop in incidence around 2002 may reflect a reduction in the use of hormone replacement therapy (HRT) among post-menopausal women.
Conversely, breast cancer mortality rates have been declining since the mid-1980s, falling 42 per cent between 1986 and 2013. The rate of decline has accelerated since 2000 (2.4 per cent per year), which may be due to a combination of increased mammography screening and the use of more effective therapies following breast cancer surgery. In 2013, the breast cancer mortality rate was estimated at 18.7 deaths per 100,000 people in Canada, the lowest since 1950.

Although there is no single cause of breast cancer, a woman’s risk is increased if she has a family history of the disease or if a mutation of the BRCA1 or BRCA2 gene is present. Reproductive factors such as early age at menarche, late age at menopause, and having no full-term pregnancies are also shown to increase risk of developing breast cancer. Other risk factors include older age, diet, physical inactivity, radiation therapy to the chest area, and having hormone replacement therapy for more than five years. There is also now a known link between alcohol consumption and breast cancer.

5.2 Local Picture

5.2.1 Incidence

Breast cancer was the most commonly diagnosed cancer in Waterloo Region from 1986 to 2009, accounting for 5,397 cases, or 14 per cent of all cancer diagnoses. In 2009, there were 310 breast cancer cases diagnosed in Waterloo Region.
Figure 5.1 shows the annual number of cases diagnosed and age-standardized breast cancer incidence rates from 1986 to 2009 in Waterloo Region. While the number of cases steadily increased over this time period, the age-standardized incidence rate remained relatively stable, with some year-to-year fluctuation.

Figure 5.1. Number of cases and age-standardized incidence rate per 100,000 people for female breast cancer, Waterloo Region, 1986-2009

The incidence rate ranged from a low of 83.3 cases per 100,000 people in 1987 to a high of 115.2 cases per 100,000 people in 2002. The decline in incidence after 2002 may reflect a reduction in the use of hormone replacement therapy (HRT) among post-menopausal women at that time.³
Figure 5.2 compares the incidence of breast cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Since the early 1990s, rates in Waterloo Region and Ontario were similar and remained relatively stable over time.

**Figure 5.2. Age-standardized incidence rate per 100,000 people for female breast cancer, Waterloo Region and Ontario, 1986-2009**

![Graph showing age-standardized incidence rate per 100,000 people for female breast cancer in Waterloo Region and Ontario from 1986 to 2009.]


Between 1986 and 2009, the overall breast cancer incidence rate in Waterloo Region was 97.3 cases per 100,000 people, compared to the provincial overall rate of 100.4 cases per 100,000 people.
Similar to other cancers, the incidence of breast cancer peaked in older age groups (Figure 5.3).

**Figure 5.3. Age-specific incidence rate per 100,000 people for female breast cancer, Waterloo Region and Ontario, 1986-2009**

Between 1986 and 2009, over 75 per cent of breast cancer cases in Waterloo Region occurred in women aged 50 years and older. Incidence rates were highest for women aged 70 to 79 years at 352.0 cases per 100,000 people. There were no significant differences in breast cancer incidence rates in Waterloo Region compared to Ontario by age group at diagnosis.

**5.2.2 Mortality**

Breast cancer was the leading cause of cancer death among women in Waterloo Region from 1986 to 2009, accounting for 1,591 deaths, or nine per cent of all cancer deaths. In 2009, there were 81 deaths attributed to breast cancer in Waterloo Region.
Figure 5.4 shows the annual number of breast cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region. While the number of deaths fluctuated over this time period, the age-standardized mortality rate decreased considerably.

**Figure 5.4. Number of deaths and age-standardized mortality rate per 100,000 people for female breast cancer, Waterloo Region, 1986-2009**

![Graph showing number of deaths and mortality rate from 1986 to 2009.]


The mortality rate was highest in 1986 at 43.0 deaths per 100,000 people, but continued to decrease throughout the 1990s and early 2000s to reach a low of 20.5 deaths per 100,000 people in 2007.
Figure 5.5 compares breast cancer mortality rates in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, there was a dramatic and steady decline in breast cancer mortality in Waterloo Region and Ontario.

For the most part, breast cancer mortality rates in Waterloo Region were comparable with those observed in the province (overall rate of 27.5 deaths per 100,000 compared to 26.6 deaths per 100,000, respectively).
Mortality due to breast cancer peaked in older age groups; more than 65 per cent of breast cancer deaths in Waterloo Region between 1986 and 2009 occurred in women aged 60 years and older (Figure 5.6).

**Figure 5.6. Age-specific mortality rate per 100,000 people for female breast cancer, Waterloo Region and Ontario, 1986-2009**

<table>
<thead>
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<th>Age Group</th>
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<th>Ontario</th>
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<td>60-69</td>
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Note: Blank cells represent suppressed data when there were 1 to 5 cases.

A similar number of deaths occurred in women aged 70 to 79 years (n=375 or 23.6 per cent) and women 80 years and older (n=388 or 24.5 per cent). However, mortality rates were highest for women aged 80 years and older at 213.8 deaths per 100,000 people. There were no significant differences in breast cancer mortality rates in Waterloo Region compared to Ontario by age group at diagnosis.

### 5.2.3 Survival

Figure 5.7 presents the five-year relative survival ratio for breast cancer in one year intervals following diagnosis. Overall, relative survival ratios were similar for Waterloo Region and Ontario, with some improvement in longer-term survival over the past two decades.
In Waterloo Region, approximately 94.0 per cent of women diagnosed with breast cancer in 1986 to 1990 were expected to survive for one year compared to women in the general population. A decade later, among people diagnosed from 1998 to 2002, the one year relative survival ratio was 95.6 per cent.

**Figure 5.7. Age-standardized relative survival ratios for female breast cancer, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

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<tr>
<th></th>
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<td>94.0%</td>
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<td>85.1%</td>
<td>79.8%</td>
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<tr>
<td>WR 1998-2002</td>
<td>95.6%</td>
<td>92.8%</td>
<td>88.0%</td>
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<td>ON 1986-1990</td>
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<td>85.6%</td>
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</table>


However, five-year relative survival ratios showed greater improvement over this time period in Waterloo Region, increasing from 78.2 per cent to 83.3 per cent a decade later. Relative survival ratios for Ontario were similar to those for Waterloo Region at one and five years post-diagnosis, with slightly better survival across the province as a whole for the most recent time period.
6.0 PROSTATE CANCER

Highlights
- There were 298 new prostate cancer cases in Waterloo Region in 2009
- Prostate cancer was the most commonly diagnosed cancer among men in Waterloo Region, accounting for 13 per cent of all cancer cases from 1986 to 2009
- Prostate cancer incidence rates increased sharply in the early 1990s, primarily due to the introduction of the PSA test
- Mortality rates of prostate cancer declined since the mid-1990s
- Males aged 70 years or older were most likely to die from prostate cancer, with very few deaths among men younger than 50 years of age
- There were dramatic improvements in longer-term survival over the last two decades; over 93 per cent of men diagnosed with prostate cancer in Waterloo Region in 1998 to 2002 were expected to survive for five years compared to men in the general population

6.1 Overview

Prostate cancer starts in the tissue of the prostate, a gland in the male reproductive system that produces fluid to make semen. Most prostate cancers are adenocarcinomas (i.e., a tumour of a gland or gland-like structure) and begin as either of two precursor lesions. Prostate cancer can be slow-growing, and some men who develop prostate cancer may live many years without ill effect before the cancer is detected.

Prostate cancer is the most commonly diagnosed cancer and the third leading cause of cancer death in Canadian men. While one in seven men will be diagnosed with the disease in their lifetime, the associated mortality for prostate cancer is relatively low. There were an estimated 23,600 new cases and 3,900 deaths due to prostate cancer among Canadian males in 2013.

The incidence rate of prostate cancer peaked in Canada in 1993 and 2001, and has declined thereafter. These peaks align with two waves of intensified screening activity using the prostate-specific antigen (PSA) test. The mortality rate for prostate cancer has declined significantly (by 3.9 per cent per year) in Canadian males between 2001 and 2009. This decline likely reflects improved treatment following advances in radiation therapy and the introduction of hormonal therapy for early and advanced-stage disease. The role of prostate cancer screening with the PSA test in reducing deaths from prostate cancer remains unclear and is the subject of much research.
Increased age, particularly over 50 years of age, is the most important risk factor for prostate cancer. Family history and ethnicity also play a role; prostate cancers are more common in men of African or Caribbean descent, and less common in men of Asian descent, and the risk increases if close family members have had the disease.\textsuperscript{2} Lifestyle factors such as a low-fibre, high-fat diet and physical inactivity are also considered risk factors for prostate cancer.\textsuperscript{2,13}

There is no evidence-based screening test recommended for the early detection of prostate cancer, although the PSA test is often used for prostate cancer screening. The PSA test remains controversial because it cannot differentiate between cancers that require treatment from cancers that do not (possibly leading to unnecessary treatment), and there is insufficient evidence to indicate that PSA screening reduces the number of prostate cancer deaths.\textsuperscript{9} Therefore, there are no national guidelines to screen for prostate cancer; however, the Canadian Urological Association recommends that prostate cancer screening be offered to all men 50 years of age or older on an annual or semi-annual basis.\textsuperscript{15} Despite uncertainty surrounding the benefits and risks of prostate cancer testing, use of the PSA test is widespread among Canadian men.\textsuperscript{3}

### 6.2 Local Picture

#### 6.2.1 Incidence

Prostate cancer was the most commonly diagnosed cancer in Waterloo Region men from 1986 to 2009, accounting for 5,235 cases or 13 per cent of all cancer diagnoses. There were 298 cases of prostate cancer diagnosed in Waterloo Region men in 2009.
Figure 6.1 shows the annual number of cases diagnosed and age-standardized prostate cancer incidence rates from 1986 to 2009 in Waterloo Region. The number of cases diagnosed and the incidence rate rose sharply in the early 1990s, from less than 65.0 cases per 100,000 people in the late-1980s to a peak of 142.4 cases per 100,000 people in 1994. This increase coincided with the introduction of the PSA test and reflects a change in screening practices rather than a true increase in prostate cancer disease rates.

Figure 6.1. Number of cases and age-standardized incidence rate per 100,000 people for prostate cancer, Waterloo Region, 1986-2009

Since this time, there was a continued increase in the number of new cases diagnosed, but incidence rates showed more year-to-year fluctuation. More recently, there was a decline in both prostate cancer cases and incidence rates after a peak in 2006. In 2009, the incidence rate was 116.6 cases per 100,000 people.
Figure 6.2 compares the incidence of prostate cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Both Waterloo Region and Ontario experienced a sharp increase in prostate cancer incidence in the early 1990s, which reflects an increased number of cases being diagnosed with the introduction of the PSA test.

**Figure 6.2. Age-standardized incidence rate per 100,000 people for prostate cancer, Waterloo Region and Ontario, 1986-2009**

![Graph showing prostate cancer incidence rates in Waterloo Region and Ontario from 1986 to 2009.](image)


Since the early 1990s, rates in Waterloo Region and Ontario continued to increase only slightly, with evidence of a decline beginning in 2007. Waterloo Region and Ontario rates followed similar trends since 1986, despite some year-to-year variability. Between 1991 and 2009, the overall incidence rate in Waterloo Region was 121.4 cases per 100,000 people compared to the provincial overall rate of 121.7 cases per 100,000 people.
Age-specific prostate cancer incidence rates increased dramatically after the age of 60 years (Figure 6.3). Between 1986 and 2009, over 85 per cent of prostate cancer cases in Waterloo Region occurred in men aged 60 years and older, with very few cases diagnosed before age 50.

**Figure 6.3. Age-specific incidence rate per 100,000 people for prostate cancer, Waterloo Region and Ontario, 1986-2009**

While the greatest number of cases was diagnosed in men aged 60 to 69 years during this time period, incidence rates were highest for men aged 70 to 79 years and 80 years and older (854.6 cases per 100,000 people and 862.4 cases per 100,000 people, respectively). There were no significant differences in rates in Waterloo Region compared to Ontario by age group at diagnosis.

### 6.2.2 Mortality

Prostate cancer was the third leading cause of cancer death among men in Waterloo Region from 1986 to 2009, accounting for six per cent of all cancer deaths. In 2009, there were 44 deaths attributed to prostate cancer in Waterloo Region.
Figure 6.4 shows the annual number of prostate cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region. While the number of deaths fluctuated over this time period, there was a steady decline in mortality rates since the mid-1990s.

Figure 6.4. Number of deaths and age-standardized mortality rate per 100,000 people for prostate cancer, Waterloo Region, 1986-2009

![Figure 6.4](image)


The mortality rate was highest in 1994 at 35.5 deaths per 100,000 people, but decreased since then, falling below 20.0 deaths per 100,000 people in 2008 and 2009. Early detection of prostate cancer through widespread screening, coupled with advancements in treatment, may have contributed to this decreasing mortality trend despite an increase in incidence rates over the same time period. 

\[16\]
Figure 6.5 compares prostate cancer mortality in Waterloo Region to that of Ontario for the period 1986 to 2009. Since the mid-1990s, there was a steady decline in prostate cancer mortality in Waterloo Region and Ontario.

Figure 6.5. Age-standardized mortality rate per 100,000 people for prostate cancer, Waterloo Region and Ontario, 1986-2009


For the most part, prostate cancer mortality rates in Waterloo Region were comparable with those observed in the province as a whole (overall rate of 25.0 deaths per 100,000 compared to 25.6 deaths per 100,000, respectively).
Figure 6.6 shows that the majority of prostate cancer deaths in Waterloo Region between 1986 and 2009 occurred in men aged 70 years or older (n=817 or 82.9 per cent).

**Figure 6.6. Age-specific mortality rate per 100,000 people for prostate cancer, Waterloo Region and Ontario, 1986-2009**

Deaths from prostate cancer were extremely rare among males younger than 50 years of age, and mortality rates rose dramatically when comparing rates among men aged 60 to 69 years to those aged 70 to 79 years and 80 years and older in Waterloo Region. There were no significant differences in prostate cancer mortality rates in Waterloo Region compared to Ontario by age group at diagnosis.

**6.2.3 Survival**

Figure 6.7 presents the five-year relative survival ratio for prostate cancer in one year intervals following diagnosis.
Overall, relative survival ratios were similar for Waterloo Region and Ontario, with dramatic improvement in longer-term survival over the past two decades. In Waterloo Region, 69.4 per cent of men diagnosed with prostate cancer in 1986 to 1990 were expected to survive for five years compared to men in the general population.

Figure 6.7. Age-standardized relative survival ratios for prostate cancer, Waterloo Region and Ontario, 1986-1990 and 1998-2002

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1986-1990</td>
<td>92.8%</td>
<td>86.8%</td>
<td>80.1%</td>
<td>74.7%</td>
<td>69.4%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>97.5%</td>
<td>95.5%</td>
<td>95.0%</td>
<td>94.4%</td>
<td>93.9%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>92.6%</td>
<td>88.5%</td>
<td>81.8%</td>
<td>77.7%</td>
<td>74.5%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>98.1%</td>
<td>97.0%</td>
<td>96.4%</td>
<td>96.2%</td>
<td>95.1%</td>
</tr>
</tbody>
</table>


A decade later, among men diagnosed from 1998 to 2002, 93.9 per cent were expected to survive for five years compared to men in the then general population. This improvement in longer-term survival may be attributed to advances in treatment, including the introduction of combined radiation and hormonal therapy in the 1990s. Relative survival ratios for Ontario were similar to those for Waterloo Region at one and five years post-diagnosis, with slightly better longer-term survival across the province as a whole.
7.0 MELANOMA (SKIN CANCER)

Highlights

- There were 79 new melanoma cases in Waterloo Region in 2009
- Melanoma was the sixth most common cancer diagnosis, accounting for four per cent of all cancer cases from 1986 to 2009
- Melanoma incidence rates increased over time since 1986; however, Waterloo Region experienced a recent decline in the rate of new cases, a trend that did not occur provincially
- While deaths due to melanoma were rare, mortality rates slowly increased
- Males experienced higher incidence and mortality rates than females
- Relative survival ratios for melanoma were very high, with local rates slightly exceeding provincial rates
- Over 90 per cent of people in Waterloo Region in 1998 to 2002 were expected to survive for five years compared to people in the general population

7.1 Overview

Melanoma is a cancer that develops in cells that produce melanin, called melanocytes, a pigment responsible for giving colour to the skin. Most melanocytes are located in the skin and almost all melanomas are skin cancers. Melanoma is most frequently found on men’s backs and on women’s backs and legs. It is the least common, but most serious, type of skin cancer. Non-melanoma skin cancer occurs frequently but is difficult to register completely, because it is usually treated successfully without requiring hospitalization or the review of a pathologic specimen. For this reason, non-melanoma skin cancer was excluded from this report.

While melanoma is diagnosed with relative frequency, deaths from melanoma are less common than for other types of cancer. In Canada, there were an estimated 6,000 new cases and 1,050 deaths attributed to melanoma in 2013. Over the last decade, the incidence of melanoma has increased significantly. Mortality has also increased, but at a slower rate.

Some factors that may increase a person’s risk of developing melanoma include: sun and ultraviolet (UV) radiation exposure including tanning beds and sunlamps; sun sensitivity (i.e., skin burns easily); a history of excessive sun exposure, especially in childhood; the presence of moles on the body; having light-coloured skin, eyes and hair; and a personal or family history of melanoma. Occupational exposure to coal tar, pitch,
creosote, arsenic compounds, or radium have also been associated with an increased risk of melanoma.17

7.2 Local Picture

7.2.1 Incidence

There were 79 new cases of melanoma diagnosed in Waterloo Region in 2009. Melanoma was the sixth leading cancer diagnosed in Waterloo Region from 1986 to 2009, accounting for 1,581 cases or four per cent of all cancer cases.

Figure 7.1 shows the annual number of cases diagnosed and age-standardized melanoma incidence rates from 1986 to 2009 in Waterloo Region. Incidence rates slowly increased since the early 1990s until 2006, after which there was a sharp decline in both the number of cases and the incidence rate.

Figure 7.1. Number of cases and age-standardized incidence rate per 100,000 people for melanoma, Waterloo Region, 1986-2009


In 2006, the incidence rate of melanoma in Waterloo Region peaked at 21.0 cases per 100,000 people, and afterward declined to levels seen in the 1990s.
Figure 7.2 compares the incidence of melanoma in Waterloo Region to that of Ontario for the period 1986 to 2009. Incidence rates in both Waterloo Region and Ontario showed a steady increase during this period, with rates in Waterloo Region slightly higher than those in Ontario (overall rate of 15.2 cases per 100,000 people and 13.0 cases per 100,000 people, respectively).

Since 2006, Waterloo Region experienced a decline in melanoma incidence rates while provincial rates continued to increase. In 2009, the incidence of new cases in Waterloo Region was 13.3 per 100,000 people compared to 15.8 per 100,000 people in Ontario as a whole.

Figure 7.3 compares the incidence rates of melanoma by sex for Waterloo Region and Ontario. Melanoma incidence rates increased during this time in both males and females.

**Figure 7.3. Age-standardized incidence rate per 100,000 people for melanoma, by sex, Waterloo Region and Ontario, 1986-2009**

![Graph showing incidence rates over time for males and females in Waterloo Region and Ontario](image)


However, rates in males were typically higher than those in females in both Ontario (overall rate of 14.9 versus 11.8 cases per 100,000 people) and Waterloo Region (overall rate of 16.8 versus 14.2 cases per 100,000 people). Since 2006, there was a decline in melanoma incidence in Waterloo Region, a trend more pronounced in males than females.
Between 1986 and 2009, the majority of new cases of melanoma in Waterloo Region (57.7 per cent) occurred among adults over age 40, with a nearly equal distribution of new cases occurring in men and women. Figure 7.4 shows that the age-specific incidence rates of melanoma increased with age; this increase was more pronounced among males than females.

**Figure 7.4. Age-specific incidence rate per 100,000 people for melanoma, by sex, Waterloo Region and Ontario, 1986-2009**

While incidence rates remained similar for both sexes until age 64 years, rates in older males (age 65 years and older) were almost double that experienced by females.

### 7.2.2 Mortality

Between 1986 and 2009, there were a total of 271 deaths attributable to melanoma, accounting for two per cent of all cancer deaths in Waterloo Region.
Figure 7.5 shows the annual number of deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region for melanoma. As deaths due to melanoma were relatively uncommon in Waterloo Region (20 or fewer deaths per year), trends over time are difficult to interpret.

**Figure 7.5. Number of deaths and age-standardized mortality rate per 100,000 people for melanoma, Waterloo Region, 1986-2009**

![Graph showing number of deaths and mortality rate per 100,000 population for melanoma in Waterloo Region, 1986-2009.]


*Note: Data not shown for Waterloo Region for 1986 and 1999. Data has been suppressed when there were 1 to 5 cases.*

Except for a peak in 2002, the mortality rate remained below 4.0 deaths per 100,000 people, with rates consistently higher among males than females each year.
Figure 7.6 compares melanoma mortality in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, mortality rates in Waterloo Region varied greatly, due to the small number of cases reported annually.

**Figure 7.6. Age-standardized mortality rate per 100,000 people for melanoma, Waterloo Region and Ontario, 1986-2009**


Note: Data not shown for Waterloo Region for 1986 and 1999. Data has been suppressed when there were 1 to 5 cases.

Ontario data suggests that mortality due to melanoma increased slightly over time, from 2.0 deaths per 100,000 people in 1986 to 2.7 deaths per 100,000 people in 2009.
Due to the small number of melanoma deaths in Waterloo Region each year, the local sex distribution of deaths cannot be disclosed, and mortality rates for males and females are presented only for Ontario (Figure 7.7). While provincial mortality rates among females remained fairly stable at less than 2.0 deaths per 100,000 people between 1986 and 2009, they increased slightly in men.

**Figure 7.7. Age-standardized mortality rate per 100,000 people for melanoma, by sex, Ontario, 1986-2009**

Between 1986 and 2009, mortality rates in males increased from 2.6 to 3.9 deaths per 100,000 people. Melanoma mortality rates were consistently higher in males than females, with the gender gap widening further since 2007.
The majority of melanoma deaths in Waterloo Region residents occurred in adults aged 50 years and older (76.0 per cent). Figure 7.8 illustrates differences in mortality rates in Waterloo Region and Ontario by age group and sex. Similar to many other cancers, melanoma mortality rates increased with age.

**Figure 7.8. Age-specific mortality rate per 100,000 people for melanoma, by sex, Waterloo Region and Ontario, 1986-2009**

![Age-specific mortality rate per 100,000 people for melanoma, by sex, Waterloo Region and Ontario, 1986-2009](image)


Note: Blank cells represent suppressed data when there were 1 to 5 cases.

Rates were also higher among males than females for each age group (overall rate of 3.6 deaths per 100,000 people and 1.9 deaths per 100,000 people, respectively in Waterloo Region). There were no significant differences between Waterloo Region and Ontario rates by age group or sex from 1986 to 2009.

### 7.2.3 Survival

Figure 7.9 highlights the variation in relative survival ratios for melanoma in Waterloo Region and Ontario over the last few decades from 1986 to 1990 and 1998 to 2002.
Overall, relative survival ratios were very high; more than 90 per cent of Waterloo Region residents diagnosed with melanoma were expected to survive for five years compared to people in the general population.

**Figure 7.9. Age-standardized relative survival ratios for melanoma, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

<table>
<thead>
<tr>
<th>Survival Ratio (%)</th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1986-1990</td>
<td>95.8%</td>
<td>92.3%</td>
<td>89.2%</td>
<td>87.4%</td>
<td>85.6%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>98.0%</td>
<td>96.1%</td>
<td>94.7%</td>
<td>93.3%</td>
<td>92.9%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>96.6%</td>
<td>92.4%</td>
<td>89.6%</td>
<td>87.4%</td>
<td>86.0%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>96.3%</td>
<td>93.3%</td>
<td>90.6%</td>
<td>89.3%</td>
<td>88.0%</td>
</tr>
</tbody>
</table>


Small improvements in survival occurred since the late 1980s both locally and provincially. In addition, survival among those diagnosed from 1998 to 2002 was higher in Waterloo Region than Ontario at all survival points between one and five years post-diagnosis, inclusive.
8.0 CERVICAL CANCER

8.1 Overview

Cervical cancer starts in the cervix, a part of the female reproductive system. It is generally a slow growing cancer that develops after the cells start to change and become abnormal. The changes begin as precancerous in nature, meaning they are not yet cancer but may develop into cancer over time. It typically takes about ten years or more for a precancerous condition to turn into cervical cancer.\(^2\)

In Canada, cervical cancer is the second most common cancer in women between the ages of 20 and 44, and world-wide is the second leading cause of potential years of life lost. There were an estimated 1,450 new cases and 380 deaths attributed to cervical cancer in Canada in 2013.\(^3\) Over the last decade, both the incidence and mortality rates for cervical cancer have been decreasing.\(^3\) Between 2000 and 2009, the mortality rate for cervical cancer decreased by 2.7 per cent per year in Canada. These declines are largely the result of Pap test screening which helped to detect precancerous and malignant lesions at an earlier stage when treatment is more effective.\(^3\)

The most important risk factor for developing cervical cancer is infection with human papillomavirus (HPV). Additional risk factors for cervical cancer include smoking, a weakened immune system, using birth control pills for more than ten years, and certain

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Highlights

- There were 15 new cervical cancer cases in Waterloo Region in 2009
- Cervical cancer accounted for one per cent of all cancer cases in Waterloo Region from 1986 to 2009
- Cervical cancer incidence fluctuated in Waterloo Region since 1986 due to normal variation seen with small numbers; however, provincially rates have steadily declined
- Cervical cancer incidence rates were highest among women aged 40 to 49 years
- Both the number of deaths due to cervical cancer and the age-standardized mortality rate have decreased over time
- Relative survival ratios for cervical cancer improved only slightly over the past few decades, although these improvements were more pronounced provincially than locally
- Over 72 per cent of women in Waterloo Region in 1998 to 2002 were expected to survive for five years compared to women in the general population
sexual practices, such as becoming sexually active at a young age and having many sexual partners.\textsuperscript{2}

HPV is thought to be responsible for a majority of cervical cancer cases. HPVs are a group of viruses that live on the skin and can be passed from person to person through any kind of sexual contact.\textsuperscript{18} There are over one hundred types of HPV, at least forty of which can be spread through sexual activity. HPV types are divided into two groups, high risk that can cause cancer (e.g., cervical, penile, and anal), and low risk that can cause skin lesions (e.g., genital warts).

HPV-16 and HPV-18 are the most common high risk types and are responsible for 70 per cent of cervical cancers. Virtually all cervical cancers are linked to a persistent, high-risk HPV infection. In fact, the association between HPV and cervical cancer is even stronger than the well-established link between tobacco use and lung cancer.\textsuperscript{19,20}

In July 2006, the HPV vaccine Gardasil\textsuperscript{®} was approved for use in Canada for the prevention of genital warts, as well as cervical, vulvar, and vaginal cancers and their precursors. Immunization of women between the ages of nine and 26 years offers protection from HPV strains responsible for the majority of cervical cancer cases.\textsuperscript{19,20} Therefore, vaccination against HPV can play a major role in the prevention of cervical cancer.

In February 2007, the National Advisory Committee on Immunization (NACI) issued a statement on the HPV vaccine and identified females between the ages of nine and 13 years as the group for whom immunization would be most efficacious. NACI has more recently supported use of the vaccine in women up to age 45, as well as among men and women ages nine to 26 years for the prevention of anal cancer.\textsuperscript{20,21}

In August 2007, Ontario introduced a voluntary, publicly funded, school-based HPV vaccination program using the vaccine Gardasil\textsuperscript{®} for implementation beginning in the 2007/2008 school year. Annually, grade eight girls (approximately 13 years of age) are eligible in Ontario for the publicly funded vaccine, using a three dose schedule. The program is locally administered by the province’s 36 public health departments.\textsuperscript{21}

\textbf{8.2 Local Picture}

\textbf{8.2.1 Incidence}

There were 456 new cases of cervical cancer diagnosed in Waterloo Region from 1986 to 2009, accounting for two per cent of all cancer cases diagnosed among females. There were 15 cervical cancer cases diagnosed in Waterloo Region in 2009.
Figure 8.1 shows that the annual number of cases diagnosed and age-standardized cervical cancer incidence rates from 1986 to 2009 in Waterloo Region fluctuated over time.

**Figure 8.1. Number of cases and age-standardized incidence rate per 100,000 people for cervical cancer, Waterloo Region, 1986-2009**

These fluctuations were likely due to variation in the small number of new cases diagnosed each year, and may not reflect true changes in cervical cancer incidence rates. Cervical cancer incidence rates in Waterloo Region ranged between 6.0 and 14.0 cases per 100,000 people from 1986 to 2009.
Figure 8.2 compares the incidence of cervical cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Although there was variability in incidence rates for Waterloo Region over this period, there was a steady decline for Ontario as a whole.

**Figure 8.2. Age-standardized incidence rate per 100,000 people for cervical cancer, Waterloo Region and Ontario, 1986-2009**

Between 1986 and 2009, cervical cancer incidence rates in Ontario decreased more than 25 per cent, from 11.5 cases per 100,000 people in 1986 to 8.3 cases per 100,000 people in 2009. Despite some year-to-year fluctuation due to small numbers of cases locally, cervical cancer incidence rates in Waterloo Region remained similar to that of the province (overall rate of 8.6 versus 9.1 cases per 100,000 people, respectively).
Figure 8.3 shows the age-specific incidence rates of cervical cancer for Waterloo Region and Ontario. Cervical cancer primarily afflicts women 30 years of age and older, with very few cases diagnosed in females less than 20 years of age.

**Figure 8.3. Age-specific incidence rate per 100,000 people for cervical cancer, Waterloo Region and Ontario, 1986-2009**

Unlike many other cancers, incidence rates of cervical cancer do not increase with age; age-specific incidence rates were highest among women aged 40 to 49 years. These trends were similar for both Waterloo Region and Ontario.

### 8.2.2 Mortality

From 1986 through 2009 there were 136 deaths due to cervical cancer among women in Waterloo Region, accounting for less than one per cent of all cancer deaths. Due to the small number of cervical cancer deaths in Waterloo Region, trends are difficult to identify and were examined only for Ontario as a whole.
Figure 8.4 shows the annual number of cervical cancer deaths and age-standardized mortality rates from 1986 to 2009 in Ontario. Over this time period, there was a considerable decline in both the number of deaths due to cervical cancer and the age-standardized mortality rate.

**Figure 8.4. Number of deaths and age-standardized mortality rate per 100,000 people for cervical cancer, Ontario, 1986-2009**

The mortality rate decreased from a high of 3.7 deaths per 100,000 people in 1988 to 1.6 deaths per 100,000 people in 2009, representing more than a 50 per cent decline in rates over this period.

Due to the small number of cervical cancer deaths in Waterloo Region, local age-specific trends were difficult to identify and as such, were examined only for Ontario as a whole. Figure 8.5 shows that mortality due to cervical cancer increased with age, with rates highest among women aged 80 years and older at 11.6 deaths per 100,000 people.

**Figure 8.5. Age-specific mortality rate per 100,000 people for cervical cancer, Ontario, 1986-2009**

A considerable number of deaths also occurred in younger women, however; more than 50 per cent of cervical cancer deaths (n=2,109) in Ontario between 1986 and 2009 occurred in women between the ages of 40 and 69 years.

### 8.2.3 Survival

Cervical cancer relative survival ratios over two time periods from 1986 to 1990 and 1998 to 2002 for Waterloo Region and Ontario are shown in Figure 8.6.
Approximately 90 per cent of women diagnosed with cervical cancer lived at least one year beyond their diagnosis, with five year relative survival ratios approaching 75 per cent.

**Figure 8.6. Age-standardized relative survival ratios for cervical cancer, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1986-1990</td>
<td>91.5%</td>
<td>84.1%</td>
<td>78.0%</td>
<td>75.9%</td>
<td>71.1%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>88.9%</td>
<td>86.7%</td>
<td>82.0%</td>
<td>78.5%</td>
<td>72.2%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>88.7%</td>
<td>79.5%</td>
<td>74.8%</td>
<td>72.2%</td>
<td>70.2%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>90.5%</td>
<td>83.6%</td>
<td>79.7%</td>
<td>77.6%</td>
<td>76.1%</td>
</tr>
</tbody>
</table>


Relative survival ratios were similar for Waterloo Region and Ontario, with little improvement in one-year or five-year survival over the last few decades.
9.0 OVARIAN CANCER

Highlights

- There were 57 new ovarian cancer cases in Waterloo Region in 2009
- Ovarian cancer was the fifth most commonly diagnosed cancer among women in Waterloo Region, accounting for just over four per cent of all female cancer cases from 1986 to 2009
- Provincially, ovarian cancer incidence rates gradually increased between 1986 and 2002, with rates levelling off afterward
- There was a gradual decline in ovarian cancer mortality since 1986, with mortality rates decreasing more rapidly since the early 2000s
- Ovarian cancer incidence and mortality rates were highest among women 70 years of age and older
- Long-term survival ratios for ovarian cancer remained mediocre in both Waterloo Region and Ontario, although local survival ratios were slightly higher than those seen provincially
- Just under 50 per cent of women in Waterloo Region diagnosed in 1998 to 2002 with ovarian cancer were expected to survive for five years compared to women in the general population

9.1 Overview

Ovarian cancer starts in the cells of one or both ovaries, a pair of female reproductive glands in which ova, or eggs, are formed. The three main types of ovarian cancer are epithelial cell cancer, germ cell tumours, and stromal cell tumours. Epithelial cell carcinomas are the most common type of ovarian cancer, while germ cell tumours are more common in younger women.\(^{22}\)

In Canada, an estimated 2,600 new cases and 1,700 deaths were attributed to ovarian cancer in 2013. The incidence of ovarian cancer increases with age, and most cases occur in women over the age of 50 years.\(^{2}\) While there was no significant change in ovarian cancer incidence rates over the last decade, between 2000 and 2009, the mortality rate for ovarian cancer decreased by 2.2 per cent per year in Canada.\(^{3}\)

Risk factors for ovarian cancer include a family history of the disease, having a mutation in either of the BRCA1 or BRCA2 genes, never being pregnant, using estrogen hormone replacement therapy, smoking, and exposure to asbestos. These risk factors have all been associated with an increased risk of epithelial cell ovarian cancers, but risk factors for germ cell and stromal tumours are not well understood.\(^{2}\)
9.2 Local Picture

9.2.1 Incidence

There were 57 new cases of ovarian cancer diagnosed in Waterloo Region in 2009. Ovarian cancer was the fifth most commonly diagnosed cancer among women in Waterloo Region from 1986 to 2009, accounting for 844 cases or just over four per cent of all female cancer cases.

Figure 9.1 shows the annual number of cases and age-standardized ovarian cancer incidence rates from 1986 to 2009 in Waterloo Region. Incidence rates varied over this time period, peaking in 1994 at 22.1 cases per 100,000 people and reaching a low in 2008 of 8.9 cases per 100,000 people.

Figure 9.1. Number of cases and age-standardized incidence rate per 100,000 people for ovarian cancer, Waterloo Region, 1986-2009


The instability of the rates may be due, in part, to variation in the small number of cases diagnosed annually in Waterloo Region. Conversely, the increase in ovarian cancer rates observed around 1988 was likely due to a change in coding practices, as borderline ovarian tumours began to be classified as ovarian cancers starting that year. Overall, from 1986 to 2009, the ovarian cancer incidence rate for Waterloo Region was 15.2 cases per 100,000 people.
Figure 9.2 compares the incidence of ovarian cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Ovarian cancer incidence rates in Waterloo Region fluctuated year-to-year, but rates for Ontario gradually increased between 1986 and 2002, before levelling off through to 2009.

**Figure 9.2. Age-standardized incidence rate per 100,000 people for ovarian cancer, Waterloo Region and Ontario, 1986-2009**

![Graph showing ovarian cancer incidence rates for Waterloo Region and Ontario from 1986 to 2009](image)


However, on average, ovarian cancer incidence rates in Waterloo Region and Ontario were comparable between 1986 and 2009 (overall incidence 15.2 versus 14.4 cases per 100,000 people, respectively).
Figure 9.3 shows that the age-specific incidence rate of ovarian cancer increased with age until older adulthood, at which time rates began to level off.

**Figure 9.3. Age-specific incidence rate per 100,000 people for ovarian cancer, Waterloo Region and Ontario, 1986-2009**

![Graph showing age-specific incidence rate per 100,000 people for ovarian cancer, Waterloo Region and Ontario, 1986-2009.]


Both Waterloo Region and Ontario experienced similar age-specific incidence rates for ovarian cancer at all ages. Ovarian cancer incidence rates were highest for women 70 years of age and older. The greatest rate of increase between age groups was seen between the 50 to 59 and the 60 to 69 year age groups; rates increased by 75 per cent in Waterloo Region women between these age groups.

### 9.2.2 Mortality

Ovarian cancer was the fourth most common cancer-related death among women in Waterloo Region from 1986 to 2009, accounting for 474 deaths, or six per cent of all cancer deaths among women. In 2009, there were 21 deaths attributed to ovarian cancer in Waterloo Region.
Figure 9.4 shows the annual number of ovarian cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region. While the number of deaths fluctuated over this time period, the age-standardized mortality rate decreased since the late 1990s, with the exception of a peak in 2003.

**Figure 9.4. Number of deaths and age-standardized mortality rate per 100,000 people for ovarian cancer, Waterloo Region, 1986-2009**

![Graph showing number of deaths and mortality rate per 100,000 people for ovarian cancer, 1986-2009](image)


The mortality rate was highest in 1989 at 11.3 deaths per 100,000 people, and since the mid-2000s remained near or below 7.0 deaths per 100,000 people.
Figure 9.5 compares ovarian cancer mortality in Waterloo Region to that of Ontario for the period 1986 to 2009. While rates fluctuated year-to-year in Waterloo Region, similar trends were observed both locally and for Ontario.

Ovarian cancer mortality rates gradually declined during this time period, with rates declining most rapidly since the mid-2000s. For the most part, breast cancer mortality rates in Waterloo Region were comparable with those observed in the province between 1986 and 2009 (overall mortality rate of 8.4 deaths per 100,000 people compared to 7.8 deaths per 100,000 people, respectively).
As seen in Figure 9.6, mortality due to ovarian cancer peaked in older age groups.

**Figure 9.6. Age-specific mortality rate per 100,000 people for ovarian cancer, Waterloo Region and Ontario, 1986-2009**

Age-specific mortality rates were highest for women age 70 years and older (greater than 50 deaths per 100,000 people), and these women accounted for a majority of ovarian cancer deaths (52 per cent). Very few ovarian cancer deaths occurred among women younger than 40 years of age. Ovarian cancer mortality rates in Waterloo Region were comparable to those in Ontario by age group at diagnosis.

### 9.2.3 Survival

Figure 9.7 presents the five-year relative survival ratio in one year intervals following a diagnosis of ovarian cancer, and highlights the variation in rates for Waterloo Region and Ontario over the last few decades from 1986 to 1990 and 1998 to 2002.
Some improvements in survival were noticeable both locally and provincially over the last few decades. In Waterloo Region, 68.6 per cent of people diagnosed with ovarian cancer in 1986 to 1990 were expected to survive for one year compared to women in the general population. A decade later, among people diagnosed from 1998 to 2002, over 80 per cent were expected to survive one year compared to women in the general population.

**Figure 9.7. Age-standardized relative survival ratios for ovarian cancer, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WR 1986-1990</strong></td>
<td>68.6%</td>
<td>58.3%</td>
<td>45.5%</td>
<td>41.3%</td>
<td>40.8%</td>
</tr>
<tr>
<td><strong>WR 1998-2002</strong></td>
<td>82.5%</td>
<td>69.7%</td>
<td>59.0%</td>
<td>50.6%</td>
<td>48.3%</td>
</tr>
<tr>
<td><strong>ON 1986-1990</strong></td>
<td>69.9%</td>
<td>53.1%</td>
<td>45.4%</td>
<td>40.6%</td>
<td>37.9%</td>
</tr>
<tr>
<td><strong>ON 1998-2002</strong></td>
<td>76.5%</td>
<td>62.9%</td>
<td>53.7%</td>
<td>48.2%</td>
<td>44.7%</td>
</tr>
</tbody>
</table>


However, long term relative survival ratios for ovarian cancer remained poor, both for Waterloo Region and Ontario; the five year relative survival ratio was less than 50 per cent. Although the declining rates of ovarian cancer survival were similar in Waterloo Region and Ontario, relative survival ratios in Waterloo Region were higher than those for Ontario as a whole.
10.0 UTERINE CANCER

Highlights

- There were 55 new uterine cancer cases in Waterloo Region in 2009
- Uterine cancer was the fourth most common cancer diagnosis among women in Waterloo Region, accounting for six per cent of all female cancer cases from 1986 to 2009
- Uterine cancer incidence rates were relatively stable between 1986 and 2009
- Deaths from uterine cancer were rare in Waterloo Region, with a majority occurring in women over the age of 70 years
- Long-term survival ratios for uterine cancer were similarly high in both Waterloo Region and Ontario.
- Over 87 per cent of women in Waterloo Region in 1998 to 2002 were expected to survive for five years compared to women in the general population

10.1 Overview

Uterine cancers are classified according to where they develop. Cancer that forms in the tissue lining the uterus is called uterine cancer or endometrial carcinoma. Cancer can also form in the muscle layers of the uterus, which is called uterine sarcoma, a rare form of uterine cancer. For the purposes of this report, uterine cancers “not otherwise specified”, which originate in an unknown tissue, were not considered.

Uterine cancer was the fourth most common cancer among women in Canada in 2013, with an estimated 5,600 new cases and 890 deaths. Most women with uterine cancer are post-menopausal and between the ages of 45 and 70 years old.

There is no single cause of uterine cancer, but some well known risk factors include taking estrogen hormone replacement therapy, young age at menarche, obesity, and use of Tamoxifen, a drug used to treat breast cancer. Less significant risk factors for developing uterine cancer include never having given birth, chronic anovulation (not ovulating during the menstrual cycle), diabetes, endometrial hyperplasia, and exposure to radiation or chemotherapy.
10.2 Local Picture

10.2.1 Incidence

There were 55 new cases of uterine cancer diagnosed in Waterloo Region in 2009. From 1986 to 2009, uterine cancer was the fourth leading cancer diagnosed in women in Waterloo Region, accounting for 1,138 cases, or six per cent of all female cancer cases.

Figure 10.1 shows the annual number of cases diagnosed and age-standardized uterine cancer incidence rates from 1986 to 2009 in Waterloo Region. While the annual number of cases increased over this period, incidence rates were widely varied and did not exhibit a noticeable temporal trend.

Figure 10.1. Number of cases and age-standardized incidence rate per 100,000 people for uterine cancer, Waterloo Region, 1986-2009

Uterine cancer incidence rates generally ranged between 18.0 and 25.0 cases per 100,000 people in Waterloo Region between 1986 and 2009. Since 2002, rates were lower than those observed in the 1990s.
Figure 10.2 compares the incidence of uterine cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, the overall incidence rate in Waterloo Region (20.7 cases per 100,000 people) was similar to that for Ontario (19.2 cases per 100,000 people).

**Figure 10.2. Age-standardized incidence rate per 100,000 people for uterine cancer, Waterloo Region and Ontario, 1986-2009**

While incidence rates in Waterloo Region fluctuated from year to year, both local and provincial rates remained relatively stable over the longer term.

A majority of uterine cancer cases in Waterloo Region between 1986 and 2009 occurred in women aged 60 years and older (n=744 or 65 per cent). Very few cases were diagnosed in women younger than 40 years of age.

Figure 10.3 shows that uterine cancer incidence rates were highest among Waterloo Region women aged 60 to 79 years at approximately 90.0 cases per 100,000 people.

Figure 10.3. Age-specific incidence rate per 100,000 people for uterine cancer, Waterloo Region and Ontario, 1986-2009

Note: Blank cells represent suppressed data when there were 1 to 5 cases.

Trends in age-specific incidence rates were similar for Waterloo Region and Ontario; however, rates were slightly higher among the older age groups in Waterloo Region compared to Ontario.

10.2.2 Mortality

Deaths due to uterine cancer were relatively rare in Waterloo Region from 1986 to 2009, accounting for 255 deaths, or approximately one per cent of all cancer deaths.
Figure 10.4 shows the annual number of uterine cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region (data was suppressed from 1986 to 1988 due to small numbers and instable rates). Due to the small number of deaths each year in Waterloo Region, trends are difficult to interpret.

**Figure 10.4. Number of deaths and age-standardized mortality rate per 100,000 people for uterine cancer, Waterloo Region, 1986-2009**

In general, both the number of deaths and uterine cancer mortality rates decreased through the late 1990s, reaching a low of 2.3 deaths per 100,000 people, before rising again in the early 2000s.

Figure 10.5 compares uterine cancer mortality in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, mortality rates remained relatively stable in Ontario, while Waterloo Region rates were much more variable, due to a small number of deaths.

**Figure 10.5. Age-standardized mortality rate per 100,000 people for uterine cancer, Waterloo Region and Ontario, 1986-2009**


For most years, uterine cancer mortality rates were slightly higher in Waterloo Region compared to the province as a whole (overall rate of 4.4 deaths per 100,000 people compared to 3.5 deaths per 100,000 people, respectively).
Figure 10.6 shows that mortality rates due to uterine cancer increased with age. Trends were similar in both Waterloo Region and Ontario.

**Figure 10.6. Age-specific mortality rate per 100,000 people for uterine cancer, Waterloo Region and Ontario, 1986-2009**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Waterloo Region</th>
<th>Ontario</th>
</tr>
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<tbody>
<tr>
<td>0-9</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>10-19</td>
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</tr>
<tr>
<td>60-69</td>
<td>43.1</td>
<td>33.6</td>
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</tbody>
</table>


*Note: Blank cells represent suppressed data when there were 1 to 5 cases.*

Age-specific mortality rates were highest among women aged 70 to 79 years and 80 years and older. These women accounted for a majority of uterine cancer deaths in Waterloo Region (64 per cent) and Ontario (61 per cent) between 1986 and 2009. Very few uterine cancer deaths occurred among women younger than 40 years of age during this time period.

**10.2.3 Survival**

Figure 10.7 presents the five-year relative survival ratios for uterine cancer in one year intervals following diagnosis in Waterloo Region and Ontario between 1986 and 2009.
Overall, relative survival ratios for uterine cancer were quite high. There were only marginal improvements in longer-term survival between 1986 to 1990 and 1998 to 2002.

Figure 10.7. Age-standardized relative survival ratios for female uterine cancer, Waterloo Region and Ontario, 1986-1990 and 1998-2002

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
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<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1986-1990</td>
<td>94.2%</td>
<td>90.5%</td>
<td>88.0%</td>
<td>84.7%</td>
<td>84.0%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>94.8%</td>
<td>89.6%</td>
<td>89.6%</td>
<td>88.3%</td>
<td>87.3%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>93.0%</td>
<td>89.6%</td>
<td>87.3%</td>
<td>85.6%</td>
<td>85.0%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>93.9%</td>
<td>90.7%</td>
<td>89.2%</td>
<td>87.8%</td>
<td>87.3%</td>
</tr>
</tbody>
</table>


In Waterloo Region, close to 95 per cent of females diagnosed with uterine cancer were expected to survive one year compared to women in the general population and 87.3 per cent were expected to survive for five years compared to women in the general population. Relative survival ratios for both Waterloo Region and Ontario were very similar at each interval following diagnosis, and for both time periods.
11.0 ORAL CANCER

Highlights

- There were 45 new oral cancer cases in Waterloo Region in 2009
- Oral cancer accounted for approximately two per cent of all cancer cases in Waterloo Region from 1986 to 2009
- Oral cancer incidence and mortality rates decreased since 1986, driven primarily by a decline in incidence rates among men; rates among women remained fairly stable during this time period
- Oral cancer incidence and mortality increased with age, with more new cases and deaths reported among men than women
- Long-term oral cancer survival ratios had only modest improvements over the last few decades

11.1 Overview

Oral cancer is any abnormal growth and spread of cells occurring in the mouth cavity including the lips, tongue, roof of the mouth, under the tongue, gums, inside the lips and cheeks, and the oropharynx.

In Canada, there were an estimated 4,100 new cases and 1,150 deaths attributed to oral cancer in 2013.\(^3\) Currently, males account for nearly two-thirds of new cases of oral cancer, and most people diagnosed are over the age of 50.\(^4\) Since 1998, both the incidence and mortality rates of oral cancers has declined in males, while there has been no significant change in incidence or mortality rates in females. A decline in smoking, which is a major risk factor for most oral cancers, likely accounted for the downward trend observed among males in Canada.\(^4\)

Smoking, chewing tobacco, drinking alcohol, low intake of vegetables and fruit, infection with the human papillomavirus (HPV), and sun exposure to the lips are some of the major risk factors for oral cancer.\(^4\) Tobacco use is the most established risk factor, and risk increases with the amount and length of time a person smokes or chews tobacco. Up to 75 per cent of oral cancers may be attributed to exposure to tobacco and/or alcohol.\(^2\)

Having regular dental check-ups is the best way to detect oral cancer early. In Canada, there is currently no required screening for oral cancer. However, oral cancer screening is part of regular dental examinations by dentists and dental hygienists. The dental practitioner looks for lumps or tissue changes in the inside of the mouth and on the neck, face and head. Early signs of disease include discoloured tissue or sores that do
not heal, difficulty swallowing and changes in taste or tongue sensation. Early detection is important so that oral cancer can be treated more successfully.  

11.2 Local Picture

11.2.1 Incidence

In Waterloo Region, there were 45 new cases of oral cancer diagnosed in 2009. For the period 1986 through 2009, there were a total of 930 cases, accounting for approximately two per cent of all cancer cases.

Figure 11.1 shows the annual number of cases diagnosed and age-standardized oral cancer incidence rates from 1986 to 2009 in Waterloo Region. During this time, annual incidence rates varied greatly, but overall there was a decreasing trend.

Figure 11.1. Number of cases and age-standardized incidence rate per 100,000 people for oral cancers, Waterloo Region, 1986-2009


In 1991, the incidence rate of oral cancer in Waterloo Region peaked at 12.5 cases per 100,000 people, and since declined to 7.4 cases per 100,000 people in 2009.
Figure 11.2 compares the incidence of oral cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Both rates declined steadily, although year-to-year fluctuations were more pronounced in Waterloo Region.

Figure 11.2. Age-standardized incidence rate per 100,000 people for oral cancers, Waterloo Region and Ontario, 1986-2009

Oral cancer incidence rates in Waterloo Region were slightly lower than, or on par with, those observed in the province as a whole (overall 9.0 cases per 100,000 people compared to 10.0 cases per 100,000 people, respectively).
Figure 11.3 shows that oral cancer incidence rates varied among males and females in Waterloo Region, with more cases among males (overall rate of 13.6 cases per 100,000 people from 1986 to 2009) than females (overall rate of 5.0 cases per 100,000 people from 1986 to 2009).

A similar trend was observed in Ontario. However, this discrepancy between the sexes narrowed, driven primarily by decreasing incidence rates among men, while rates among women remained fairly stable.
From 1986 to 2009, approximately half of all new oral cancer cases occurred among adults between the ages of 50 and 69 years. Oral cancer incidence rates increased with age, with the highest rates among men and women 75 years of age and older (Figure 11.4).

Figure 11.4. Age-specific incidence rate per 100,000 people for oral cancer, by sex, Waterloo Region and Ontario, 1986-2009

The greatest rate of increase in incidence rates was seen among men between the ages of 20 to 44 years and 45 to 64 years. Age-specific incidence rates were higher among men than women, and rates were slightly higher in Ontario than Waterloo Region for almost every age group.

11.2.2 Mortality

From 1986 to 2009 there were 299 deaths attributable to oral cancer, accounting for approximately two per cent of all cancer-related deaths.
Figure 11.5 shows the annual number of deaths due to oral cancer and age-standardized mortality rates from 1986 to 2009 in Waterloo Region. Both the number of deaths and the age-standardized mortality rate fluctuated over this time period, with a noticeable decline in the mortality rate since the early 2000s.

Figure 11.5. Number of deaths and age-standardized mortality rate per 100,000 people for oral cancers, Waterloo Region, 1986-2009

As seen above, oral cancer mortality rates remained below 3.0 deaths per 100,000 people since 2005.

Figure 11.6 compares the oral cancer mortality rates in Waterloo Region to that of Ontario for the period 1986 to 2009. While rates in Waterloo Region exhibited some year-to-year variability, in general, mortality rates for oral cancer declined considerably over time, both locally and for Ontario as a whole.

Figure 11.6. Age-standardized mortality rate per 100,000 people for oral cancers, Waterloo Region and Ontario, 1986-2009

Over this time period, mortality rates decreased approximately 40 per cent. On average, oral cancer mortality rates in Waterloo Region were similar to Ontario rates (overall 2.9 deaths per 100,000 people compared to 3.1 deaths per 100,000 people, respectively).

From 1986 to 2009, approximately two-thirds of all oral cancer deaths occurred in males. However, relatively few oral cancer deaths occur in any given year in Waterloo Region, and it is difficult to interpret trends over time when examined by sex. Therefore, sex-specific mortality for oral cancer was examined only for Ontario as a whole.
Figure 11.7 shows that mortality due to oral cancer varied in Ontario by sex between 1986 and 2009, with more oral cancer deaths occurring among males (overall rate of 4.5 deaths per 100,000 people) than females (overall rate of 1.7 deaths per 100,000 people).

**Figure 11.7. Age-standardized mortality rate per 100,000 people for oral cancer, by sex, Ontario, 1986-2009**

![Graph showing age-standardized mortality rate per 100,000 people for oral cancer, by sex, Ontario, 1986-2009.](image)


Similar to the trend observed with oral cancer incidence, there was a narrowing of this gender gap driven primarily by decreasing mortality among men, while rates among women were fairly stable between 1986 and 2009.
Figure 11.8 presents the age-specific oral cancer mortality rates for males and females in Waterloo Region and Ontario for the period 1986 to 2009. During this time, almost three-quarters of oral cancer deaths occurred in adults aged 60 years and older (73.6 per cent). Oral cancer mortality rates increased with age in Waterloo Region, with the highest rates experienced among men and women 75 years of age and older (28.8 deaths per 100,000 people and 16.2 deaths per 100,000 people, respectively).

Mortality rates were considerably higher among males than females over 65 years of age, with less variation by sex in evidence for younger adults. Age-specific mortality rates were slightly higher in Ontario than Waterloo Region for almost every age group, except among women 75 years of age and older.

**11.2.3 Survival**

Oral cancer five-year relative survival ratios over two time periods from 1986 to 1990 and 1998 to 2002 for Waterloo Region and Ontario are shown in Figure 11.9.
Approximately 80.0 per cent of people diagnosed with oral cancer were expected to live for one year compared to people in the general population, with five year survival ratios approaching 60.0 per cent.

**Figure 11.9. Age-standardized relative survival ratios for oral cancers, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

![Graph showing age-standardized relative survival ratios for oral cancers, Waterloo Region and Ontario, 1986-1990 and 1998-2002](image)

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
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<td>WR 1986-1990</td>
<td>79.1%</td>
<td>64.6%</td>
<td>61.4%</td>
<td>57.7%</td>
<td>55.9%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>81.5%</td>
<td>66.1%</td>
<td>61.1%</td>
<td>60.4%</td>
<td>58.8%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>80.9%</td>
<td>69.2%</td>
<td>63.6%</td>
<td>59.9%</td>
<td>57.3%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>82.5%</td>
<td>73.2%</td>
<td>67.9%</td>
<td>65.4%</td>
<td>63.0%</td>
</tr>
</tbody>
</table>


Relative survival ratios were slightly higher for Ontario compared to Waterloo Region, with more gains in survival made provincially over the last few decades. In Waterloo Region, 58.8 per cent of people diagnosed between 1998 and 2002 with oral cancer were expected to survive for five years compared to people in the general population, compared to a five year relative survival ratio of 63.0 per cent for people in Ontario as a whole.
12.0 BLADDER CANCER

Highlights

- There were 84 new bladder cancer cases in Waterloo Region in 2009
- Bladder cancer was the eighth most common cancer diagnosis in Waterloo Region from 1986 to 2009, accounting for approximately three per cent of all cancer cases
- Bladder cancer incidence rates decreased from 1986 to 2009
- Bladder cancer incidence and mortality rates were significantly higher in men than women, particularly among men aged 75 years or older
- Survival ratios in Waterloo Region were lower than those for all of Ontario
- Both locally and provincially, there were slight declines in short and long-term survival ratios from bladder cancer over the last few decades; these declines may be due more to a change in coding practices than a true decline in survival
- Approximately 65 per cent of people in Waterloo Region diagnosed with bladder cancer in 1998 to 2002 were expected to survive for five years compared to people in the general population

12.1 Overview

Nearly all bladder cancers start in the lining of the bladder. Cancer that is only in the lining is called superficial bladder cancer. If the cancer spreads into the muscle wall of the bladder, it is called invasive bladder cancer.\(^{26}\)

Bladder cancer predominantly affects Canadians over the age of 70 years and was the fifth leading cancer diagnosis among Canadians in 2013. There were an estimated 7,900 new cases and 2,100 deaths attributed to bladder cancer in 2013, the majority of which occurred in males.\(^3\) Over the last decade, incidence rates in males have fallen slightly, with little or no change observed in female incidence rates.\(^3\) It is important to note that a change in coding practices in 1989 resulted in a significant decline in the number of bladder cancer diagnoses recorded from that year onward.

Cigarette smoking is the most common risk factor for bladder cancer and accounts for approximately 50 per cent of all bladder cancers in both males and females.\(^3\) Other risk factors include increased age, a family or personal history of bladder cancer, diet, and exposure to certain chemicals including industrial dyes, aromatic amines, polyaromatic hydrocarbons (PAHs), diesel engine exhaust, and arsenic.\(^2\)
12.2 Local Picture

12.2.1 Incidence

There were 84 new cases of bladder cancer diagnosed in Waterloo Region in 2009. Bladder cancer was the eighth leading cancer diagnosis in Waterloo Region from 1986 to 2009, accounting for 1,179 cases, or approximately three per cent of all cancer cases.

Figure 12.1 shows the annual number of cases diagnosed and age-standardized bladder cancer incidence rates from 1986 to 2009 in Waterloo Region. While the number of new cases diagnosed annually increased over this time period, incidence rates slowly decreased.

Figure 12.1. Number of cases and age-standardized incidence rate per 100,000 people for bladder cancer, Waterloo Region, 1986-2009

![Graph showing annual number of cases and incidence rate per 100,000 population for bladder cancer, 1986 to 2009.]


There was a large drop in incidence observed in the late 1980s; this rapid decline was primarily due to a change in coding practices for bladder cancers in 1989. From that year onward, incidence rates continued to decline, but at a more modest pace. Since the mid-1990s, bladder cancer incidence rates ranged from ten to 15 cases per 100,000 people.
Figure 12.2 compares the incidence of bladder cancer in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, trends in Waterloo Region have mirrored that of Ontario, with both showing a steady decline in bladder cancer incidence, with the most pronounced drop observed in the late 1980s.

**Figure 12.2. Age-standardized incidence rate per 100,000 people for bladder cancer, Waterloo Region and Ontario, 1986-2009**

The steep decline at that time can be attributed to a change in coding practices for bladder cancers. This reclassification resulted in a significantly lower number of bladder cancer diagnoses recorded from 1989 onward. Between 1986 and 2009, incidence rates in Waterloo Region remained on par or slightly lower than those observed in the province.
From 1986 through 2009, men comprised three-quarters (74.5 per cent) of all new cases of bladder cancer in Waterloo Region. Bladder cancer incidence rates also differed for males and females, with higher rates in males (overall rate of 23.2 cases per 100,000 people) than females (overall rate of 5.9 cases per 100,000 people).

Figure 12.3 shows that bladder cancer incidence rates decreased among both men and women in Waterloo Region over this time period, although the rate of decline was more dramatic among men, particularly during the late 1980s, due to the change in coding practices.

Figure 12.3. Age-standardized incidence rate per 100,000 people for bladder cancer, by sex, Waterloo Region and Ontario, 1986-2009

This declining trend in bladder cancer incidence rates for both sexes was also observed provincially, with similar rates observed annually for Waterloo Region (overall rate of 13.2 cases per 100,000 from 1986 to 2009) and Ontario (overall rate of 14.0 cases per 100,000 from 1986 to 2009).
Figure 12.4 shows that the incidence of bladder cancer rose steeply with age, particularly among men, in Waterloo Region and Ontario from 1986 to 2009.

**Figure 12.4. Age-specific incidence rate per 100,000 people for bladder cancer, by sex, Waterloo Region and Ontario, 1986-2009**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Waterloo Region</th>
<th>Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
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</tbody>
</table>

Source: Cancer Care Ontario - SEER*Stat – OCRIS (May 2012) October 2012 release. Database: Ontario Cancer Incidence with Public Health Unit 1986-2009. Note: Blank cells represent suppressed data when there were 1 to 5 cases.

From 1986 to 2009, bladder cancer incidence rates were 23.0 cases per 100,000 people among men aged 45 to 64 years in Waterloo Region. This rate increased to 209.9 cases per 100,000 people among men aged 75 years and older. A much more modest increase was observed among women. Cases of bladder cancer were very rare among men and women less than 45 years of age in Waterloo Region. Both Waterloo Region and Ontario had similar age-specific incidence rates for bladder cancer between 1986 and 2009 within each age group.

### 12.2.2 Mortality

Bladder cancer was the tenth leading cause of cancer death among Waterloo Region residents from 1986 to 2009, accounting for 472 deaths or three per cent of all cancer deaths. In 2009, there were 36 deaths attributed to bladder cancer in Waterloo Region.
Figure 12.5 shows the annual number of bladder cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region. While the annual number of deaths tended to increase over time, the age-standardized mortality rate fluctuated considerably throughout this time period without a discernible temporal trend.

**Figure 12.5. Number of deaths and age-standardized mortality rate per 100,000 people for bladder cancer, Waterloo Region, 1986-2009**

The mortality rate ranged from a high of 6.6 deaths per 100,000 people in 1987 to a low of 2.7 deaths per 100,000 people in 1992. In 2009, the age-standardized mortality rate for bladder cancer peaked again at 5.8 deaths per 100,000 people.

Figure 12.6 compares bladder cancer mortality rates in Waterloo Region to that of Ontario for the period 1986 to 2009. While rates in Waterloo Region exhibited more year-to-year variability, mortality due to bladder cancer remained relatively stable over this period.

**Figure 12.6. Age-standardized mortality rate per 100,000 people for bladder cancer, Waterloo Region and Ontario, 1986-2009**

On average, bladder cancer mortality rates in Waterloo Region were similar to those for Ontario (overall 4.5 deaths per 100,000 people compared to 4.2 deaths per 100,000 people, respectively).
From 1986 to 2009, approximately two-thirds of all bladder cancer deaths in Waterloo Region occurred in males. As relatively few bladder cancer deaths occur in a given year in Waterloo Region, it is difficult to interpret sex-specific trends over time. Therefore, Ontario data was used to examine trends in bladder cancer mortality rates separately for men and women (Figure 12.7).

**Figure 12.7. Age-standardized mortality rate per 100,000 people for bladder cancer, by sex, Ontario, 1986-2009**

![Graph showing mortality rates for bladder cancer by sex in Ontario, 1986-2009.](image)


Mortality rates among men were three and a half times greater than rates among women between 1986 and 2009 in Ontario (7.4 cases per 100,000 people compared to 2.1 cases per 100,000 people, respectively). While mortality rates among women remained stable between 1986 and 2009, rates among men decreased slightly over the same period.
Figure 12.8 presents the age-specific bladder cancer mortality rates for males and females in Waterloo Region and Ontario for the period 1986 to 2009. During this time, three-quarters of bladder cancer deaths occurred in adults aged 70 years and older (75.0 per cent).

**Figure 12.8. Age-specific mortality rate per 100,000 people for bladder cancer, by sex, Waterloo Region and Ontario, 1986-2009**

Bladder cancer mortality increased with age in Waterloo Region, with the highest increase in rates among men and women 75 years of age and older. Mortality rates were considerably higher among males than females 65 years of age and older, with less variation by sex for younger adults. There were no significant differences in bladder cancer mortality rates between Waterloo Region and Ontario for any age group between 1986 and 2009.

**12.2.3 Survival**

Figure 12.9 highlights the variation in five-year relative survival ratios for bladder cancer in Waterloo Region and Ontario over the last few decades, from 1986 to 1990 and 1998 to 2002.
Overall, relative survival ratios were slightly higher in Ontario than Waterloo Region for each time period, and no improvements in survival were evident over the last few decades.

**Figure 12.9. Age-standardized relative survival ratios for bladder cancer, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

<table>
<thead>
<tr>
<th>Survival Ratio (%)</th>
<th>1 y</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WR 1986-1990</strong></td>
<td>84.2%</td>
<td>77.7%</td>
<td>74.8%</td>
<td>72.8%</td>
<td>66.7%</td>
</tr>
<tr>
<td><strong>WR 1998-2002</strong></td>
<td>84.2%</td>
<td>75.8%</td>
<td>71.1%</td>
<td>68.7%</td>
<td>65.3%</td>
</tr>
<tr>
<td><strong>ON 1986-1990</strong></td>
<td>88.3%</td>
<td>82.4%</td>
<td>78.9%</td>
<td>76.6%</td>
<td>75.0%</td>
</tr>
<tr>
<td><strong>ON 1998-2002</strong></td>
<td>85.9%</td>
<td>78.7%</td>
<td>75.2%</td>
<td>72.7%</td>
<td>71.0%</td>
</tr>
</tbody>
</table>


The apparent trend of decreased survival ratios in both Waterloo Region and Ontario from 1986-1990 to 1998 to 2002 might actually result from the bladder cancer coding change in 1989. The change in coding practice may have removed less severe cases from the definition of bladder cancer, thereby leaving a greater proportion of more severe cases, which in turn may appear to worsen the more recent survival ratios.

In Waterloo Region, approximately 85 per cent of people diagnosed with bladder cancer were expected to survive for one year compared to people in the general population, whereas just over 65 per cent of people were expected to survive for five years compared to people in the general population. Long-term survival ratios were slightly higher in Ontario, with just over 70 per cent expected to survive for five years compared to people in the general population.
13.0 LEUKEMIA

Highlights

- There were 74 new leukemia cases in Waterloo Region in 2009
- Leukemia accounted for approximately three per cent of all cancer cases in Waterloo Region from 1986 to 2009
- Incidence rates of leukemia were relatively constant since 1986, despite some year-to-year fluctuations
- Unlike many other types of cancer, incidence rates of leukemia were moderately high among children and adolescents
- Leukemia mortality rates slowly decreased over time among both males and females
- Males experienced higher incidence and mortality rates than females
- Survival ratios for leukemia were modest, with similar or slightly lower rates in Waterloo Region compared to those for the province as a whole.
- Five-year relative survival ratios in Waterloo Region in 1998 to 2002 were just over 50 per cent.

13.1 Overview

Leukemia is the general term for cancers that start in blood-forming tissue, such as the bone marrow, and cause large numbers of abnormal blood cells to be produced and enter the bloodstream. There are several types of leukemia, dependent on the type of stem cell from which they develop and how quickly they grow. The ways in which patients are affected and how they are treated are different for each type of leukemia.

The four main types of leukemia are:
- acute lymphoblastic leukemia
- acute myelogenous leukemia
- chronic lymphoblastic leukemia
- chronic myelogenous leukemia

In Canada, there were an estimated 5,800 new cases and 2,600 deaths attributed to leukemia in 2013. Over the last decade, the incidence of leukemia has increased slightly, while mortality rates have been slowly declining. This trend was observed in both males and females.
While there is no single known cause for developing leukemia, some of the acknowledged risk factors include smoking, exposure to radiation or chemotherapy, and chronic exposure to benzene. Other risk factors include older age, a family history of the disease, certain blood disorders or viral infections, and some genetic disorders, such as Down syndrome. 

13.2 Local Picture

13.2.1 Incidence

There were 74 new cases of leukemia diagnosed in Waterloo Region in 2009. Between 1986 and 2009, leukemia accounted for 1,365 cases or approximately three per cent of all cancer cases in Waterloo Region.

Figure 13.1 shows the annual number of new leukemia cases and age-standardized incidence rates from 1986 to 2009 in Waterloo Region. Over this period, both the number of cases and incidence rates fluctuated with no noticeable temporal trend.

**Figure 13.1. Number of cases and age-standardized incidence rate per 100,000 people for leukemia, Waterloo Region, 1986-2009**

The overall leukemia incidence rate in Waterloo Region from 1986 and 2009 was 13.4 cases per 100,000 people, with a range from 7.9 to 18.8 cases per 100,000 people over this time period.
Figure 13.2 compares the incidence of leukemia in Waterloo Region to that of Ontario for the period 1986 to 2009. During this time, leukemia incidence in Waterloo Region has been similar to that in Ontario, but with considerable variability from year to year.

**Figure 13.2. Age-standardized incidence rate per 100,000 people for leukemia, Waterloo Region and Ontario, 1986-2009**

![Graph showing leukemia incidence rates for Waterloo Region and Ontario from 1986 to 2009.](image)


Ontario rates were relatively consistent over time, with only a slight upward trend beginning in 2001.
Figure 13.3 shows that incidence rates for leukemia were higher among males than females in Waterloo Region from 1986 to 2009 (overall rate of 17.6 cases per 100,000 people compared to 10.1 cases per 100,000 people, respectively).

This discrepancy in sex-specific incidence rates remained constant over time, and was observed in both Waterloo Region and Ontario. While there was variability in annual leukemia rates for males and females in Waterloo Region, Ontario rates were fairly stable for both sexes from 1986 to 2009.

The incidence of many cancers generally increases with age. This trend also held true for leukemia, with two-thirds of new cases diagnosed in adults 60 years of age and older. At the same time, age-specific incidence rates are also moderately high among children and adolescents 19 years of age and younger (Figure 13.4), a trend not seen with other types of cancers.

Figure 13.4. Age-specific incidence rate per 100,000 people for leukemia, by sex, Waterloo Region and Ontario, 1986-2009

Furthermore, a majority of these cases were actually diagnosed in children less than ten years of age; between 1986 and 2009, there were 87 new cases of leukemia diagnosed in children less than ten years of age compared to 41 cases in adolescents aged ten to 19 years in Waterloo Region.

While leukemia incidence rates were similar for males and females through adolescence and early adulthood, after age 65, rates were approximately two times higher in men than women. There were no significant differences in leukemia incidence rates for Waterloo Region and Ontario by age group at diagnosis.

13.2.2 Mortality

Mortality due to leukemia was the seventh leading cause of cancer death in Waterloo Region from 1986 to 2009, accounting for 687 deaths, or approximately four per cent of
all cancer deaths. In 2009, there were 28 deaths attributed to leukemia in Waterloo Region.

Figure 13.5 shows the annual number of deaths and age-standardized mortality rates for leukemia from 1986 to 2009 in Waterloo Region. While the number of deaths fluctuated over this time period, and even appeared to increase slightly, the age-standardized mortality rate showed no discernible changes over time, aside from some year-to-year variability.

**Figure 13.5. Number of deaths and age-standardized mortality rate per 100,000 people for leukemia, Waterloo Region, 1986-2009**

Despite a peak in incidence in 2004 (9.6 cases per 100,000 people), leukemia mortality rates decreased slightly since the early 2000s compared to previous time periods. In 2009, the mortality rate for leukemia was 4.9 cases per 100,000 people.
Figure 13.6 compares mortality rates due to leukemia in Waterloo Region to that of Ontario for the period 1986 to 2009. During this period, there was a small yet steady decline in leukemia mortality in Ontario.

**Figure 13.6. Age-standardized mortality rate per 100,000 people for leukemia, Waterloo Region and Ontario, 1986-2009**

![Graph showing mortality rates for leukemia in Waterloo Region and Ontario from 1986 to 2009.](image)


Although mortality rates in Waterloo fluctuated from year to year, they followed a similar downward trend over time. In general, mortality rates for leukemia in Waterloo Region were comparable to those for the province as a whole (overall rate of 6.7 deaths per 100,000 people compared to 6.7 deaths per 100,000 people, respectively).
Despite fluctuations in rates due to small numbers of cases each year, there has been a modest decline in mortality due to leukemia in Waterloo Region from 1986 to 2009 (Figure 13.7).

Figure 13.7. Age-standardized mortality rate per 100,000 people for leukemia, by sex, Waterloo Region and Ontario, 1986-2009


Ontario data suggests a similar decreasing trend over the same period, which was evident for both males and females. However, mortality rates of leukemia have remained consistently higher in men than women; the overall mortality rate from 1986 to 2009 in Waterloo Region was 9.5 deaths per 100,000 people in males, compared to 4.7 deaths per 100,000 people in females.

Older adults, particularly those aged 70 years and older, accounted for the majority of leukemia deaths in both Waterloo Region (61.3 per cent) and Ontario (59.7 per cent) between 1986 and 2009. There were relatively few deaths in children and adolescents younger than 20 years of age during this time period.
Figure 13.8 shows that age-specific mortality rates were higher among males than females for each age group, and were similar in Waterloo Region and Ontario across all age groups and for both sexes.

**Figure 13.8. Age-specific mortality rate per 100,000 people for leukemia, by sex, Waterloo Region and Ontario, 1986-2009**

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterloo Region</td>
<td>1.2 1.5 7.7 38.9 95.7 0.6 0.7 4.1 18.6</td>
<td>1.1 1.5 7.5 32.9 86.3 0.7 1.1 4.7 17.3</td>
</tr>
<tr>
<td>Ontario</td>
<td>1.1 1.5 7.5 32.9 86.3 0.7 1.1 4.7 17.3</td>
<td>1.1 1.5 7.5 32.9 86.3 0.7 1.1 4.7 17.3</td>
</tr>
</tbody>
</table>


In Waterloo Region, the age-specific mortality rate for leukemia peaked among males 75 years and older at 95.7 deaths per 100,000 people. Mortality due to leukemia also peaked in this age group for females, but rates were lower at 47.2 deaths per 100,000 people.

**13.2.3 Survival**

Figure 13.9 presents the five-year relative survival ratio in one year intervals following diagnosis of leukemia in Waterloo Region and Ontario over the last few decades from 1986 to 1990 and 1998 to 2002.
Short-term survival among those diagnosed with leukemia approached 70.0 per cent for the one year relative survival ratio. Relative survival ratios were similar for Waterloo Region and Ontario, with modest improvements in long-term survival between 1986 to 1990 and 1998 to 2002 both locally and provincially.

Figure 13.9. Age-standardized relative survival ratios for leukemia, Waterloo Region and Ontario, 1986-1990 and 1998-2002

<table>
<thead>
<tr>
<th></th>
<th>1 y</th>
<th>2 y</th>
<th>3 y</th>
<th>4 y</th>
<th>5 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1986-1990</td>
<td>68.3%</td>
<td>56.4%</td>
<td>53.4%</td>
<td>47.3%</td>
<td>44.2%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>69.9%</td>
<td>62.2%</td>
<td>55.3%</td>
<td>52.8%</td>
<td>51.4%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>65.8%</td>
<td>56.9%</td>
<td>51.5%</td>
<td>48.1%</td>
<td>45.2%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>69.0%</td>
<td>62.3%</td>
<td>58.8%</td>
<td>56.8%</td>
<td>55.0%</td>
</tr>
</tbody>
</table>


In Waterloo Region, 44.2 per cent of people diagnosed with leukemia in 1986 to 1990 were expected to survive for five years compared to people in the general population. A decade later, among people diagnosed from 1998 to 2002, 51.4 per cent were expected to survive for five years compared to people in the general population. Five-year survival ratios were slightly higher for Ontario, approaching 55.0 per cent.
14.0 NON-HODGKIN LYMPHOMA

Highlights

- There were 99 new non-Hodgkin lymphoma (NHL) cases in Waterloo Region in 2009
- NHL was the fifth most common cancer in Waterloo Region from 1986 to 2009, accounting for four per cent of all cancer cases
- NHL incidence rose steadily from 1986 to 2009
- NHL mortality increased through the 1980s and 1990s, but declined since that time
- Males experienced higher incidence and mortality rates than females
- Survival ratios were similar in Waterloo Region and Ontario
- Both short and long-term NHL survival ratios improved over the last few decades
- In 1998-2002, 60 per cent of Waterloo Region residents diagnosed with NHL were expected to survive for five years compared to people in the general population

14.1 Overview

Non-Hodgkin lymphoma (NHL) encompasses a wide variety of malignancies arising in the lymphocytes (white blood cells). There are over 30 types of NHL, classified by how the cells look, develop and spread, and in which type of lymphocyte they originated. Depending on the subtype, the cancer may grow slowly or rapidly, and it can be formed from either the B-cells or T-cells of the immune system. The two broadest sub-types are diffuse and nodular, also known as follicular lymphomas.\textsuperscript{28,29}

In Canada, there were an estimated 7,800 new cases and 2,600 deaths attributed to NHL in 2013.\textsuperscript{3} The number of new cases and deaths each year from NHL has almost tripled over the last 30 years in both males and females. NHL incidence rates have also increased over this time, and have climbed faster among males than females.\textsuperscript{28} This is likely a result of improved detection, as well as changes in risk factors for the disease.\textsuperscript{14} Conversely, since the late 1990s, there have been significant decreases in NHL mortality in Canada for both males and females, which may reflect improvements in treatment or the introduction of anti-retroviral treatment for human immunodeficiency virus (HIV) infection.\textsuperscript{3,14}

The etiology of NHL is poorly understood and there is no known single cause of the disease. However, it may be related to exposure to an infectious agent and/or due to an uncontrolled immune response. NHL may also be associated with chronic disorders of the immune system or other exposures that depress the immune system's
responsiveness, such as HIV infection or treatment with immunosuppressive drugs. Other factors that increase one’s risk of NHL include increasing age and prior exposure to radiation or chemotherapy.²,²⁸

### 14.2 Local Picture

#### 14.2.1 Incidence

There were 99 new cases of NHL diagnosed in Waterloo Region in 2009. NHL was the fifth leading cancer diagnosed in Waterloo Region from 1986 to 2009, accounting for 1,729 cases, or four per cent of all cancer cases.

Figure 14.1 shows the annual number of cases diagnosed and age-standardized NHL incidence rates from 1986 to 2009 in Waterloo Region. Both the number of cases and incidence rate increased over this time period in Waterloo Region.

**Figure 14.1. Number of cases and age-standardized incidence rate per 100,000 people for Non-Hodgkin lymphoma, Waterloo Region, 1986-2009**

NHL incidence peaked in 2007 at 21.5 cases per 100,000 people, and since that time, declined slightly. This recent downward trend may reflect natural variation in annual rates, and not a true long-term decreasing trend.

Figure 14.2 compares the incidence of NHL in Waterloo Region to that of Ontario for the period 1986 to 2009. Over this period, NHL incidence steadily increased both locally and provincially.

**Figure 14.2. Age-standardized incidence rate per 100,000 people for Non-Hodgkin lymphoma, Waterloo Region and Ontario, 1986-2009**

In general, rates from 1986 to 2009 in Waterloo Region were very similar to those in Ontario (overall rate of 16.9 cases per 100,000 people, compared to 16.4 cases per 100,000 people, respectively).
NHL incidence rates among males and females varied in Waterloo Region, with more cases reported among males (overall rate of 20.0 cases per 100,000 people from 1986 to 2009) than females (overall rate of 14.3 cases per 100,000 people from 1986 to 2009) (Figure 14.3). A similar trend was observed for Ontario.

Figure 14.3. Age-standardized incidence rate per 100,000 people for Non-Hodgkin lymphoma, by sex, Waterloo Region and Ontario, 1986-2009


NHL incidence increased at a faster rate among males than females. Between 1986 and 2009, the NHL incidence rate in Waterloo Region males increased from 16.3 cases per 100,000 people in 1986 to 23.0 cases per 100,000 people in 2009. Among females, NHL incidence rates increased less dramatically over the same time period, and began to level off in the mid-2000s.
Figure 14.4 shows that the incidence of NHL increased with age between 1986 and 2009 in Waterloo Region.

**Figure 14.4. Age-specific incidence rate per 100,000 people for Non-Hodgkin lymphoma, by sex, Waterloo Region and Ontario, 1986-2009**

Age-specific incidence rates were highest for men and women 75 years of age or older (106.6 cases per 100,000 people and 80.8 cases per 100,000 people, respectively). However, half (50.8 per cent) of NHL cases occurred among adults aged 40 to 69 years during this period. Both Waterloo Region and Ontario experienced similar age-specific incidence rates for NHL by sex across all age groups.

### 14.2.2 Mortality

NHL was the sixth leading cause of cancer death in Waterloo Region from 1986 to 2009, accounting for 727 deaths, or four per cent of all cancer deaths. In 2009, there were 28 deaths attributed to NHL in Waterloo Region.


Note: Blank cells represent suppressed data when there were 1 to 5 cases.
Figure 14.5 shows the annual number of NHL deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region. While the number of deaths increased over this time period, the age-standardized mortality rate increased through the 1980s and 1990s, then began to decline after that point.

**Figure 14.5. Number of deaths and age-standardized mortality rate per 100,000 people for Non-Hodgkin lymphoma, Waterloo Region, 1986-2009**

![Graph showing the annual number of NHL deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region.](image)


NHL mortality peaked in 2000 at a rate of 10.7 deaths per 100,000 people, but decreased to 4.7 deaths per 100,000 people in 2009.
Figure 14.6 compares NHL mortality rates in Waterloo Region to those of Ontario for the period 1986 to 2009. During this period, mortality rates in Waterloo Region mirrored those for Ontario, aside from greater local variability.

Figure 14.6. Age-standardized mortality rate per 100,000 people for Non-Hodgkin lymphoma, Waterloo Region and Ontario, 1986-2009

NHL mortality increased slightly through the late 1980s and 1990s, followed by a decline through the 2000s. In general, mortality rates for NHL in Waterloo Region were similar to those for the province as a whole (overall rate of 7.1 deaths per 100,000 people from 1986 to 2009, compared to 6.7 deaths per 100,000 people, respectively).
Due to the small number of sex-specific NHL deaths in Waterloo Region each year, it is difficult to interpret trends over time; therefore, mortality rates for males and females are presented only for Ontario (Figure 14.7).

While mortality rates remained consistently higher among males than females between 1986 and 2009, there was a similar trend of increasing NHL mortality through the late 1980s and 1990s, followed by a decline in mortality in the 2000s observed for both sexes.

**Figure 14.7. Age-standardized mortality rate per 100,000 people for Non-Hodgkin lymphoma, by sex, Ontario, 1986-2009**

![Graph showing age-standardized mortality rate per 100,000 people for Non-Hodgkin lymphoma, by sex, Ontario, 1986-2009](image)


Among males, NHL mortality rates decreased from a high of 9.2 deaths per 100,000 people in 2001 to 7.4 deaths per 100,000 people in 2009. Among females, the NHL mortality peaked at 6.4 deaths per 100,000 people in 1997, but then declined to 4.9 deaths per 100,000 people in 2009.
Between 1986 and 2009, approximately three-quarters of NHL deaths (78.0 per cent) in Waterloo Region occurred in adults 60 years of age and older. There were relatively few deaths in persons younger than 45 years of age during this time period.

Figure 14.8 presents the age-specific mortality rates for NHL by sex in Waterloo Region and Ontario for the period 1986 to 2009. In general, NHL mortality increased with age.

Figure 14.8. Age-specific mortality rate per 100,000 people for Non-Hodgkin lymphoma, by sex, Waterloo Region and Ontario, 1986-2009

Rates were only slightly higher in men than women in older adulthood. In Waterloo Region, the age-specific mortality rate for NHL peaked among both men and women 75 years or older (70.0 deaths per 100,000 people and 59.3 deaths per 100,000 people, respectively). NHL mortality rates were similar in Waterloo Region and Ontario across all age groups and for both sexes.

14.2.3 Survival

Figure 14.9 highlights the variation of NHL survival ratios for Waterloo Region and Ontario over the last few decades from 1986 to 1990 and 1998 to 2002. The graph presents five-year relative survival ratios in one year intervals following diagnosis.
Overall, relative survival ratios were similar for Waterloo Region and Ontario at each time period, with notable improvements between 1986 to 1990 and 1998 to 2002 at each survival interval.


<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1986-1990</td>
<td>71.4%</td>
<td>64.8%</td>
<td>59.5%</td>
<td>56.9%</td>
<td>53.1%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>79.0%</td>
<td>69.7%</td>
<td>65.9%</td>
<td>63.5%</td>
<td>59.9%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>73.6%</td>
<td>65.3%</td>
<td>60.6%</td>
<td>57.4%</td>
<td>54.4%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>78.2%</td>
<td>70.8%</td>
<td>67.5%</td>
<td>64.7%</td>
<td>62.6%</td>
</tr>
</tbody>
</table>


In Waterloo Region, approximately 70.0 per cent of people diagnosed with NHL in 1986 to 1990 were expected to survive for one year compared to people in the general population. A decade later, among people diagnosed from 1998 to 2002, almost 80.0 per cent were expected to survive for one year compared to the general population. At five years post-diagnosis with NHL, the relative survival ratio was 53.1 per cent of people in Waterloo Region diagnosed in 1986 to 1990 and, a decade later in 1998 to 2002, the five year relative survival ratio was 59.9 per cent. In general, relative survival ratios for Ontario were similar to those for Waterloo Region.
15.0 CANCERS OF THE HEAD AND NECK

15.1 Overview

Cancers that are known collectively as head and neck cancers usually begin in the squamous cells that line the moist, mucosal surfaces inside the head and neck (for example, inside the mouth, nose and throat). These squamous cell cancers are often referred to as squamous cell carcinomas of the head and neck. Head and neck cancers can also begin in the salivary glands, but those types are relatively uncommon.30

Cancers of the head and neck are further categorized by the area of the head or neck in which they begin, including the oral cavity, pharynx, larynx, paranasal sinuses and nasal cavity, or salivary glands. Cancers of the brain, the eye, the esophagus, and the thyroid gland, as well as those of the scalp, skin, muscles, and bones of the head and neck, are not usually classified as head and neck cancers.30 In this report, thyroid cancers were reported separately and, therefore, were excluded from head and neck cancers.

Head and neck cancers are diagnosed in approximately 4,300 Canadians per year. Men are nearly three times more likely to develop the disease than women. One study that investigated trends in cancers of the head and neck in Canada over the last two decades (grouped into three categories based on their site of origin) found that the incidence of oropharynx cancers has been increasing, while oral cavity tumours and other head and neck cancers have been decreasing. The increase in oropharynx cancers may be due to their strong association with human papillomavirus (HPV) infection, which is also increasing in Canada.31
Alcohol and tobacco use (including smokeless tobacco, sometimes called “chewing tobacco” or “snuff”) are the two most important risk factors for head and neck cancers, especially cancers of the oral cavity, oropharynx, hypopharynx, and larynx. At least 75 per cent of head and neck cancers are caused by tobacco and alcohol use. Researchers have found that people who smoke one pack of cigarettes a day are six times more likely than people who do not smoke to get cancer of the head or neck. Those who use both tobacco and alcohol are at greater risk of developing these cancers than people who use either tobacco or alcohol alone.\textsuperscript{30}

In addition, infection with cancer-causing types of HPV, especially HPV-16, is a risk factor for some types of head and neck cancers, particularly oropharyngeal cancers that involve the tonsils or the base of the tongue.\textsuperscript{30} Other risk factors for cancers of the head and neck include consumption of certain preserved or salted foods, poor oral hygiene, radiation exposure to the head and neck, occupational exposure to wood dust, asbestos and synthetic fibres, and infection with Epstein-Barr virus.\textsuperscript{30}

\textbf{15.2 Local Picture}

\textbf{15.2.1 Incidence}

There were 62 new cases of head and neck cancer in Waterloo Region in 2009. Cancer of the head and neck accounted for approximately 1,315 new cases, or three per cent of all cases of cancer diagnosed in Waterloo Region from 1986 to 2009.
Figure 15.1 shows the annual number of cases diagnosed and age-standardized incidence rates from 1986 to 2009 in Waterloo Region. Incidence rates for cancers of the head and neck peaked in 1991 at 18.3 cases per 100,000 people.

Figure 15.1. Number of cases and age-standardized incidence rate per 100,000 people for cancers of the head and neck, Waterloo Region, 1986-2009


Incidence rates then declined through the mid-1990s, and were relatively stable since that time. In 2009, the incidence of head and neck cancers in Waterloo Region fell to 10.2 cases per 100,000 people.
Figure 15.2 compares the incidence of head and neck cancers in Waterloo Region to that of Ontario for the period 1986 to 2009. Incidence rates were highest during the 1980s around 16.0 cases per 100,000 people and then decreased through the 1990s.

Figure 15.2. Age-standardized incidence rate per 100,000 people for cancers of the head and neck, Waterloo Region and Ontario, 1986-2009

Since 2000, incidence rates levelled off. From 1986 to 2009, overall trends in head and neck cancer incidence were very similar between Waterloo Region and Ontario, although local rates were generally slightly lower than provincial rates. On average, incidence rates were about seven per cent higher in Ontario compared to Waterloo Region between 1986 and 2009.

Between 1986 and 2009, over two-thirds (72.2 per cent) of newly diagnosed head and neck cancers in Waterloo Region were among males. Figure 15.3 presents the age-standardized incidence rates for cancers of the head and neck by sex for Waterloo Region and Ontario for the period 1986 through 2009. Similar trends in incidence were observed for Waterloo Region and Ontario for both sexes over this period.

**Figure 15.3. Age-standardized incidence rate per 100,000 people for cancers of the head and neck, by sex, Waterloo Region and Ontario, 1986-2009**

![Graph showing age-standardized incidence rates](image)


While rates were relatively stable over time among females, there was a steady decline in incidence rates among males since the early 1990s. On average, rates were approximately three times higher among men than women in both Waterloo Region and Ontario.
Figure 15.4 shows the age-specific incidence rate of head and neck cancers by sex for Waterloo Region and Ontario between 1986 and 2009. Among both males and females, incidence rates increased with age, and were highest among older adults aged 65 years and older.

**Figure 15.4. Age-specific incidence rate per 100,000 people for cancers of the head and neck, by sex, Waterloo Region and Ontario, 1986-2009**

Incidence rates of head and neck cancers were quite low in both males and females younger than 45 years of age. Both Waterloo Region and Ontario experienced a similar trend of increasing incidence with age, although rates were slightly higher in Ontario compared to Waterloo Region for almost all age groups for both sexes.

### 15.2.2 Mortality

Cancers of the head and neck accounted for 459 cancer-related deaths in Waterloo Region from 1986 to 2009. Figure 15.5 shows the annual number of head and neck cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region.
While the number of deaths remained relatively stable over this time, the age-standardized mortality rate decreased considerably.

Figure 15.5. Number of deaths and age-standardized mortality rate per 100,000 people for cancers of the head and neck, Waterloo Region, 1986-2009


With the exception of a peak in 2004 (6.2 deaths per 100,000 people), mortality due to head and neck cancers dropped by approximately 50 per cent between 1986 and 2009, reaching a low of 2.6 deaths per 100,000 people in 2009.
Figure 15.6 compares mortality rates due to cancers of the head and neck in Waterloo Region to that of Ontario from 1986 to 2009. During this period, mortality rates in both Waterloo Region and Ontario decreased considerably, with the exception of a peak in mortality in 2004 that was not seen for Ontario as a whole.

Figure 15.6. Age-standardized mortality rate per 100,000 people for cancers of the head and neck, Waterloo Region and Ontario, 1986-2009


On average, mortality rates for cancers of the head and neck were similar for Waterloo Region and Ontario at approximately 5.0 deaths per 100,000 people between 1986 and 2009, and in both cases there was an approximate 50 per cent decline in rates from 1986 to 2009.
Due to the small number of head and neck cancer deaths reported in Waterloo Region each year, particularly among females, sex-specific mortality rates are presented only for Ontario (Figure 15.7). On average, rates were three times higher among men than women between 1986 and 2009.

**Figure 15.7. Age-standardized mortality rate per 100,000 people for cancers of the head and neck, by sex, Ontario, 1986-2009**

While mortality rates remained relatively stable among females (approximately 2.0 deaths per 100,000 people), rates in males declined considerably from 10.1 deaths per 100,000 people in 1986 to 5.8 deaths per 100,000 people in 2009.
Between 1986 and 2009, almost half of all deaths due to cancers of the head and neck (46.2 per cent) in Waterloo Region occurred in adults 70 years of age and older. There were relatively few deaths in persons younger than 45 years of age during this time period.

Figure 15.8 shows the age-specific mortality rates of head and neck cancers by sex for Waterloo Region and Ontario between 1986 and 2009.

**Figure 15.8. Age-specific mortality rate per 100,000 people for cancers of the head and neck, by sex, Waterloo Region and Ontario, 1986-2009**

![Age-specific mortality rate per 100,000 people for cancers of the head and neck, by sex, Waterloo Region and Ontario, 1986-2009](image)

Note: Blank cells represent suppressed data when there were 1 to 5 cases.

Among both males and females, mortality rates increased with age, and were highest among older adults aged 75 years and older. However, mortality rates were significantly higher among men than women during older adulthood.

### 15.2.3 Survival

Five-year relative survival ratios for cancers of the head and neck for Waterloo Region and Ontario from 1986 to 1990 and 1998 to 2002 are presented in Figure 15.9.
Overall, relative survival ratios were similar for Waterloo Region and Ontario, with no significant improvements in either short or long-term survival between 1986 to 1990 and 1998 to 2002.

**Figure 15.9. Age-standardized relative survival ratios for cancers of the head and neck, Waterloo Region and Ontario, 1986-1990 and 1998-2002**

<table>
<thead>
<tr>
<th></th>
<th>1 yr</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR 1986-1990</td>
<td>80.9%</td>
<td>67.9%</td>
<td>65.9%</td>
<td>60.5%</td>
<td>58.5%</td>
</tr>
<tr>
<td>WR 1998-2002</td>
<td>83.8%</td>
<td>68.3%</td>
<td>63.5%</td>
<td>62.0%</td>
<td>59.2%</td>
</tr>
<tr>
<td>ON 1986-1990</td>
<td>82.3%</td>
<td>71.3%</td>
<td>65.9%</td>
<td>62.1%</td>
<td>59.4%</td>
</tr>
<tr>
<td>ON 1998-2002</td>
<td>83.2%</td>
<td>73.6%</td>
<td>68.4%</td>
<td>65.9%</td>
<td>63.5%</td>
</tr>
</tbody>
</table>


In Waterloo Region, just over 80.0 per cent of people diagnosed with head and neck cancers were expected to survive for one year compared to people in the general population. The five year relative survival rate of people with neck and head cancers is less than 60.0 per cent. Relative survival ratios for Ontario were similar to those for Waterloo Region at one and five years post-diagnosis, and for each time period in between.
16.0 RARE CANCERS

Highlights

- Anal cancer:
  - There were approximately ten cases diagnosed per year
  - Incidence and mortality rates did not change much over time
  - The Ontario five year relative survival ratio was 66 per cent

- Kidney cancer:
  - There were 50 or fewer local cases per year
  - Locally and provincially, the incidence rate slowly increased
  - Rates were higher in men than women, and most cases occurred in individuals over age 60

- Liver cancer:
  - There were approximately ten cases diagnosed in Waterloo Region per year, the majority of which were men
  - Incidence rates steadily increased in Ontario
  - The five year relative survival ratio was less than 25 per cent

- Pancreatic cancer:
  - There were typically 50 or fewer local cases per year
  - There was a modest decline in mortality rates over time
  - Survival remained quite poor; the five year relative survival ratio was less than 10 per cent

- Stomach cancer:
  - There were typically 40 or fewer local cases diagnosed per year, the majority of which were men
  - Incidence and mortality rates decreased over time both locally and provincially
  - The five year relative survival ratio was about 25 per cent

- Testicular cancer:
  - There were typically fewer than 20 local cases per year
  - Provincial incidence rates slowly increased over time
  - Two-thirds of cases were diagnosed in men aged 20 to 39 years
  - Survival ratios were excellent, with a five year relative survival ratio of more than 96 per cent

- Thyroid cancer:
  - There were typically fewer than 50 local cases per year, eighty per cent of which were diagnosed among females
  - Provincial incidence rates more than quadrupled over time
  - Survival ratios were excellent, with a five year relative survival ratio of more than 97 per cent
16.1 Overview

There are many other types of cancer, several of which are rarely diagnosed in Waterloo Region. While these cancers are still important to understand and monitor, the lack of cases on an annual basis makes it difficult to report on local trends over time. Some of these cancers will be briefly discussed below, although the data presented focuses on overall trends for Ontario, with local data comparisons reported when a sufficient number of cases were available.

Cancers included in this section of the report include those cancers with fewer than 1,000 cases reported over the entire study period from 1986 to 2009 in Waterloo Region, or those with less than 50 cases reported annually, on average. Sex-specific cancers (those cancers experienced by only one of the sexes, such as testicular cancer) were considered rare if there were fewer than 500 cases reported over the entire study period from 1986 to 2009 in Waterloo Region.

16.2 Anal Cancer

Cancers that form in the tissues of the anus (the opening of the rectum to the outside of the body) are known as anal cancers.32 Risk factors for anal cancer include infection with human papillomavirus (HPV), certain sexual activities, such as having anal intercourse and multiple sexual partners, having lowered immunity, and smoking.2 While there is no general screening program for anal cancers, people at high risk may benefit from a Pap test of cells from the anus.2

There are typically fewer than ten cases of anal cancer per year diagnosed in Waterloo Region. Between 1986 and 2009, a total of 137 cases of anal cancer were diagnosed in Waterloo Region, of which over half (58.4 per cent) were diagnosed among females.
Figure 16.1 shows the annual number of cases diagnosed and age-standardized anal cancer incidence rates from 1986 to 2009 in Ontario.

Prior to the mid-1990s, both the number of cases and incidence rate remained relatively stable, with some year-to-year variability. From the mid-1990s through the mid-2000s, there was a slight increase in the number of cases and incidence rate.

**Figure 16.1. Number of cases and age-standardized incidence rate per 100,000 people for anal cancer, Ontario, 1986-2009**

Anal cancer incidence increased from 1.3 cases per 100,000 people in 1995 to 1.9 cases per 100,000 people in 2005 in Ontario. Since 2005, incidence rates have again stabilized, and even begun to decrease slightly, dropping to 1.5 cases per 100,000 people.
While it was difficult to examine sex- and age-specific trends in incidence rates of anal cancer in Waterloo Region due to small numbers of cases, Ontario data shows that rates were comparable between men and women and, similar to other cancers, the age-specific incidence rate increased with age (Figure 16.2).

**Figure 16.2. Age-specific incidence rate per 100,000 people for anal cancer, by sex, Ontario, 1986-2009**

<table>
<thead>
<tr>
<th></th>
<th>Rate per 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
<td>0.4</td>
</tr>
<tr>
<td>20-44</td>
<td>3.1</td>
</tr>
<tr>
<td>45-64</td>
<td>6.9</td>
</tr>
<tr>
<td>65-74</td>
<td>9.8</td>
</tr>
<tr>
<td>75+</td>
<td></td>
</tr>
</tbody>
</table>


Note: Blank cells represent suppressed data when there were 1 to 5 cases.

The highest incidence rates were experienced among men and women 75 years of age or older (9.8 and 8.7 cases per 100,000 people, respectively). Very few anal cancers were diagnosed in men and women younger than 45 years of age in Waterloo Region or Ontario.
Between 1986 and 2009, there were fewer than 15 deaths due to anal cancer in Waterloo Region and less than 500 deaths in Ontario as a whole; over half (58.2 per cent) of these were among females. Figure 16.3 shows the annual number of anal cancer deaths and age-standardized mortality rates from 1986 to 2009 in Ontario.

**Figure 16.3. Number of deaths and age-standardized mortality rate per 100,000 people for anal cancer, Ontario, 1986-2009**

![Graph showing annual number of anal cancer deaths and age-standardized mortality rates from 1986 to 2009 in Ontario.](image)


Due to the small number of deaths reported annually in Ontario, it is difficult to interpret trends over time, but in general anal cancer mortality rates remained consistently below 0.3 deaths per 100,000 people.
While the small number of deaths makes interpretation of sex- and age-specific trends difficult, Ontario data shows that anal cancer mortality rates were comparable between men and women and increased slightly with age (Figure 16.4).

Figure 16.4. Age-specific mortality rate per 100,000 people for anal cancer, by sex, Ontario, 1986-2009

Note: Blank cells represent suppressed data when there were 1 to 5 cases.

The highest mortality rates were experienced among men and women 75 years of age and older (1.3 and 1.2 deaths per 100,000 people, respectively).

While there has been some improvement in long-term survival ratios for anal cancer over the last few decades, five-year relative survival remained moderately poor; approximately two-thirds (66.0 per cent) of people diagnosed between 1998 and 2002 in Ontario were expected to survive for five years compared to people in the general population (data not shown).

16.3 Kidney Cancer

Kidney cancer forms in the tissues of the kidneys and includes renal cell carcinoma (cancer that forms in the lining of very small tubes in the kidney that filter the blood and remove waste products) and renal pelvis carcinoma (cancer that forms in the center of the kidney where urine collects). It also includes Wilms tumor, which is a type of kidney
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Cancer that usually develops in children under the age of five.\(^{33}\) Approximately 80 per cent of all kidney cancers are renal cell carcinomas.\(^{34}\)

Risk factors for kidney cancer include tobacco smoking, being overweight or obese, having high blood pressure, end stage kidney disease or certain genetic conditions. A family history of kidney cancer can also increase one's risk for developing the disease.\(^{2}\)

There are typically fewer than 50 cases of kidney cancer diagnosed per year in Waterloo Region. Between 1986 and 2009, a total of 919 cases of kidney cancer were diagnosed in Waterloo Region, 60.7 per cent of which were diagnosed among males.

Figure 16.5 shows the annual number of cases diagnosed and age-standardized kidney cancer incidence rates from 1986 to 2009 in Waterloo Region and Ontario. During this period, there was a gradual increase in the incidence rate of kidney cancer.

**Figure 16.5. Number of cases and age-standardized incidence rate per 100,000 people for kidney cancer, Waterloo Region and Ontario, 1986-2009**

![Graph showing kidney cancer incidence rates from 1986 to 2009 in Waterloo Region and Ontario.]


In Waterloo Region, incidence rates rose from 6.6 cases per 100,000 people in 1986 to 10.3 cases per 100,000 people in 2009. While incidence rates remained consistently higher among males than females during this time period, both sexes experienced a similar increasing trend (data not shown).
While a small number of cases of kidney cancer were diagnosed annually among people less than 40 years of age, a majority of cases (59.1 per cent) were diagnosed in men and women 60 years of age and older.

Figure 16.6 shows that the age-specific incidence rate for kidney cancer increased sharply after 65 years of age, and male rates were almost double those experienced by females.

**Figure 16.6. Age-specific incidence rate per 100,000 people for kidney cancer, by sex, Waterloo Region and Ontario, 1986-2009**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Waterloo Region</th>
<th>Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>20-44</td>
<td>2.1</td>
<td>2.6</td>
</tr>
<tr>
<td>45-64</td>
<td>23.9</td>
<td>25.1</td>
</tr>
<tr>
<td>65-74</td>
<td>54.4</td>
<td>53.1</td>
</tr>
<tr>
<td>75+</td>
<td>51.8</td>
<td>64</td>
</tr>
</tbody>
</table>

The highest incidence rates were found among men 65 to 74 years of age in Waterloo Region (54.4 cases per 100,000 people).
Between 1986 and 2009, there were 375 deaths due to kidney cancer in Waterloo Region, accounting for two per cent of all cancer-related deaths. Almost two-thirds (62.1 per cent) of these deaths were reported among males.

Figure 16.7 shows the annual number of kidney cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region and Ontario.

Due to the small number of deaths reported annually in Waterloo Region, it is difficult to interpret trends over time. However, Ontario data shows that kidney cancer mortality rates remained relatively stable over time at just under 4.0 deaths per 100,000 people on average between 1986 and 2009.
Figure 16.8 presents age-specific kidney cancer mortality rates by sex for Waterloo Region and Ontario. Kidney cancer mortality increased with age, with the highest mortality rates among men 75 years of age and older (43.0 deaths per 100,000 people).

Mortality rates in males were approximately double those experienced among females of the same age group.

While one-year relative survival ratios for kidney cancer approached 80 per cent, long-term survival ratios were more modest; five-year relative survival ratios for people diagnosed between 1998 and 2002 in Ontario were 70.6 per cent. Relative survival ratios for kidney cancer among Waterloo Region residents were slightly lower than those for Ontario as a whole for each time period following diagnosis (data not shown).

16.4 Liver Cancer

Primary liver cancer is cancer that forms in the tissues of the liver, including the cells, bile ducts, blood vessels or connective tissue of the liver. Secondary liver cancer is cancer that spreads to the liver from another part of the body. Most primary liver cancers begin in the cells, also called hepatocytes, and are called hepatocellular...
carcinoma. Liver cancers that arise in the bile ducts are less common and are called cholangiocarcinomas. Liver cancer is one of the fastest growing cancer types in Canada in terms of number of new cases and deaths. It is increasing particularly quickly in men, with an average annual per cent increase in incidence of 3.6 per cent.

While there is no single cause of liver cancer, major risk factors include viral hepatitis infection (hepatitis B and C), smoking, alcohol consumption and obesity. Other factors which increase one’s risk for developing liver cancer include having chronic liver infection, cirrhosis (scarring of the liver), and some metabolic disorders, such as hemochromatosis.

There are typically fewer than ten cases of liver cancer per year diagnosed in Waterloo Region. Between 1986 and 2009, a total of 186 cases of liver cancer were diagnosed in Waterloo Region, approximately three-quarters (72.0 per cent) of which were diagnosed among males.

Figure 16.9 shows the annual number of cases diagnosed and age-standardized liver cancer incidence rates from 1986 to 2009 in Ontario.
During this period, there was a steep increase in both the number of cases and incidence rate of liver cancer. Incidence rates more than doubled, increasing from 1.7 cases per 100,000 people in 1986 to 4.2 cases per 100,000 people in 2009.

**Figure 16.9. Number of cases and age-standardized incidence rate per 100,000 people for liver cancer, Ontario, 1986-2009**

This increase was primarily due to rising incidence rates among males which increased from 3.0 to 7.2 cases per 100,000 people between 1986 and 2009. Meanwhile, female rates remained relatively stable over this time period, between 1.0 and 2.0 cases per 100,000 people (data not shown).

Ontario data also shows that the age-specific incidence rate of liver cancer increased with age, and was much higher among males than females (Figure 16.10).

Figure 16.10. Age-specific incidence rate per 100,000 people for liver cancer, by sex, Ontario, 1986-2009

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>20-44</td>
<td>0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>45-64</td>
<td>9.7</td>
<td>2.0</td>
</tr>
<tr>
<td>65-74</td>
<td>24.1</td>
<td>6.8</td>
</tr>
<tr>
<td>75+</td>
<td>23.5</td>
<td>8.5</td>
</tr>
</tbody>
</table>


The highest incidence rates were experienced among men 65 to 74 years (24.1 cases per 100,000 people) and 75 years of age and older (23.5 cases per 100,000 people). Very few liver cancers were diagnosed in men and women younger than 45 years of age, and incidence rates were quite low for these age groups.

There are typically ten or fewer deaths attributed to liver cancer per year in Waterloo Region. Between 1986 and 2009, there were a total of 185 liver cancer deaths in Waterloo Region, approximately two-thirds (65.4 per cent) of which were among males.
Figure 16.11 shows the annual number of liver cancer deaths and age-standardized mortality rates from 1986 to 2009 in Ontario.

**Figure 16.11. Number of deaths and age-standardized mortality rate per 100,000 people for liver cancer, Ontario, 1986-2009**


While the number of deaths increased steadily, mortality rates increased until the mid-1990s, at which time the rates began to stabilize around 3.0 cases per 100,000 people.
Ontario data suggests that the age-specific mortality rate of liver cancer increased with age, and was noticeably higher among males than females (Figure 16.12).

Figure 16.12. Age-specific mortality rate per 100,000 people for liver cancer, by sex, Ontario, 1986-2009


Mortality rates also increased at a faster rate among males than females, particularly since the early 1990s (data not shown). The highest incidence rates were experienced among men 75 years of age and older (29.7 deaths per 100,000 people). Liver cancer mortality rates were quite low among men and women younger than 45 years of age.

While there was some improvement in relative survival ratios for liver cancer over the last few decades, long-term survival remains very poor with less than 25 per cent of people diagnosed between 1998 and 2002 expected to survive for five years compared to people in the general population (data not shown).

16.5 Pancreatic Cancer

Pancreatic cancer starts in the cells of the pancreas, an organ that aids in digestion by creating digestive juices. The pancreas is also part of the endocrine system, making insulin and other hormones which help the body absorb, store and use nutrients from food. Most pancreatic cancers develop in the ducts that carry pancreatic juices, while those that start in the hormone-producing cells are rare.
The most significant risk factor for developing pancreatic cancer is smoking tobacco, with an estimated 20 to 30 per cent of all pancreatic cancers attributed to smoking tobacco. Risk increases as both the frequency and length of time spent smoking increases. Other risk factors for pancreatic cancer include excess body weight, diet, diabetes, pancreatitis, genetic predisposition, and occupational exposure to certain chemicals, including petroleum compounds and solvents, pesticides and dyes.²

There are typically fewer than 50 cases of pancreatic cancer per year diagnosed in Waterloo Region. Between 1986 and 2009, a total of 901 cases of pancreatic cancer were diagnosed in Waterloo Region, with cases equally distributed across males and females. Figure 16.13 shows the annual number of cases diagnosed and age-standardized pancreatic cancer incidence rates from 1986 to 2009 in Waterloo and Ontario.

**Figure 16.13. Number of cases and age-standardized incidence rate per 100,000 people for pancreatic cancer, Waterloo Region and Ontario, 1986-2009**

![Chart showing annual number of cases and age-standardized incidence rate per 100,000 people for pancreatic cancer, Waterloo Region and Ontario, 1986-2009.]


During this period, there was a marginal decline in pancreatic cancer incidence both provincially and locally, while Waterloo Region rates exhibited more variability. Incidence rates decreased from approximately 10.0 cases per 100,000 people in 1986 to 9.0 cases per 100,000 people in 2009.
While sex-specific incidence rates of pancreatic cancer in Waterloo Region were unstable, likely due to small numbers of cases reported annually for each sex, Ontario data suggests that rates were slightly higher among males than females between 1986 and 2009 (data not shown). However, since the early 2000s, this difference in rates between the sexes narrowed (data not shown).

The incidence rate of pancreatic cancer increased with age, and was similar for men and women at each age group (Figure 16.14).

Figure 16.14. Age-specific incidence rate per 100,000 people for pancreatic cancer, by sex, Waterloo Region and Ontario, 1986-2009

Note: Blank cells represent suppressed data when there were 1 to 5 cases.

The highest incidence rates were among men and women age 75 years and older (78.6 cases per 100,000 people and 73.5 cases per 100,000 people, respectively). Very few pancreatic cancers were diagnosed in men and women younger than 45 years of age.
Mortality rates for pancreatic cancer are very high, relative to the rarity of the occurrence of this type of cancer. Between 1986 and 2009, there were 855 deaths due to pancreatic cancer in Waterloo Region, making it the fifth leading cancer-related cause of death. Just over half (51.9 per cent) of these deaths were females.

Figure 16.15 shows the annual number of pancreatic cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region and Ontario.

*Figure 16.15. Number of deaths and age-standardized mortality rate per 100,000 people for pancreatic cancer, Waterloo Region and Ontario, 1986-2009*

While the number of deaths increased over this time period, there was a very modest decline in mortality rates. Over the last few decades, mortality due to pancreatic cancer remained below 10.0 deaths per 100,000 people in Ontario.
Figure 16.16 presents age-specific pancreatic cancer mortality rates by sex for Waterloo Region and Ontario. Pancreatic cancer mortality increased with age, with the highest mortality rates among men and women 75 years of age and older (86.4 and 77.0 deaths per 100,000 people, respectively). Although the trend of increasing mortality with age was similar for both sexes, mortality rates were slightly higher for men than women after age 45 years.

Pancreatic cancer has one of the worst survival outcomes of all cancers. Approximately 25 per cent of people diagnosed with pancreatic cancer between 1998 and 2002 in Ontario were expected to survive for one year compared to people in the general population. The relative survival ratio drops to less than ten per cent for five years (data not shown). Relative survival ratios for pancreatic cancer among Waterloo Region residents were slightly lower than those for Ontario as a whole for each one-year survival interval following diagnosis (data not shown).

16.6 Stomach Cancer

Stomach cancer is formed in the tissues lining the stomach, and is also called gastric cancer.\textsuperscript{37} Risk factors include infection with \textit{Helicobacter pylori} (\textit{H. pylori}), tobacco smoking, a family history of stomach cancer, and some genetic disorders.\textsuperscript{2}
There are typically fewer than 40 cases of stomach cancer per year diagnosed in Waterloo Region. Between 1986 and 2009, a total of 794 cases of stomach cancer were diagnosed in Waterloo Region, approximately three-quarters (67.3 per cent) of which were diagnosed among males.

Figure 16.17 shows the annual number of cases diagnosed and age-standardized stomach cancer incidence rates from 1986 to 2009 in Waterloo Region and Ontario. During this time period, there was a steady decrease in the incidence of stomach cancer in Ontario; incidence rates declined from 11.0 to 7.2 cases per 100,000 people between 1986 and 2009.

**Figure 16.17. Number of cases and age-standardized incidence rate per 100,000 people for stomach cancer, Waterloo Region and Ontario, 1986-2009**

While a similar decreasing trend was observed in Waterloo Region, rates were more stable since the mid-1990s. Although both sexes experienced decreases in stomach cancer incidence rates between 1986 and 2009, the decline was more dramatic among males than females. And stomach cancer incidence rates have remained higher in males than females every year during this time period (data not shown).
The age-specific incidence rate of stomach cancer increased with age, and was much higher among males than females (Figure 16.18).

Figure 16.18. Age-specific incidence rate per 100,000 people for stomach cancer, by sex, Waterloo Region and Ontario, 1986-2009

The highest incidence rates were experienced among men 65 to 74 years (50.5 cases per 100,000 people) and 75 years of age and older (95.8 cases per 100,000 people) in Waterloo Region between 1986 and 2009. Very few stomach cancers were diagnosed in men and women younger than 45 years of age, and incidence rates were quite low for these age groups. Age-specific stomach cancer incidence rates were slightly higher for Ontario than Waterloo Region for most age groups, although not significantly different.

Between 1986 and 2009, there were 525 deaths due to stomach cancer in Waterloo Region, accounting for three per cent of all cancer-related deaths. Stomach cancer was the eighth leading cause of cancer-related deaths in Waterloo Region during this time period. Almost two-thirds (64.2 per cent) of these deaths were reported among males.
Figure 16.19 shows the annual number of stomach cancer deaths and age-standardized mortality rates from 1986 to 2009 in Waterloo Region and Ontario. There was much variability in the number of deaths reported annually in Waterloo Region so it is difficult to interpret trends over time. However, Ontario data shows that stomach cancer mortality rates tended to steadily decrease over time, from a high of 7.9 deaths per 100,000 people in 1986 to 4.5 deaths per 100,000 people in 2009.

Figure 16.19. Number of deaths and age-standardized mortality rate per 100,000 people for stomach cancer, Waterloo Region and Ontario, 1986-2009


Stomach cancer incidence rates decreased in both sexes, but the decline was more pronounced among males than females (data not shown).
Figure 16.20 presents age-specific stomach cancer mortality rates by sex for Waterloo Region and Ontario. Stomach cancer mortality increased with age, with the highest mortality rates among men 75 years of age and older (72.3 deaths per 100,000 people in Waterloo Region).

**Figure 16.20. Age-specific mortality rate per 100,000 people for stomach cancer, by sex, Waterloo Region and Ontario, 1986-2009**

![Graph showing stomach cancer mortality rates by age and sex for Waterloo Region and Ontario, 1986-2009.](image)


Note: Blank cells represent suppressed data when there were 1 to 5 cases.

Male mortality rates were more than double those experienced among women in each age group.

One-year relative survival ratios for people diagnosed with stomach cancer between 1998 and 2002 were approximately 50 per cent. Long-term survival ratios were quite poor, with only about one-quarter of those diagnosed with stomach cancer expected to survive for five years compared to people in the general population. Relative survival ratios for stomach cancer among Waterloo Region residents were slightly lower than those for Ontario as a whole for each time period following diagnosis (data not shown).

### 16.7 Testicular Cancer

Testicular cancer forms in the tissues of one or both testicles. Most testicular cancers begin in the germ cells (the cells that make sperm) and are called testicular germ cell tumors. Testicular cancer is the most commonly diagnosed cancer in male adolescents...
and young adults aged 15 to 29 years, accounting for approximately one-quarter of all cancers diagnosed in males in this age group.\textsuperscript{38}

A family history of testicular cancer increases one’s risk of developing the disease, and having testicular cancer in one testicle increases the chances of cancer developing in the other testicle.

There are typically fewer than twenty cases of testicular cancer per year diagnosed in Waterloo Region. From 1986 to 2009, there were a total of 336 new cases of testicular cancer diagnosed among Waterloo Region males.

Figure 16.21 shows the annual number of cases diagnosed and age-standardized testicular cancer incidence rates from 1986 to 2009 in Waterloo Region and Ontario.  

\textbf{Figure 16.21. Number of cases and age-standardized incidence rate per 100,000 people for testicular cancer, Waterloo Region and Ontario, 1986-2009}

![Graph showing testicular cancer incidence rates from 1986 to 2009 in Waterloo Region and Ontario.]


Although there was some annual variation in the number of new cases and incidence rates locally, Ontario data shows a clear trend of increased testicular cancer incidence between 1986 and 2009. Incidence rates rose from less than five cases per 100,000 people in the late 1980s to almost six cases per 100,000 people in 2009.
Figure 16.22 shows that the age-specific incidence rate of testicular cancer peaked among young adults aged 20 to 39 years, who accounted for two-thirds of (65.9 per cent) of all cases diagnosed in Ontario males between 1986 and 2009.

**Figure 16.22. Age-specific incidence rate per 100,000 people for testicular cancer, Waterloo Region and Ontario, 1986-2009**

The highest incidence rates were experienced among men 30-39 years (15.2 cases per 100,000 people in Waterloo Region and 11.5 cases per 100,000 people in Ontario). Unlike most other types of cancer, very few testicular cancers are diagnosed in older adults, particularly after 70 years of age.
Between 1986 and 2009, there were 14 deaths due to testicular cancer in Waterloo Region and 342 deaths in Ontario. Figure 16.23 shows the annual number of testicular cancer deaths and age-standardized mortality rates from 1986 to 2009 in Ontario.

**Figure 16.23. Number of deaths and age-standardized mortality rate per 100,000 people for testicular cancer, Ontario, 1986-2009**

Due to the small number of deaths reported annually, it is difficult to interpret trends over time. While there is some evidence that testicular cancer mortality rates declined marginally between 1986 and 2009, the rates remained well below one death per 100,000 people over this time period.
Figure 16.24 presents age-specific testicular cancer mortality rates for Ontario between 1986 and 2009.

While mortality due to testicular cancer was very low for all age groups, rates were highest among young adults aged 20 to 44 years (0.4 deaths per 100,000 people) and adults 75 years of age and older (0.5 deaths per 100,000 people).

Prognosis for those diagnosed with testicular cancer is typically very good, and it boasts one of the highest survival ratios of any cancer. There were modest improvements in relative survival ratios for testicular cancer over the last few decades, and long-term survival ratios currently exceed 95 per cent. Among people diagnosed between 1998 and 2002 in Ontario, 98.1 per cent were expected to survive for one year compared to the general population and 96.1 per cent were expected to survive for five years compared to the general population (data not shown).

16.8 Thyroid Cancer

Thyroid cancer starts in the cells of the thyroid gland (an organ at the base of the throat that makes hormones to help control heart rate, blood pressure, body temperature and weight). The four main types of thyroid cancer are papillary, follicular, medullary and anaplastic thyroid cancer, which are classified by how the cells appear and their rate of growth.39 Thyroid cancer can develop at any age, but occurs most often in adults 20 to
60 years of age. It is currently on the rise in the Canadian population, and it is approximately three times more prevalent in women than men. These trends may possibly be due to increased use of diagnostic testing which has detected earlier stage or asymptomatic thyroid cancers more frequently, although the observed increase in the number of thyroid cancer diagnoses could also be as a result of a true increase in cases over time.\textsuperscript{2,14}

The most well known risk factor for thyroid cancer is radiation exposure to the thyroid, particularly ionizing radiation. People exposed to high levels of radiation are at greater risk of developing papillary and follicular thyroid cancers, and risk is highest for those exposed at younger ages. Other risk factors include a family history of thyroid cancer, benign thyroid conditions, and other genetic conditions.

On average, there are fewer than 50 cases of thyroid cancer per year diagnosed in Waterloo Region. Between 1986 and 2009 there were a total of 780 cases diagnosed in Waterloo Region. Approximately four-fifths (79.9 per cent) of thyroid cancer cases were diagnosed among females. Figure 16.25 shows the annual number of cases diagnosed and age-standardized thyroid cancer incidence rates from 1986 to 2009 in Waterloo Region and Ontario.

Figure 16.25. Number of cases and age-standardized incidence rate per 100,000 people for thyroid cancer, Waterloo Region and Ontario, 1986-2009

During this period, there was a dramatic increase in both the number of cases and incidence rate of thyroid cancer. In Ontario, incidence rates more than quadrupled, increasing from 4.0 cases per 100,000 people in 1986 to 17.0 cases per 100,000 people in 2009. Thyroid cancer incidence rates increased for both sexes, although they were increasing more quickly among females than males, particularly since the late 1990s (data not shown).

The age-specific incidence rate of thyroid cancer increased through younger and middle adulthood, peaking in women aged 45 to 64 years and in men aged 65 to 74 years. This peak was followed by a decline in incidence through older adulthood (Figure 16.26).

**Figure 16.26. Age-specific incidence rate per 100,000 people for thyroid cancer, by sex, Waterloo Region and Ontario, 1986-2009**

Incidence rates were higher among females than males in all age groups from 1986 to 2009 in both Waterloo Region and Ontario. The highest incidence rates were experienced among women aged 20 to 44 years and 45 to 64 years in Waterloo Region (15.8 and 18.8 cases per 100,000 people, respectively).
Between 1986 and 2009, there were 38 deaths due to thyroid cancer in Waterloo Region and 1,246 deaths in Ontario. Almost two-thirds (60.5 per cent) of these deaths were reported among females. Figure 16.27 shows the annual number of thyroid cancer deaths and age-standardized mortality rates from 1986 to 2009 in Ontario.

Figure 16.27. Number of deaths and age-standardized mortality rate per 100,000 people for thyroid cancer, Ontario, 1986-2009

Due to the small number of deaths reported annually, it is difficult to interpret trends over time. However, Ontario data suggests that the annual number of deaths due of thyroid cancer increased since 1986, whereas mortality rates remained quite stable at less than one death per 100,000 people.

Figure 16.28 presents age-specific thyroid cancer mortality rates by sex for Ontario. While mortality rates remain low for all ages, they increase slightly with age, with the highest mortality rates observed for women 75 years of age and older (4.3 deaths per 100,000 people).

Figure 16.28. Age-specific mortality rate per 100,000 people for thyroid cancer, by sex, Ontario, 1986-2009

![Chart showing age-specific mortality rates](chart.png)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20-44</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>45-64</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>65-74</td>
<td>1.7</td>
<td>1.9</td>
</tr>
<tr>
<td>75+</td>
<td>3.1</td>
<td>4.3</td>
</tr>
</tbody>
</table>


Note: Blank cells represent suppressed data when there were 1 to 5 cases.

Very few thyroid cancer deaths were reported among those less than 45 years of age between 1986 and 2009 in Ontario.

Prognosis for those diagnosed with thyroid cancer is generally very good, and it boasts one of the highest survival ratios of any cancer. There were modest improvements in relative survival ratios for thyroid cancer over the last few decades, particularly for long-term survival ratios which now exceed 95 per cent.

Among people diagnosed between 1998 and 2002 in Ontario, 98.1 per cent were expected to survive for one year compared to people in the general population and 97.8 per cent were expected to survive for five years compared to people in the general population. Relative survival ratios for thyroid cancer among Waterloo Region residents were only slightly lower than those for Ontario as a whole, but still exceeded 95 per cent for each time period following diagnosis (data not shown).
17.0 PREVENTION AND EARLY DETECTION

Highlights

- Tobacco use and second-hand smoke exposure:
  - Twenty per cent of the population in Waterloo Region were current smokers, similar to Ontario
  - Current smoking rates decreased with age, higher household income, and higher levels of education
  - Nearly 17 per cent of the population in Waterloo Region were regularly exposed to second-hand smoke, similar to Ontario

- Sun and UV radiation exposure:
  - Over one-third of adults in Waterloo Region got sunburnt within the past 12 months
  - Younger adults, those with higher incomes and those with more education were more likely to have been sunburnt
  - Two-thirds of adults wore sunglasses with UV protection, the most commonly reported sun protective behaviour

- Alcohol consumption:
  - Sixty-two per cent of the population aged 12 years and older in Waterloo Region regularly drank, similar to Ontario
  - Seventeen per cent of the population had one or more heavy drinking episodes in the past 12 months, similar to Ontario
  - Men were more likely to have heavy drinking episodes than women
  - Women used to be less likely than men to be regular drinkers, but now they are equally likely to regularly drink
  - Regular drinking rates were higher in young adults, and in those with higher household income or higher education

- Nutrition:
  - Over one-third of the population aged 12 years and older in Waterloo Region consumed vegetables and fruit five or more times per day, similar to Ontario
  - The prevalence of consuming vegetables and fruit five or more times per day decreased from 2009/2010 to 2011/2012 both locally and provincially
  - Just over forty per cent of Waterloo Region adults reported being at a healthy weight, similar to Ontario
Highlights (continued)

- Physical activity and sedentary behaviour:
  - The proportion of the population who were active during leisure time was lower in Waterloo Region than Ontario
  - Physical inactivity increased with age
  - There were slight increases over time in moderately active and active physical activity both locally and provincially
  - Nearly two-thirds of people were sedentary for 15 hours or more per week during leisure time, a significant increase in proportion over time, both locally and provincially
  - Older adults were more likely to watch TV or videos

- HPV infection:
  - Two-thirds of the population aged 15 to 49 years in Waterloo Region reported their age of sexual debut was less than 20 years old, similar to Ontario
  - The proportion of the population aged 15 to 49 years in Waterloo Region who reported having two or more sexual partners in the past 12 months was lower compared to all of Ontario
  - Men were more likely to have had multiple partners in the past 12 months compared to women

- Breast cancer screening:
  - Just over sixty per cent of eligible women in Waterloo Region had up to date breast cancer screening, similar to Ontario
  - Local and provincial mammogram rates increased from 2004/2005 to 2008/2009 and then leveled off into 2010/2011

- Cervical cancer screening:
  - Two-thirds of eligible women in Waterloo Region had up to date cervical cancer screening, slightly higher than Ontario
  - Local and provincial Pap test rates increased slightly from 2000/2002 to 2009/2011
  - Just over half of grade eight girls were vaccinated for HPV in 2010/2011

- Colorectal cancer screening:
  - Just over one-third of eligible adults in Waterloo Region had up to date colorectal cancer screening, slightly higher than Ontario
The goal of Chronic Disease Prevention in the Ontario Public Health Standards (OPHS) is to reduce the burden of preventable chronic diseases of public health importance. Both primary and secondary prevention strategies are specified in the OPHS. Primary prevention aims to halt disease occurrence and results in a decrease in the incidence of a particular disease. Secondary prevention aims to detect disease at an earlier, more treatable stage and results in a decrease in morbidity and/or mortality from a disease.

Relevant prevention strategies in the OPHS focus on making the public smoke free, improving eating habits, increasing physical activity levels, reducing alcohol consumption, reducing exposure to ultraviolet (UV) radiation, and increasing uptake of screening and early detection. These prevention strategies for cancer will be described below, including data on local and provincial trends where relevant, as monitoring the number of people having exposures or engaging in behaviours that affect their risk of cancer is a useful way to measure progress towards cancer prevention and control.

17.1 Risk Factors for Cancer

There are many risk factors for cancer that cannot be changed, such as age, sex and genetic inheritance. These are known as non-modifiable risk factors. This report will focus on the prevalence of risk factors that can be changed (modifiable risk factors).

Tobacco use, an unhealthy diet, excess body weight, physical inactivity, sedentary behaviour, alcohol consumption, and exposure to sun or UV radiation are well documented modifiable risk factors for several major cancers. These risk factors contribute to many cancer cases and deaths each year (Table 17.1).

Table 17.1. Estimated number of cancer cases and deaths potentially preventable according to selected modifiable risk factors, Canada, 2005

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Number of cases</th>
<th>Number of cancer deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco smoke*</td>
<td>44,700</td>
<td>20,850</td>
</tr>
<tr>
<td>Unhealthy diet, physical inactivity, and/or excess body weight*</td>
<td>44,700</td>
<td>20,850</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>4,470</td>
<td>2,085</td>
</tr>
<tr>
<td>Sun exposure§</td>
<td>65,840</td>
<td>725</td>
</tr>
</tbody>
</table>

* Assumes 30% of certain cancer cases/deaths are related to the risk factor
^ Assumes 3% of certain cancer cases/deaths are related to the risk factor
§ Assumes 80% of certain cancer cases/deaths are related to the risk factor


Research suggests that it should be possible to prevent many cases of cancer by either reducing the number of people exposed to substances that increase cancer risk, or improving cancer-protective behaviours. Table 17.2 shows potential risk reductions for major cancer sites which are associated with modifiable risk factors.
Table 17.2. Potential cancer risk reductions associated with key cancer prevention strategies

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>Prevention strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avoid tobacco</td>
</tr>
<tr>
<td>Bladder</td>
<td>✓</td>
</tr>
<tr>
<td>Breast</td>
<td>✓</td>
</tr>
<tr>
<td>Cervix</td>
<td>✓</td>
</tr>
<tr>
<td>Colorectal</td>
<td>✓</td>
</tr>
<tr>
<td>Esophagus</td>
<td>✓</td>
</tr>
<tr>
<td>Kidney</td>
<td>✓</td>
</tr>
<tr>
<td>Larynx</td>
<td>✓</td>
</tr>
<tr>
<td>Lung</td>
<td>✓</td>
</tr>
<tr>
<td>Oral</td>
<td>✓</td>
</tr>
<tr>
<td>Pancreas</td>
<td>✓</td>
</tr>
<tr>
<td>Prostate</td>
<td></td>
</tr>
<tr>
<td>Melanoma</td>
<td></td>
</tr>
<tr>
<td>Stomach</td>
<td>✓</td>
</tr>
<tr>
<td>Uterus</td>
<td></td>
</tr>
</tbody>
</table>


As the table illustrates, lifestyle factors including avoiding tobacco and eating a healthy diet have the potential to impact the risk associated with a number of major cancer sites.

17.1.1 Tobacco Use and Exposure to Second-Hand Smoke

A. Tobacco Use
Tobacco use is the leading preventable cause of disease and death in Ontario. Tobacco products include, but are not limited to, cigarettes, cigars, cigarillos (e.g., little cigars), pipe tobacco, smokeless (e.g., chew), shisha (used in water pipes), bidis and kreteks. Tobacco products contain chemicals which, when inhaled or absorbed in the mouth and throat, can trigger the development and growth of damaged cells, and impair the body’s normal ability to repair these cells.

Tobacco use accounts for 30 per cent of fatal cancers and smoking, in particular, and is responsible for upwards of 80 per cent of all lung cancers in developed countries.

Tobacco use:

- Increases the risk of developing many other cancers including, but not limited to, cancers of the head, neck and bladder;
- Increases the severity of cancer;
- Decreases the effectiveness of treatment outcomes; and
- Is also a major risk factor for heart disease, stroke, and respiratory illnesses.

Quitting tobacco use is the only proven way to reduce tobacco-related cancer risks. There are significant health benefits regardless of a person’s age or years of use. Quitting tobacco use can contribute to: improved breathing; increased energy; improved quality of life; better treatment outcomes; increased chances of survival; reductions in the risk of infection; and a decrease in adverse treatment outcomes.

Individuals who smoked and who quit entirely cut their risk of developing head, neck and bladder cancer by half within five years. Within ten years, their risk of dying from lung cancer also drops by half.

As seen in Table 17.3, nearly twenty per cent of people aged 12 years and older in Waterloo Region currently smoked in 2011/2012, compared to 18.7 per cent in Ontario. These proportions were not significantly different.

<table>
<thead>
<tr>
<th>Place of residence</th>
<th>Smoking status</th>
<th>2007/2008 Per cent (95% CI)</th>
<th>2009/2010 Per cent (95% CI)</th>
<th>2011/2012 Per cent (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterloo Region</td>
<td>Currently smokes</td>
<td>21.7 (18.5-24.9)</td>
<td>18.0 (15.5-20.5)</td>
<td>19.8 (16.5-23.1)</td>
</tr>
<tr>
<td></td>
<td>Smokes daily</td>
<td>17.1 (14.3-20.0)</td>
<td>13.3 (11.2-15.3)</td>
<td>14.4 (11.7-17.1)</td>
</tr>
<tr>
<td></td>
<td>Formerly smoked</td>
<td>31.9 (28.7-35.2)</td>
<td>38.3 (34.6-42.0)</td>
<td>34.4 (30.7-38.1)</td>
</tr>
<tr>
<td></td>
<td>Never smoked</td>
<td>46.4 (42.6-50.1)</td>
<td>43.7 (40.1-47.3)</td>
<td>45.8 (42.0-49.5)</td>
</tr>
<tr>
<td>Ontario</td>
<td>Currently smokes</td>
<td>20.3 (19.7-20.9)</td>
<td>19.0 (18.3-19.6)</td>
<td>18.7 (18.0-19.4)</td>
</tr>
<tr>
<td></td>
<td>Smokes daily</td>
<td>15.9 (15.3-16.5)</td>
<td>14.4 (13.9-15.0)</td>
<td>14.0 (13.4-14.6)</td>
</tr>
<tr>
<td></td>
<td>Formerly smoked</td>
<td>35.0 (34.3-35.7)</td>
<td>34.6 (33.8-35.4)</td>
<td>34.5 (33.6-35.4)</td>
</tr>
<tr>
<td></td>
<td>Never smoked</td>
<td>44.7 (44.0-45.5)</td>
<td>46.4 (45.6-47.3)</td>
<td>46.8 (45.9-47.7)</td>
</tr>
</tbody>
</table>

CI = 95 per cent confidence interval.

From 2007/2008 to 2011/2012, smoking rates fluctuated slightly in Waterloo Region, but not with any statistical significance. For all of Ontario, there was a small but statistically significant decrease in current smoking rates from 2007/2008 (20.3 per cent) to 2011/2012 (18.7 per cent).

It is hypothesized that the rates of smoking have plateaued over time because those individuals who currently smoke tend to smoke more heavily and have higher levels of nicotine addiction.\(^{41}\) It has also been suggested that access to cheap contraband cigarettes is contributing to the persistent lack of meaningful decline in smoking prevalence.\(^ {47}\)

In addition to higher smoking rates, those who live in neighbourhoods with lower incomes and less education also tend to experience more challenges and report poorer physical and mental health outcomes.\(^ {41}\) Table 17.4 illustrates this point, showing the proportions of people in Waterloo Region in 2011/2012 by smoking status, and by household income, and level of education, as well as sex and age group.

### Table 17.4. Proportion of population aged 12 years and older by smoking status, household income and level of education, Waterloo Region, 2011/2012

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Category</th>
<th>Currently smokes</th>
<th>Formerly smoked</th>
<th>Never smoked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Per cent (95% CI)</td>
<td>Per cent (95% CI)</td>
<td>Per cent (95% CI)</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>21.6 (17.3-26.0)</td>
<td>38.9 (33.7-44.0)</td>
<td>39.5 (34.0-45.0)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>18.0 (13.4-22.7)</td>
<td>29.3 (24.7-33.9)</td>
<td>52.7 (47.4-57.9)</td>
</tr>
<tr>
<td>Age group</td>
<td>12 to 18 years</td>
<td>NR</td>
<td>NR</td>
<td>94.3 (89.5-99.2)</td>
</tr>
<tr>
<td></td>
<td>19 to 44 years</td>
<td>28.2 (22.6-33.9)</td>
<td>31.1 (25.6-36.5)</td>
<td>40.7 (35.6-45.8)</td>
</tr>
<tr>
<td></td>
<td>45 to 64 years</td>
<td>18.5 (13.1-23.8)</td>
<td>40.6 (32.0-49.3)</td>
<td>40.9 (31.2-50.7)</td>
</tr>
<tr>
<td></td>
<td>65 to 74 years</td>
<td>8.8(^E) (4.4-13.2)</td>
<td>54.2 (43.3-65.1)</td>
<td>37.0 (25.9-48.2)</td>
</tr>
<tr>
<td></td>
<td>75 years or older</td>
<td>NR</td>
<td>58.0 (49.4-66.6)</td>
<td>36.6 (28.3-45.0)</td>
</tr>
<tr>
<td>Household income</td>
<td>Less than $50,000</td>
<td>23.8 (18.8-28.9)</td>
<td>34.2 (28.2-40.2)</td>
<td>42.0 (35.7-48.3)</td>
</tr>
<tr>
<td></td>
<td>$50,000 to $99,000</td>
<td>22.9 (17.3-28.6)</td>
<td>37.4 (31.6-43.2)</td>
<td>39.7 (34.3-45.1)</td>
</tr>
<tr>
<td></td>
<td>$100,000 or more</td>
<td>12.8(^E) (8.6-17.0)</td>
<td>31.5 (25.3-37.7)</td>
<td>55.7 (48.9-62.4)</td>
</tr>
<tr>
<td>Level of education</td>
<td>Less than high school</td>
<td>28.7 (19.2-38.2)(^E)</td>
<td>37.1 (27.9-46.3)</td>
<td>34.2 (25.5-42.9)</td>
</tr>
<tr>
<td></td>
<td>High school degree</td>
<td>25.3 (15.6-35.1)(^E)</td>
<td>34.1 (25.9-42.2)</td>
<td>40.6 (30.4-50.8)</td>
</tr>
<tr>
<td></td>
<td>Some post-secondary</td>
<td>NR</td>
<td>35.0 (17.7-52.4)(^E)</td>
<td>46.4 (28.2-64.5)(^E)</td>
</tr>
<tr>
<td></td>
<td>Post-secondary degree</td>
<td>15.2 (11.8-18.6)</td>
<td>44.5 (38.9-50.0)</td>
<td>40.3 (34.7-46.0)</td>
</tr>
</tbody>
</table>

CI = 95 per cent confidence interval.
The superscript “E” denotes high sampling variability, and estimates must be interpreted with caution.
NR denotes estimates which were suppressed due to unacceptably high sampling variability or insufficient number of cases.
Source: CCHS, 2011/2012, Statistics Canada, Share File, Ontario MOHLTC.
Table 17.4 indicates a number of significant differences in smoking rates within Waterloo Region. Women were more likely than men to have never smoked (52.7 per cent versus 39.5 per cent). By age, older adults aged 65 to 74 years were significantly less likely to be current smokers compared to younger adults aged 19 to 44 years (8.8 per cent^a versus 28.2 per cent), and were more likely to have formerly smoked and quit (54.2 per cent versus 31.1 per cent).

Current smoking rates tended to be higher in populations with lower household income; 23.8 per cent of individuals in households that made less than $50,000 currently smoked, compared to 12.8 per cent^a of individuals in households that made $100,000 or more. Current smoking rates also tended to be higher for individuals with fewer years of formal education; 28.7 per cent^a of individuals with less than a high school education currently smoked, compared to 15.2 per cent of those with a post-secondary degree. Smoking rates were also examined by municipality, but no significant differences existed (data not shown).

Tobacco cessation programs and services need to address populations with higher smoking rates in order to successfully decrease smoking rates over time. Increasing capacity for cessation programs and services in multiple settings, such as health care and workplace sectors, with access to low or no cost pharmacotherapy, will contribute to a ‘no wrong door’ approach for tobacco users, potentially leading to reductions in tobacco use.41

Region of Waterloo Public Health contributes to tobacco use reductions by:
- Working in partnership with local health care professionals and workplace intermediaries through programs such as Project Health to increase capacity to implement tobacco cessation programs and policies.
- Providing brief tobacco cessation interventions to all Region of Waterloo Public Health clients receiving health-related services.
- Providing tobacco cessation programs to tenants of Waterloo Region Housing (WRH) to support their smoke-free housing policy.
- Partnering with the Centre for Addiction and Mental Health program Smoking Treatment for Ontario Patients (STOP) on the Road to provide free nicotine replacement therapy to people who smoke and are interested in quitting
- Responding to requests from the public for tobacco-related information.

B. Exposure to second-hand smoke

Second-hand smoke (SHS) comes from the burning end of lit tobacco, and from the smoke exhaled into the air by someone who smokes. SHS contains more than 7,000 chemicals, 70 of which are known to cause cancer. The U.S. Environmental Protection Agency has labelled SHS a “class A carcinogen”, meaning it is known to cause cancer. There is no known safe level of exposure to SHS.48

^a This estimate had high sampling variability, and must be interpreted with caution.
Adult exposure to second-hand smoke (SHS) has been shown to increase the risk of lung cancer, breast cancer, nasal sinus cavity carcinoma, and nasopharyngeal carcinoma. In particular, evidence shows a 20 to 30 per cent increased risk of lung cancer from SHS exposure associated with living with someone who smokes. Exposure to SHS has also been shown to increase the risk of certain childhood cancers including leukemia, lymphomas, and brain tumors.

Exposure to second-hand smoke (SHS) occurs primarily in the home, cars, workplaces, and public places, such as outside of bars and restaurants (e.g., patios). Table 17.5 describes the proportion of the non-smoking population aged 12 years and older who reported regular exposure to SHS, by place of exposure, for Waterloo Region and Ontario in 2007/2008, 2009/2010 and 2011/2012.

Table 17.5. Proportion of non-smoking population aged 12 years and older by place of regular exposure to second-hand smoke, Waterloo Region and Ontario, 2007/2008, 2009/2010 & 2011/2012

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per cent (95% CI)</td>
<td>Per cent (95% CI)</td>
<td>Per cent (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Waterloo Region</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the home</td>
<td>5.7 (4.1-7.3)</td>
<td>5.4 (3.6-7.2)</td>
<td>2.6 (1.5-3.8)</td>
<td></td>
</tr>
<tr>
<td>In a vehicle</td>
<td>6.7 (4.7-8.6)</td>
<td>6.1 (4.2-8.1)</td>
<td>4.9 (3.3-6.5)</td>
<td></td>
</tr>
<tr>
<td>In public places</td>
<td>6.3 (4.4-8.2)</td>
<td>8.7 (6.5-11.0)</td>
<td>11.7 (9.2-14.2)</td>
<td></td>
</tr>
<tr>
<td>Any of the above</td>
<td>12.9 (10.4-15.4)</td>
<td>15.5 (12.4-18.5)</td>
<td>16.9 (14.2-19.7)</td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the home</td>
<td>5.8 (5.4-6.2)</td>
<td>5.3 (4.9-5.7)</td>
<td>4.5 (4.0-5.0)</td>
<td></td>
</tr>
<tr>
<td>In a vehicle</td>
<td>7.4 (6.9-7.9)</td>
<td>6.5 (6.0-7.0)</td>
<td>5.6 (5.2-6.1)</td>
<td></td>
</tr>
<tr>
<td>In public places</td>
<td>11.4 (10.8-12.1)</td>
<td>12.3 (11.6-13.0)</td>
<td>13.3 (12.6-14.0)</td>
<td></td>
</tr>
<tr>
<td>Any of the above</td>
<td>18.6 (17.9-19.3)</td>
<td>18.5 (17.8-19.3)</td>
<td>19.2 (18.3-20.0)</td>
<td></td>
</tr>
</tbody>
</table>

CI = 95 per cent confidence interval.
The superscript ‘E’ denotes high sampling variability, and estimates must be interpreted with caution.

In 2011/2012, non-smokers aged 12 years and older in Waterloo Region reported regular second-hand (SHS) exposure in public places (11.7 per cent), in a vehicle (4.9 per cent), and in the home (2.6 per cent), with 16.9 per cent reporting exposure in one or more of those three places. Rates of SHS exposure in Waterloo Region appeared to have decreased over time from 2007/2008 to 2011/2012 in the home (5.7 per cent to 2.6 per cent), as well as in vehicles (6.7 per cent to 4.9 per cent). At the same time, the rate of SHS exposure in public places significantly increased from 2007/2008 (6.3 per cent) to 2011/2012 (11.7 per cent). Reasons for this increase in exposure to SHS in public places are not clear. Similar trends in each case were also evident in Ontario.

The rates of second-hand smoke (SHS) exposure in Waterloo Region were consistently lower than that in Ontario, although in some cases the differences were not significant. The rates of SHS exposure in public places in Waterloo Region was significantly lower

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b This estimate had high sampling variability, and must be interpreted with caution.
than that for Ontario in 2007/2008 and 2009/2010 (6.3 per cent versus 11.4 per cent and 8.7 per cent versus 12.3 per cent), and while the rate in Waterloo Region was still lower in 2011/2012 than the provincial rate, the difference was no longer statistically significant (11.7 per cent versus 13.3 per cent).

There is currently no legislation in Waterloo Region targeting exposure to second-hand smoke (SHS) in homes or outdoor spaces. Some local community and private multi-unit dwelling (e.g., apartment buildings, townhouses) housing providers have introduced smoke-free policies requiring all newly rented units to be smoke-free and limiting smoking outdoors to specific areas away from entrances and exits. The Smoke-free Ontario Act prohibits smoking or holding lit tobacco in workplaces, enclosed public spaces and in a motor vehicle when a person under the age of 16 is present.49

Region of Waterloo Public Health contributes to reductions in exposure to second-hand smoke (SHS) by:

- Continuing to partner with Waterloo Region Housing (WRH) and the Propel Centre for Population Health Impact at the University of Waterloo to implement and monitor the WRH smoke-free policy. Effective April 1, 2010, all new leases signed with WRH require that no one smoke or hold lit tobacco in the leased unit, including the balcony, patio or other areas as specified. Smoking is only permitted outdoors at a distance of five metres away from windows, entrances or exits to the residential complex.

- Providing support to other community housing providers to implement smoke-free policies, to protect tenants from exposure to SHS.

- Providing consultation and resources to support the cities and townships interested in the exploration of a smoke-free bylaw for outdoor spaces such as sports fields, parks and playgrounds.

- Providing consultation and support through programs such as Project Health to local workplaces interested in implementing smoke-free property policies (e.g., smoke-free hospital grounds).

17.1.2 Sun and Ultraviolet (UV) Radiation Exposure

Exposure to UV radiation is the most significant risk factor for developing skin cancer. The main source of UV radiation is sunlight, but some types of artificial light, such as tanning beds, are also harmful.50 Skin cancer develops from damaged skin cells. Some damaged skin cells die or repair themselves, but if the damage is too severe, skin cancer can develop.

A tan or sunburn is visible proof that the skin has been damaged by UV exposure. Skin damage from UV radiation is cumulative, meaning daily exposure adds up over the lifespan.51 Several research studies have concluded that people who have suffered severe sunburns in childhood are at greater risk for developing skin cancer later in life.52 Other factors that can increase one’s risk of developing skin cancer include: sun and ultraviolet (UV) radiation exposure, including tanning beds and sunlamps; sun sensitivity (i.e., skin burns easily); a history of excessive sun exposure; the presence of moles on
the body; having light-coloured skin, eyes and hair; and a personal or family history of melanoma.\textsuperscript{17,50}

Daily UV radiation levels are influenced by a variety of factors including: sun elevation, latitude, cloud cover, altitude, ozone levels, and ground reflection. UV radiation cannot be seen or felt so it is important to be aware of UV levels, factors that influence these levels, and protective measures to mitigate the harmful effects. In 1995, the World Health Organization collaborated with a number of other international bodies to create a UV index. This index was intended to accompany weather forecasts, serve as a mechanism to raise public awareness, and alert people about the need to adopt personal sun protective measures when UV readings are high.\textsuperscript{53}

In addition to the UV index, there are several other sun protection strategies that can be applied to reduce overexposure to UV radiation. Limiting UV exposure during peak periods is one way to protect against overexposure. In Canada, peak UV periods are between 11:00 a.m. and 4:00 p.m. when the sun’s rays are the strongest, or whenever the UV index is three or higher. During these periods it is best to limit sun exposure by seeking shade, creating your own shade, or simply staying indoors. Additional sun protection strategies include: covering up with clothing that is loose fitting and tightly woven, wearing a hat with a wide brim, wearing sunglasses with UV protection, and using sunscreen.\textsuperscript{54}
Data from the Rapid Risk Factor Surveillance System (RRFSS), a local telephone survey conducted on behalf of Region of Waterloo Public Health, helps paint a picture of UV exposure-related behaviours among Waterloo Region residents aged 18 years or older (Figure 17.1).

**Figure 17.1. Proportion of population aged 18 years and older who reported UV radiation exposure-related behaviours, Waterloo Region, 2008, 2010 & 2012**

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>2008</th>
<th>2010</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunburnt in last 12 months</td>
<td>37.9</td>
<td>38.1</td>
<td>34.2</td>
</tr>
<tr>
<td>Avoids sun between 11am and 4pm</td>
<td>42.5</td>
<td>37.4</td>
<td>45.6</td>
</tr>
<tr>
<td>Wears sunglasses with UV protection</td>
<td>63.3</td>
<td>65.8</td>
<td>66.8</td>
</tr>
<tr>
<td>Wears protective clothing while outdoors</td>
<td>40.6</td>
<td>41.3</td>
<td>46.2</td>
</tr>
<tr>
<td>Wears sunscreen while outdoors</td>
<td>40.8</td>
<td>41.0</td>
<td>44.6</td>
</tr>
</tbody>
</table>


A sunburn is defined as any reddening or discomfort of the skin lasting longer than 12 hours after exposure to UV sources to any part of the body.

As shown in Figure 17.1, over one third (34.2 per cent) of Waterloo Region residents in 2012 reported getting sunburnt in the past 12 months. A slightly higher proportion of individuals reported avoiding the sun during peak UV hours (45.6 per cent), wearing protective clothing while outdoors (46.2 per cent), and wearing sunscreen while outdoors (44.6 per cent). The most commonly reported protective behaviour reported was wearing sunglasses with UV protection (66.8 per cent).

When further exploring the 2012 RRFSS data, some differences were evident by sex, age, household income and level of education (data not shown). Females were significantly more likely than males to report avoiding the sun between 11am and 4pm (51.7 per cent versus 37.5 per cent) and wearing sunglasses with UV protection (72.4 per cent versus 59.1 per cent).
By age, in general young adults tended to exhibit fewer UV protective behaviours than older adults. Young adults aged 18 to 44 years were more likely to have been sunburnt in the past 12 months (50.9 per cent) compared adults aged 45 to 64 (30.7 per cent) or those aged 65 to 74 (17.1 per cent). Young adults aged 18 to 44 years were also significantly less likely to avoid sun during peak hours (35.9 per cent) compared to adults aged 46 to 64 (53.5 per cent), and were less likely to wear protective clothing while outdoors (42.5 per cent) compared to adults aged 75 years and older (67.2 per cent). Young adults were, however, significantly more likely to report wearing sunscreen (52.9 per cent) compared to adults aged 65 to 74 years (28.5 per cent).

Individuals from households earning less than $50,000 were significantly less likely to report having been sunburnt (25.0 per cent) compared to those in households earning $50,000 to $99,999 (36.8 per cent) and those in households earning $100,000 or more (47.9 per cent). Individuals from households earning less than $50,000 were also significantly less likely to wear sunscreen (35.5 per cent) compared to those from households earning $100,000 or more (58.6 per cent).

In general, individuals with fewer years of formal education tended to exhibit fewer UV protective behaviours than those with more education. Individuals with less than high school education were significantly less likely to avoid the sun during peak hours (28.2 per cent versus 36.1 per cent in those with some post-secondary and 48.7 per cent of those with a post-secondary degree), to wear sunglasses with UV protection (50.0 per cent versus 70.7 per cent in those with a post-secondary degree) and to wear sunscreen (23.1 per cent versus 49.6 per cent in those with a post-secondary degree). Those with less than high school education were also less likely to report having been sunburnt in the past 12 months, however (19.4 per cent versus 40.9 per cent in those with some post-secondary and 37.6 per cent in those with a post-secondary degree).

RRFSS data from 2008, 2011 and 2012 was also available on use of artificial tanning equipment in Waterloo Region (data not shown). Overall, rates of artificial tanning equipment use decreased slightly over time. Nearly nine per cent (8.7 per cent) of individuals using artificial tanning equipment in 2008, compared to 5.7 per cent in 2011 and 4.9 per cent in 2012. In 2012, females in Waterloo Region were significantly more likely to have used artificial tanning equipment compared to males (6.8 per cent versus 2.5 per cent, respectively).

Region of Waterloo Public Health works in partnership with local stakeholders to research, develop, implement and evaluate UV protection initiatives. Many of these initiatives focus on increasing natural and built shade, as shade is a simple and evidence-based way to protect everyone from UV radiation from the sun.

Such initiatives include:

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\( ^{c} \) This estimate had high sampling variability, and must be interpreted with caution.

\( ^{d} \) This estimate had high sampling variability, and must be interpreted with caution.
Hosting an annual community shade forum to educate local stakeholders on the benefits of shade, and support them in developing their own shade policies;

Supporting municipalities and school boards to develop a culture of sun safety through education, the creation of supportive environments, and policy;

Developing practical tools, such as a shade audit tool, to assist organizations and community members in assessing and planning for shade in outdoor spaces;

Creating networks and partnerships between organizations working on UV protection and promotion initiatives;

Providing health promotion services to workplaces primarily through the Project Health program to assist them in providing education to employees, creating supportive environments, and developing policy to support a workplace culture of sun safety;

Managing a community listserv to keep local stakeholders abreast of emerging shade and UV information, training opportunities, funding opportunities, events, tools, and resources.

17.1.3 Alcohol Consumption

Alcohol use is one of the leading risk factors for death from cancer worldwide, along with smoking, unhealthy diet, and physical inactivity. Research has shown a strong link between alcohol consumption and cancers of the oral cavity, throat (pharynx and larynx), esophagus, colon, rectum, female breast, and liver. Alcohol consumption increases cancer risk through mechanisms, such as:

- Exposing the body to ethanol (the form of alcohol found in all alcoholic beverages) and acetaldehyde (a chemical that is produced when the body metabolizes alcohol), both of which are known carcinogens;
- Irritating and damaging cells in the mouth and throat which can lead to cancerous cell changes;
- Acting as a solvent and helping other harmful chemicals, such as those found in tobacco smoke, enter cells that line the upper gastrointestinal tract.

The risk increases substantially when alcohol intake is four or more drinks per day. Following Canada’s Low-Risk Alcohol Drinking Guidelines can help lower one’s risk overall from drinking alcohol. According to these guidelines, men should not drink more than three standard drinks per day, and no more than 15 drinks per week. Women should not drink more than one or two standard drinks per day, and no more than ten

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6 Cancer Care Ontario and the Canadian Centre on Substance Abuse have recently reported on more stringent alcohol drinking guidelines which specifically aim to reduce cancer risk. Region of Waterloo Public Health will be reviewing these cancer-specific alcohol drinking guidelines and the Low-Risk Alcohol Drinking Guidelines and may update recommendations in the future. For more information on these cancer risk-specific alcohol drinking guidelines, see: http://www.ccsa.ca/Resource%20Library/CCSA-Cancer-and-Alcohol-Summary-2014-en.pdf.
drinks per week. Non-drinking days are also advised to minimize tolerance and avoid habit development.\textsuperscript{57}

Canadian Community Health Survey (CCHS) data showing the proportion of the population aged 12 years and older by alcohol consumption status in Waterloo Region and Ontario are illustrated below (Figure 17.2).

Figure 17.2. Proportion of population aged 12 years and older by alcohol consumption status*, Waterloo Region and Ontario, 2007/2008, 2009/2010 & 2011/2012

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Drinker</td>
<td>59.1</td>
<td>57.9</td>
<td>61.8</td>
<td>58.1</td>
<td>57.6</td>
</tr>
<tr>
<td>Occasional Drinker</td>
<td>17.6</td>
<td>19.9</td>
<td>16.3</td>
<td>16.4</td>
<td>16.2</td>
</tr>
<tr>
<td>No Drinks in the Past 12 Months</td>
<td>23.2</td>
<td>22.3</td>
<td>21.9</td>
<td>25.5</td>
<td>26.2</td>
</tr>
</tbody>
</table>

\textsuperscript{*}Regular drinking is defined as once per month or more frequently.
\textsuperscript{*}Occasional drinking is defined as less than once per month.


In 2011/2012, 61.8 per cent of Waterloo Region residents aged 12 years and older report drinking regularly (at least once per month), on par with the rate for Ontario (57.6 per cent). There were no significant changes over time from 2007/2008 to 2011/2012 in Waterloo Region in the proportion of the population who were regular drinkers, occasional drinkers, or non-drinkers. In Ontario, the rates of regular and occasional drinking remained consistent over time.
Figure 17.3 illustrates the prevalence of heavy alcohol drinking episodes in Waterloo Region and Ontario in 2007/2008, 2009/2010 and 2011/2012.

Figure 17.3. Proportion of population aged 12 years and older who reported episodes of heavy alcohol drinking*, Waterloo Region and Ontario, 2007/2008, 2009/2010 & 2011/2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Waterloo Region</th>
<th>Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007/2008</td>
<td>19.6</td>
<td>16.0</td>
</tr>
<tr>
<td>2009/2010</td>
<td>16.5</td>
<td>16.2</td>
</tr>
<tr>
<td>2011/2012</td>
<td>17.4</td>
<td>16.8</td>
</tr>
</tbody>
</table>

*Heavy alcohol drinking is characterized by at least one episode in the last 12 months of consuming five or more alcoholic beverages on one occasion.


In 2011/2012, 17.4 per cent of the population aged 12 years and older in Waterloo Region had at least one episode of heavy alcohol drinking (which consists of consuming five or more alcoholic beverages on one occasion) in the past 12 months, similar to the provincial rate (16.8 per cent). Rates in Waterloo Region and Ontario did not change significantly over time.

When considering alcohol consumption and heavy drinking episodes by sex (data not shown), in 2011/2012, males in Waterloo Region were significantly more likely than females to have had at least one heavy drinking episode in the past 12 months (24.7 per cent versus 10.4 per cent). Where previously in 2009/2010, men in Waterloo Region were significantly more likely to be regular drinkers (65.0 per cent versus 50.7 per cent), in 2011/2012 there were no significant differences by sex in the proportion who were regular drinkers. This local evidence supports findings from a 2011 report from the Centre for Addition and Mental Health which indicated that the proportion of women in Ontario who were regular drinkers has been increasing over time.58
By age, in 2011/2012, young adults aged 19 to 44 years were significantly more likely to regularly drink (73.1 per cent) compared to all older age groups (62.0 per cent in 45 to 64 years, 58.5 per cent in 65 to 74 years, and 50.8 per cent in 75 years and older). Young adults aged 19 to 44 years were also significantly more likely to have had at least one heavy drinking episode in the past 12 months (25.5 per cent) compared to older adults aged 45 to 64 years (14.3 per cent).

By household income, in 2011/2012, the proportion of individuals who were regular drinkers increased significantly with household income; 52.0 per cent of those from households earning less than $50,000 were regular drinkers, compared to 71.1 per cent of those from households earning $100,000 or more. By level of education, those individuals with less than high school education were significantly less likely to be a regular drinker (37.2 per cent), compared to those with higher levels of education (67.7 per cent for those with a high school diploma, 64.9 per cent for those with some post-secondary, and 69.9 per cent for those with a post-secondary degree). There were no significant differences by household income or level of education in the prevalence of heavy drinking episodes.

To address the requirements of the Ontario Public Health Standards, Region of Waterloo Public Health works in partnership with local stakeholders to research, develop, implement and evaluate a variety of substance misuse initiatives pertaining to alcohol use.

Such initiatives include:

- **Hook up to Breast Cancer Prevention program** – a program aimed at secondary and post-secondary schools which seeks to help young women reduce their risk of breast cancer by encouraging healthy lifestyle behaviours, such as reduced alcohol and tobacco consumption, increased physical activity, and healthy eating.

- **Project Health** – a comprehensive workplace health program that provides a variety of services to workplaces on a range of health topics, including alcohol and drug use. Specific to alcohol and drug use, the program seeks to: promote awareness of the risks associated with alcohol/drug use, encourage the development of supportive and safe work environments, provide employees with the skills needed to change and support positive behaviour, and assist employers in developing policies to prevent and reduce harm.

- **Health care provider consultations** – working with key health care intermediaries to increase their capacity to implement alcohol screening, brief intervention and referrals with clients.

- **Substance misuse education** – working with key community stakeholders and priority populations to promote Canada's Low-Risk Alcohol Drinking Guidelines.
17.1.4 Nutrition

One-third of cancer deaths in the developed world can be attributed to diet and physical activity habits.69-71 There are several diet-related factors which are known to either increase or decrease the risk for cancer, and are described below:

Red meat and processed meat - High consumption of red meat and processed meat increases the risk of developing cancers of the colon and rectum.56,61,62

Salt - Increased salt consumption is associated with an increased risk of developing stomach cancer.56,61,62

Vegetables and fruit - The consumption of vegetables and fruit is associated with a reduced risk of developing cancer of the lung, mouth, pharynx, larynx, esophagus, stomach, colon and rectum.61,62

Fibre and whole grains - The consumption of whole grains and dietary fiber reduces the risk of developing colorectal cancer.56,61,62

Body weight - Excess body weight is associated with an increased risk of developing many types of cancer, including: breast, colon and rectum, endometrium, kidney, esophagus, and pancreas.61,62 In general, overweight and obesity contribute to between 14 to 20 per cent of all cancer deaths.61,64

The American Cancer Society recommends consuming less red meat, processed meat, refined grains and sugar sweetened beverages, while consuming a diet that contains a variety of vegetables, fruit, and whole grains.61 The dietary recommendations of the American Cancer Society for the prevention of diet-related cancers align with the recommendations in Canada’s Food Guide (www.healthcanada.gc.ca/foodguide).65
Table 17.6 shows the proportion of the population in 2011/2012 in Waterloo Region and Ontario by frequency of daily vegetable and fruit consumption.

Table 17.6. Proportion of population aged 12 years and older, by frequency of daily vegetable and fruit consumption, Waterloo Region & Ontario, 2011/2012

<table>
<thead>
<tr>
<th>Place of residence</th>
<th>Frequency of daily vegetable and fruit consumption</th>
<th>Per cent (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterloo Region</td>
<td>Less than five times per day</td>
<td>65.2 (61.0-69.3)</td>
</tr>
<tr>
<td></td>
<td>5 to 10 times per day</td>
<td>32.6 (28.6-36.7)</td>
</tr>
<tr>
<td></td>
<td>More than 10 times per day</td>
<td>2.2 (1.3-3.1)E</td>
</tr>
<tr>
<td></td>
<td>Five or more times per day</td>
<td>34.9 (30.7-39.0)</td>
</tr>
<tr>
<td>Ontario</td>
<td>Less than five times per day</td>
<td>61.8 (60.8-62.8)</td>
</tr>
<tr>
<td></td>
<td>5 to 10 times per day</td>
<td>35.0 (34.0-35.9)</td>
</tr>
<tr>
<td></td>
<td>More than 10 times per day</td>
<td>3.3 (3.0-3.6)</td>
</tr>
<tr>
<td></td>
<td>Five or more times per day</td>
<td>38.2 (37.3-39.2)</td>
</tr>
</tbody>
</table>

CI = 95 per cent confidence interval.
The superscript “E” denotes high sampling variability, and estimates must be interpreted with caution.
Source: CCHS, 2011/2012, Statistics Canada, Share File, Ontario MOHLTC.

Over one-third (34.9 per cent) of the population in Waterloo Region aged 12 years and older consumed vegetables and fruit five or more times per day. This proportion was similar to the provincial rate of 38.2 per cent. The proportion of the Ontario population who consumed vegetables and fruit five or more times per day decreased from 2009/2010 (42.6 per cent) to 2011/2012 (38.2 per cent), and although the proportion also decreased in Waterloo Region, this difference was not significant (40.9 per cent in 2009/2010 versus 34.9 per cent in 2011/2012; data not shown).

The Healthy Eating Index is a more detailed measure of healthy eating than assessing frequency of vegetable and fruit intake alone. The Healthy Eating Index uses a point system to compare dietary intake to Canadian nutrition recommendations. In 2009, the Neighbourhood Environment in Waterloo Region: Patterns of Transportation and Health (NEWPATH) study was conducted. The results of the NEWPATH study showed that 39.6 per cent of participants consumed a ‘poor’ quality diet and 60 per cent consumed a diet that ‘needs improvement’. Only 0.3 per cent of participants met the criteria for a ‘good’ diet (i.e., consistent with Canadian nutrition recommendations). The average Healthy Eating Index score of 53.2 indicated that the average diet of residents in Waterloo Region was much closer to the ‘poor’ diet category than the ‘good’ diet category.66 These statistics demonstrate a need for improvement in dietary intake in the local population, to effectively reduce risk of weight gain and other diet-related conditions.
Table 17.7 shows the proportion of the population aged 18 years and older in Waterloo Region and Ontario in 2011/2012, by self-reported body mass index category.

**Table 17.7. Proportion of adults aged 18 years and older, by body mass index (BMI) category, Waterloo Region & Ontario, 2011/2012**

<table>
<thead>
<tr>
<th>Place of residence</th>
<th>BMI category</th>
<th>BMI value</th>
<th>Per cent (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterloo Region</td>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>2.0 (1.0-2.9)E</td>
</tr>
<tr>
<td></td>
<td>Healthy weight</td>
<td>18.5-24.9</td>
<td>43.8 (40.0-47.5)</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>25.0-29.9</td>
<td>36.1 (31.7-40.4)</td>
</tr>
<tr>
<td></td>
<td>Obese</td>
<td>≥30</td>
<td>18.2 (15.3-21.1)</td>
</tr>
<tr>
<td></td>
<td>Overweight and obese</td>
<td>≥25</td>
<td>54.3 (50.5-58.0)</td>
</tr>
<tr>
<td>Ontario</td>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>2.5 (2.2-2.8)</td>
</tr>
<tr>
<td></td>
<td>Healthy weight</td>
<td>18.5-24.9</td>
<td>44.9 (43.8-45.9)</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>25.0-29.9</td>
<td>34.1 (33.1-35.1)</td>
</tr>
<tr>
<td></td>
<td>Obese</td>
<td>≥30</td>
<td>18.6 (17.8-19.3)</td>
</tr>
<tr>
<td></td>
<td>Overweight and obese</td>
<td>≥25</td>
<td>52.7 (51.6-53.7)</td>
</tr>
</tbody>
</table>

CI = 95 per cent confidence interval. The superscript “E” denotes high sampling variability, and estimates must be interpreted with caution. Source: CCHS, 2011/2012, Statistics Canada, Share File, Ontario MOHLTC.

In 2011/2012, just over forty per cent (43.8 per cent) of adults in Waterloo Region reported being at a healthy body weight, a rate similar to that for all of Ontario (44.9 per cent). Just over half (54.3 per cent) of adults in Waterloo Region were overweight or obese, again similar to that for all of Ontario (52.7 per cent). The proportion of the adult population who were at a healthy body weight did not change significantly over time from 2007/2008 to 2011/2012 in neither Waterloo Region nor Ontario (data not shown).

Efforts to educate the public on the importance of healthy eating have been successful in terms of improving knowledge; however, eating habits of the majority of the population continue to be suboptimal.67

Eating habits are often thought to be a personal issue.68 An approach that focuses on the individual seeks to improve dietary habits by providing individuals with information that they need to consume a healthier diet, but largely ignores the powerful influence of environmental factors that are beyond individual control such as: marketing, price, food availability, convenience and portion size.68-71 Interventions aimed at improving dietary intake need to move beyond educating individuals to address the food environment in order to make healthy choices easier.65

Region of Waterloo Public Health supports many interventions that address the environmental influences on eating habits, including:

- **Community gardens** – As reported in the Region of Waterloo Public Health report *Not Just a Passing Fancy: How community gardens contribute to healthy and*
inclusive neighbourhoods, community gardens provide many health benefits, including increased vegetable and fruit consumption, improved mental health and opportunities for physical activity. In addition, community gardens provide an opportunity for social connections to be made. Region of Waterloo Public Health supports several community garden development projects in Waterloo Region.

- **Waterloo Catholic District School Board (WCDSB) – Food and Nutrition Policy** - in 2009, the WCDSB implemented a comprehensive Food and Nutrition Policy for Elementary Schools. This policy addresses the nine essential elements outlined in the Ontario Society of Nutrition Professionals in Public Health Call to Action: Creating a Healthy School Nutrition Environment. Region of Waterloo Public Health provided support to the WCDSB in the development, implementation and evaluation of the policy.

  In 2011, the Waterloo Catholic District School Board – Food and Nutrition Policy was revised to go beyond P/PM 150. The WCDSB policy applies to food and beverages offered at school, use of food as a reward, as well as food and beverages sold for fundraising purposes.

- **Region of Waterloo Public Health Project Health** - Region of Waterloo Public Health offers the Project Health program to workplaces in Waterloo Region. This initiative allows Public Health staff to work with local workplaces to apply the concepts of a healthy workplace nutrition environment as laid out by the Ontario Society of Nutrition Professionals in Public Health Workplace Nutrition Advisory Group. The initiative provides a variety of health promotion services to workplaces interested in improving and/or sustaining a healthy workplace in Waterloo Region. Workplaces can access the services of public health professionals to improve the health of employees on a variety of topics including healthy eating.

- **Waterloo Region Food System Roundtable** - a networking and policy-making group working on building a strong voice for a healthy food system in Waterloo Region. The group is working on five priority areas including access to healthy food. The group has been awarded a 2014 Heart and Stroke Foundation Spark Advocacy grant to expand community gardens and neighbourhood markets in Waterloo Region.

- **Healthy Communities Coalitions** – these coalitions in Woolwich and Wilmot townships use education, engagement and collaboration to work together with individuals and groups to make their respective townships healthier and contribute to healthy public policy. Healthy eating, physical activity and mental health are three focus areas for each of these groups. Region of Waterloo Public Health is a member of both of these coalitions.

- **Waterloo Region Healthy Communities Partnership** – this partnership was established and is coordinated by Region of Waterloo Public Health as a network of networks to oversee health promotion activities carried out by local partners to promote healthy eating, physical activity and mental health in a comprehensive way. Since its inception, the Partnership has accomplished a number of
initiatives that have encouraged community participation in the promotion and implementation of healthy public policies.

17.1.5 Physical Activity and Sedentary Behaviours

The risk for developing colorectal and post-menopausal breast cancer has been shown to have a strong inverse relationship with physical activity (occupational, household, transport and recreational).^62,72-76^ Current Canadian physical activity guidelines recommend that adults over 18 years accumulate at least 150 minutes of moderate- to vigorous-intensity physical activity (MVPA) per week, in bouts of ten minutes or more. Children and youth (5 to 17 years) should accumulate at least 60 minutes MVPA each day. In the early years, infants under one year of age should be physically active several times daily, and toddlers (1 to 2 years) and preschoolers (3 to 4 years) should accumulate at least 180 minutes of physical activity at any intensity spread throughout the day. Canadian sedentary behaviour guidelines for children and youth state that recreational screen time should be less than two hours per day.\(^77\)

If the entire Canadian population followed current physical activity guidelines, it is estimated that approximately 20 per cent of deaths related to colon cancer and 14 per cent of deaths related to breast cancer could be prevented. In addition, physical activity at or above the recommended levels is associated with a 30 per cent decreased risk for developing colon cancer and a 20 per cent decreased risk for developing breast cancer.\(^73,78\)

Self-reported data from CCHS has shown previously that about 54 per cent of Canadian adults were at least moderately active during their leisure time.\(^79\) However, when physical activity levels were objectively measured, only 15 per cent of Canadian adults accumulated the recommended minimum level of MVPA per week and spent almost ten waking hours sedentary (not including sleep).\(^80\) Among Canadian children and youth six to 17 years, only eight per cent of boys and four per cent of girls accumulate the recommended minimum level of MVPA and are sedentary for about nine hours per day (64 per cent of their waking hours).\(^81\)

Physical activity and sedentary behaviours are influenced at the community level through a complex relationship between people and their environment. While individuals are responsible for their own physical activity levels, their behaviours are influenced by the social and physical environments in which they live, go to work or school, and spend their leisure time.\(^82\) The NEWPATH study conducted in Waterloo Region in 2009 illustrated that the more “walkable” a neighbourhood, the greater the likelihood that individuals will be physically active. Individuals in high walkable neighbourhoods were 50 per cent more likely to walk than those living in medium walkable neighbourhoods, and 180 per cent more likely to walk than those living in low walkable neighbourhoods.\(^83\)
The proportion of the population aged 12 years and older in Waterloo Region and Ontario by leisure time physical activity status is described below in Figure 17.4.

**Figure 17.4. Proportion of population aged 12 years and older by leisure time physical activity status*, Waterloo Region and Ontario, 2007/2008, 2009/2010 & 2011/2012**

<table>
<thead>
<tr>
<th></th>
<th>2007/08</th>
<th>2009/10</th>
<th>2011/12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waterloo Region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td>21.7</td>
<td>29.9</td>
<td>23.9</td>
</tr>
<tr>
<td>Moderately Active</td>
<td>23.7</td>
<td>22.3</td>
<td>28.6</td>
</tr>
<tr>
<td>Inactive</td>
<td>54.6</td>
<td>47.8</td>
<td>47.4</td>
</tr>
<tr>
<td><strong>Ontario</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td>25.7</td>
<td>27.2</td>
<td>29.3</td>
</tr>
<tr>
<td>Moderately Active</td>
<td>24.0</td>
<td>23.6</td>
<td>24.8</td>
</tr>
<tr>
<td>Inactive</td>
<td>50.3</td>
<td>49.2</td>
<td>45.9</td>
</tr>
</tbody>
</table>

*Active – average energy expenditure of 3.0+ kcal/kg/day (e.g., walking an hour or jogging 20 minutes day); Moderately active – average energy expenditure of 1.5-2.9 kcal/kg/day (e.g., walking 30-60 minutes a day or taking an hour-long exercise class 3x/week); Inactive – average energy expenditure of less than 1.5 kcal/kg/day (e.g., walking less than 30 min/day).


In general, self-reported leisure time physical activity levels in Waterloo Region appeared to increase slightly over time. There was a small but significant increase in the proportion of the population who were active in Waterloo Region from 2007/2008 (21.7 per cent) to 2009/2010 (29.9 per cent); this proportion decreased again in 2011/2012, although the change did not appear to be statistically significant (23.9 per cent). The proportion of Waterloo Region residents who were moderately active significantly increased from 2009/2010 (22.3 per cent) to 2011/2012 (28.6 per cent). For the province as a whole, a similar increase in leisure-time physical activity levels was also observed, with 25.7 per cent of Ontarians aged 12 years and older reporting active physical activity levels in 2007/2008, compared to 27.2 per cent in 2009/2010, and 29.3 per cent in 2011/2012.

The proportion of the population in Waterloo Region who were active in 2011/2012 (23.9 per cent) was significantly lower than the rate for all of Ontario (29.3 per cent).
When considering the current Canadian physical activity guidelines, just over half of Waterloo Region residents reported being active at a level that would meet current physical activity guidelines (i.e., either active or moderately active), which was similar to provincial rates, as well as to the national rate reported earlier. It is not known from the available data how much time the ‘inactive’ respondents spent in light intensity physical activity versus sedentary activities.

When the self-reported CCHS data was examined by age, sex, municipality, household income and level of education, no significant differences were found except by age, where older adults aged 75 years and older were significantly more likely to be inactive during leisure time (62.6 per cent) compared to young adults aged 18 to 44 years (43.7 per cent; data not shown).

Table 17.8 describes the proportion of the population aged 12 years and older in Waterloo Region and Ontario by leisure time sedentary activities in 2011/2012.

Table 17.8. Proportion of population aged 12 years and older by type of leisure time sedentary activity, Waterloo Region and Ontario, 2011/2012

<table>
<thead>
<tr>
<th>Place of residence</th>
<th>Sedentary activity</th>
<th>2011/2012 Per cent (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterloo Region</td>
<td>15+ hours/week on TV/video</td>
<td>29.4 (26.1-32.8)</td>
</tr>
<tr>
<td></td>
<td>11+ hours/week on video games</td>
<td>2.5 (1.5-3.5)</td>
</tr>
<tr>
<td></td>
<td>11+ hours/week on computer</td>
<td>25.9 (22.2-29.5)</td>
</tr>
<tr>
<td></td>
<td>15+ hours/week on any of the above</td>
<td>62.7 (58.9-66.5)</td>
</tr>
<tr>
<td>Ontario</td>
<td>15+ hours/week on TV/video</td>
<td>29.0 (28.2-29.8)</td>
</tr>
<tr>
<td></td>
<td>11+ hours/week on video games</td>
<td>3.3 (3.0-3.6)</td>
</tr>
<tr>
<td></td>
<td>11+ hours/week on computer</td>
<td>26.7 (25.9-27.6)</td>
</tr>
<tr>
<td></td>
<td>15+ hours/week on any of the above</td>
<td>61.5 (60.6-62.4)</td>
</tr>
</tbody>
</table>

CI = 95 per cent confidence interval.
Source: CCHS, 2011/2012, Statistics Canada, Share File, Ontario MOHLTC.

In 2011/2012, 62.7 per cent of Waterloo Region residents aged 12 years or older reported 15 hours or more per week engaged in selected leisure time sedentary activities (watching TV/videos, playing video games, or on a computer). This proportion was similar to that for all of Ontario (61.5 per cent). For both Waterloo Region and Ontario, this proportion represented a significant increase over time from 2007/2008 (50.9 per cent up to 62.7 per cent in Waterloo Region and 52.3 per cent up to 61.5 per cent in Ontario; data not shown).

When the data from 2011/2012 was examined by sex, age group, municipality, household income, and level of education, there were no significant differences in the proportion of the population engaged in sedentary activities, except by age (data not shown). Individuals aged 12 to 17 years and 18 to 44 years were significantly less likely to spend 15 hours or more per week watching TV or videos (21.0 per cent\(^{1}\) and 20.9 per

\(^{1}\) This estimate had high sampling variability, and must be interpreted with caution.
cent, respectively) compared to those aged 65 to 74 years and 75 years and older (51.2 per cent and 60.6 per cent, respectively).

Based on the data described above, local self-reported physical activity and sedentary activities appear similar to provincial and national levels.

The most effective approach for increasing physical activity involves a combination of efforts at all levels – individual, interpersonal, organizational, community and public policy. At both the international and national levels, four areas for focus have been identified:

- Policy development, change and implementation
- Targeted information and public education
- High quality, accessible programs and services
- Community design

In an effort to increase the proportion of Waterloo Region residents meeting physical activity guidelines, Region of Waterloo Public Health works with various partners at local, regional and provincial levels on a number of initiatives that address these focus areas across multiple settings – schools, workplaces and the broader community.

Region of Waterloo Public Health initiatives relating to physical activity in schools include:

- **Active Transportation Master Plan (Walk Cycle Waterloo Region)**, currently in final draft, is the Region of Waterloo’s plan on how to make it easier to walk, bike and roll in our community. The Region has committed to ensuring that the health and social benefits of an active lifestyle influence transportation planning and design decisions. While the project is being led by the Region’s Transportation Planning Department, it includes representatives from across the Region including Public Health.

- **Healthy Communities Coalitions** – these coalitions in Woolwich and Wilmot townships use education, engagement and collaboration to work together with individuals and groups to make their respective townships healthier and contribute to healthy public policy. Healthy eating, physical activity and mental health are three focus areas for each of these groups. Region of Waterloo Public Health is a member of both of these coalitions.

- **Trails Waterloo Region** – acts as a facilitator in the development of an inter-linked trail system for people-powered transportation across the urban and rural areas of Waterloo Region. Public Health is a contributing member of this committee.

- **Waterloo Region Active Living Network** – works to support the creation of healthy public policies, supportive environments in recreational settings and the built environment to increase access to opportunities for physically activity. This group, with support from Public Health, is working on a Physical Activity Charter for Waterloo Region.
• **Waterloo Region Healthy Communities Partnership** – this partnership was established and is coordinated by Region of Waterloo Public Health as a network of networks to oversee health promotion activities carried out by local partners to promote healthy eating, physical activity and mental health in a comprehensive way. Since its inception, the Partnership has accomplished a number of initiatives that have encouraged community participation in the promotion and implementation of healthy public policies.

• **Waterloo Region Walks** is an independent community partnership of local walking leaders, key stakeholders and community members who have a vested interest in the promotion of walking for all ages for purposes of health, transportation and recreation. Region of Waterloo Public Health is one of many members contributing to this partnership.

### 17.1.6 HPV Infection

Human papillomavirus (HPV) is the most common sexually transmitted infection. With over 100 different types, it affects approximately 550,000 people in Canada every year. Persistent infections from high risk types of HPV can lead to cancer of the cervix, vagina, anus, vulva, and penis, as well as oral cancers.

In Waterloo Region, the age-standardized incidence rate for all HPV-associated cancers between 2002 and 2007 was 16.8 cases per 100,000 people (Table 17.9).
Oral cavity and pharyngeal cancer cases had the highest incidence rates of all the HPV-related cancer in Waterloo Region. Cervical cancer cases had the next highest incidence rate. Of note is the relatively young age at which cervical cancers began to appear and peak.

Risk factors for HPV infection include younger age, sexual activity without use of a physical barrier method of contraception (e.g., condom), and higher number of sexual partners. Both have been correlated to a higher risk for HPV infection. Past and current cigarette smoking have also been associated with HPV infection.\(^87\)

Available screening for HPV includes Pap tests. This screening test affects cancer risk by assisting in early detection and identification of abnormal cancer causing cells.\(^88\) Pap tests are critically important to the early detection of cancer and should continue to be performed, even with the advent of the HPV vaccine.
Because HPV infection is so prevalent and its risk factors fairly universal, it is difficult to completely prevent in sexually active populations. The advent of a quadrivalent vaccine for HPV that is approved for use by Health Canada may represent the best primary prevention method for HPV. In July 2006, the HPV vaccine Gardasil® was approved for use in Canada for the prevention of cervical, vulvar, vaginal cancers and their precursors, as well as genital warts. In February 2007, the National Advisory Committee on Immunization (NACI) issued a statement on the HPV vaccine and identified females between the ages of nine and thirteen years as the group for whom immunization would be most efficacious. NACI has more recently supported use of the vaccine in women up to age 45 years, as well as among men and women ages nine to 26 years for the prevention of anal cancer.89

In 2007, Ontario introduced a voluntary, publicly funded, school-based HPV immunization program. This program is delivered through local health units, including Region of Waterloo Public Health. Each year, grade eight girls in Ontario are eligible to receive the publicly-funded vaccine free of charge. Additionally, girls who missed the vaccine in grade eight are eligible to receive it up until grade 12.

Although all provinces in Canada have implemented publicly-funded HPV vaccination programs, HPV vaccine coverage rates vary from province to province. In Ontario the coverage rate in 2007 was reported at 53 per cent.90 HPV immunization coverage rates in Waterloo Region continue to trend upward. The HPV coverage rate for females in grade eight in Waterloo Region is believed to be somewhere between 60 and 75 per cent. Due to constraints with the provincial immunization reporting system, Region of Waterloo Public Health is not able to provide specific immunization rates. The current provincial information system is scheduled to be replaced by a new system (Panorama) over the next year. This new system will enable health units and the province to accurately determine immunization coverage rates for school program immunizations.

For behavioural risk factors related to HPV infection, data is available to report on age of sexual debut as well as number of sexual partners in the past year. As shown in Table 17.10, 66.3 per cent of the population aged 15 to 49 years in Waterloo Region reported their age of sexual debut as less than 20 years in 2011/2012.
The proportion of the population aged 15 to 49 years in Waterloo Region who reported their age of sexual debut as less than 20 years appeared to increase slightly from 2007/2008 (64.7 per cent) to 2011/2012 (66.3 per cent), although these differences were not significant. Local proportions were similar to those for Ontario as a whole. When age of sexual debut was examined by age and sex, no significant differences were evident (data not shown). This data highlights that approximately two-thirds of the population in Waterloo Region have the potential to be exposed to HPV at a relatively early age.

Having multiple sexual partners, or a partner with multiple sexual partners also presents increased risk for HPV infection. As shown in Table 17.11, 6.9 per cent\(^6\) of the population aged 15 to 49 years in Waterloo Region in 2011/2012 reported having two or more sexual partners in the past 12 months.

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\(^{6}\)This estimate had high sampling variability, and must be interpreted with caution.

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had two or more sexual partners was significantly lower in Waterloo Region compared to Ontario in 2011/2012 (6.9 per cent\(^1\) versus 10.6 per cent, respectively).

When number of sexual partners was examined by sex, males were significantly more likely to report having two or more sexual partners in the past 12 months (10.6 per cent) compared to females (5.2 per cent; 2007-2012 combined; data not shown). Adults aged 20 to 24 years were significantly more likely to report having two or more sexual partners in the past 12 months (22.8 per cent) compared to all other age groups (2007-2012 combined; data not shown).

### 17.2 Screening and Early Detection

Cancer screening can detect some types of cancer before symptoms are present. This means that even if a person feels well, and lives a healthy lifestyle, they should still get screened for cancer when appropriate. In some cases, cancer screening tests can actually prevent cancer by identifying cell changes that could progress to cancer if left untreated. In other cases, cancer screening may detect cancer at an early stage when there are more treatment options, and treatment is more likely to be successful.\(^91\) The goal of cancer screening is to reduce the cancer death rate and, by detecting cancer early, improve the likelihood of successful treatment.\(^92\)

Various cancers have different screening tests and guidelines for when and how often to get screened. The specific provincial cancer screening guidelines for breast, cervical and colorectal cancer can be found in the subsequent sections of this chapter. Regular checkups and awareness of bodily changes are also important for the early detection of cancer.

Because screening involves subjecting apparently healthy individuals to potential risk, population-based screening programs are recommended only when:

- a) the screening test has been shown to reduce mortality;
- b) the screening test is able to detect the disease in a pre-clinical phase;
- c) the test is able to accurately predict when cancer does exist (high sensitivity) and when it does not exist (high specificity);
- d) the test is considered safe and does not subject an individual to an unacceptable level of risk; and
- e) if a cancer can be identified through screening, effective treatment is available.\(^92\)

Population-based screening is most effective and cost-efficient when offered through an organized screening program that incorporates all elements of the screening process, including evidence-based screening and follow-up guidelines, and recruitment and retention strategies to maximize participation.\(^92\)
Breast, cervical, and colorectal cancers are all part of provincially organized screening programs. The Ontario Breast Screening Program (OBSP) was launched in 1990, followed by the Ontario Cervical Screening Program in 2000, and ColonCancerCheck in 2008. These programs are led by the Ministry of Health and Long-Term Care (MOHLTC) and Cancer Care Ontario, and implemented with support from a range of partners including regional cancer programs and public health units. The goals of the organized screening programs are to improve the capacity of partners to engage in organized cancer screening, and to reduce mortality through screening.\(^{93,95}\)

There are other cancers for which screening tests exist (e.g., prostate and oral cancers), but there is no organized screening program available due to a lack of evidence for population-based screening. Unfortunately, for many common and high-mortality cancers such as lung cancer, there are no screening measures available.\(^{92}\)

Prostate cancer, which currently is not part of an organized provincial screening program, has two associated screening tests. The prostate-specific antigen (PSA) test and digital rectal exam are both tests used to detect early signs of prostate cancer. However, several research studies have failed to determine whether it’s a good idea to use these tests to look for prostate cancer or not; recent reviews indicate that mortality rates from prostate cancer did not differ significantly between men who were screened and those who were not.\(^{96}\) For this reason, it is recommended that men near the age of 50 years talk to their primary health care provider to discuss prostate cancer risk, and the benefits and risks of screening.\(^{96}\)

Oral cancer screening is conducted as part of regular dental examinations by dentists and dental hygienists. The dental practitioner will look for lumps or tissue changes in the inside of the mouth and on the neck, face and head. Early signs of disease can be discoloured tissue or sores that do not heal, difficulty swallowing and changes in taste or tongue sensation. Early detection is important so that oral cancer can be treated more successfully.\(^{24}\)

### 17.2.1 Breast Cancer Screening

Breast cancer screening helps to detect and evaluate breast changes over time. It is important to identify cancerous breast changes early, as this leads to a better chance of successful treatment, the possibility for more treatment options, and a decreased likelihood that the cancer will spread. Screening is usually performed through a breast x-ray known as a mammogram.\(^{97}\) During a mammogram, a woman’s breasts are pressed together between two plates and pictures are taken from different angles. Compressing the breast tissue in this way increases the clarity of the pictures and helps radiologists to see breast changes.\(^{98}\)

In Ontario, it is recommended that women aged 50 to 74 years have a screening mammogram every two years. Women aged 30 to 69 years who are confirmed as high risk for breast cancer by a health care professional should have both a mammogram and breast magnetic resonance imaging (MRI) every year.\(^{99}\) Certain factors increase a
woman’s risk for breast cancer, including: the presence of a mutation of the BRCA1 or BRCA2 genes, personal or family history of breast cancer, reproductive history, older age, diet, physical inactivity, alcohol consumption, radiation therapy to the chest area, and having hormone replacement therapy for more than five years. \(^{10,11,100}\)

Women in Ontario can receive a mammogram in one of two ways. They can call to make an appointment through Ontario’s organized provincial screening program OBSP, or with a referral from their primary health care provider, they can visit a non-OBSP site. \(^{98}\)

Highlights of the OBSP program include: \(^{93}\)
- no doctor’s referral required
- access to free high-quality mammograms
- results sent within two weeks
- help setting up extra tests if needed
- automatic letter sent every two years to remind clients that they are due for screening

All provinces in Canada now have breast screening programs, although the specifics of each program vary slightly from province to province. \(^{98}\) It is believed that part of the decrease in breast cancer mortality rates observed since 2000 is due in part to increased mammography screening.\(^3\) Even so, some women eligible through provincial programs are not being screened for breast cancer. Results from the self-reported CCHS indicated that in 2007/2008 (the most recent available national-level data), less than two-thirds (62.5 per cent) of Canadian women aged 50 to 69 years received a mammogram in the past two years. The Ontario rate of 62.7 per cent was not significantly different than the national rate. \(^{101}\)

According to breast cancer screening participation rates from Cancer Care Ontario, in 2010/2011, 60.6 per cent of women aged 50 to 74 years in Waterloo Region had a screening mammogram in the past two years, a very similar rate to that for the province as a whole (60.8 per cent). Mammogram uptake in Waterloo Region increased from 2004/2005 (55.0 per cent) to 2008/2009 (60.8 per cent), similar to Ontario (56.9 per cent in 2004/2005, up to 61.1 per cent in 2008/2009).

While Cancer Care Ontario is the more accurate source for breast cancer screening participation rates, those data were not available by municipality, income or education to allow for more detailed examination of cervical cancer screening rates within Waterloo Region. As such, self-reported CCHS data on breast cancer screening participation rates within Waterloo Region were examined by municipality, household income, and level of education for 2005, 2007/2008 and 2011/2012 combined. There was some variation by household income and level of education. Mammogram screening rates appeared to increase in individuals with more years of formal education, and in individuals from households earning higher incomes, although no statistically significant differences were evident (data not shown). The lack of statistically significant
differences is likely due to the relatively small sample sizes that were observed, however, and not necessarily because there were no true differences in the population.

The aforementioned breast cancer screening data helps paint a picture of breast cancer screening trends in Waterloo Region as it compares to Ontario and Canada. Based on the data presented, breast cancer screening initiatives remain important in Waterloo Region and Ontario, given that less than two-thirds of eligible women are currently being screened.

Public health units across the province are mandated through the OPHS to collaborate with community partners to promote provincially approved screening programs. Using the local breast screening data, Region of Waterloo Public Health has created tailored programming which includes:

- **The Cancer Screening Program** – A program that promotes the cancer screening guidelines and provides screening support to priority populations (e.g., assistance with appointment booking, route finding, transportation, etc.). This is accomplished through targeted information sessions at community housing sites and in other community spaces with lower screening rates.

- **Project Health** – A program that provides a variety of health promotion services to workplaces to assist them in promoting screening guidelines to employees and developing supportive strategies to encourage screening (e.g., providing flexible work hours to allow employees to attend screening appointments). These services contribute to the development of a healthy workplace.

### 17.2.2 Cervical Cancer Screening

Cervical cancer screening is performed using a Pap test. Pap tests look for changes in cells from the cervix. Pap tests are often performed during annual check-ups at a family physician’s office or clinic. The test only takes a few minutes and while there may be some discomfort, the test is usually not painful.

In Ontario, cervical cancer screening is recommended for all women starting at age 21 years who are or have ever been sexually active. Sexual activity includes intercourse as well as digital and oral sexual activity. If they are not yet sexually active by age 21, women should delay cervical cancer screening until a time when they do become sexually active. Women may stop screening at age 70 years if they have had three or more normal Pap tests in the past ten years.

Cell changes of the cervix are most often caused by persistent HPV infection. In fact, the association between HPV and cervical cancer is stronger than the well-known link between tobacco and lung cancer. HPV is transmitted through sexual activity of any kind. Approximately 75 per cent of males and females will have an HPV infection at some point in their lifetime, making it the most common sexually transmitted infection. Persistent infections with high-risk HPV types which are not found and treated early can progress to cancer.
For this reason, regular cervical cancer screening is very important as it can prevent the development of cancer or detect it early. Additionally, HPV vaccination is recommended, as it is almost 100 per cent effective in preventing infection with four HPV types which are responsible for 70 per cent of all cervical cancer cases. For more details on HPV infection as a risk factor for cancer and on HPV immunization as a preventative measure against cervical cancer, see 17.1.6 HPV Infection.

According to cervical cancer screening rates from Cancer Care Ontario, in 2009-2011, 66.1 per cent of women aged 20 to 69 years in Waterloo Region had at least one Pap test in the past three years. This figure was slightly higher than the provincial screening rate (64.9 per cent). Cervical cancer screening rates increased slightly over time, from 62.5 per cent in Waterloo Region in 2000-2002, up to 66.1 per cent in 2009-2011. The Waterloo Region rate consistently remained slightly higher than the provincial rate from 2000-2002 to 2009-2011 (data not shown).

While Cancer Care Ontario is the more accurate source for cervical cancer screening rates, those data were not available by municipality, income or education to allow for more detailed examination of cervical cancer screening rates within Waterloo Region. As such, self-reported CCHS data on Pap test rates from 2005, 2007/2008 and 2011/2012 combined were examined by municipality, household income and education level in Waterloo Region. There was some variation by municipality, income and education, but no trends were obvious and no statistically significant differences were evident (data not shown). The lack of statistically significant differences is likely due to the relatively small sample sizes that were observed, however, and not necessarily because there were no true differences in the population.

Overall, Waterloo Region cervical cancer screening rates appear to be slightly higher than the province as a whole. Even so, approximately one-third of women are not up-to-date with Pap tests.

Public health units across the province are mandated through the OPHS to collaborate with community partners to promote provincially approved screening programs. Using the local cervical screening data, Region of Waterloo Public Health has created tailored programming which includes:

- **The Cancer Screening Program** – A program that promotes the cancer screening guidelines and provides screening support to priority populations (e.g., assistance with appointment booking, route finding, transportation, etc.). This is accomplished through targeted information sessions at community housing sites and in other community spaces with lower screening rates.
- **Project Health** – A program that provides a variety of health promotion services to workplaces to assist them in promoting screening guidelines to employees and developing supportive strategies to encourage screening (e.g., providing flexible work hours to allow employees to attend screening appointments). These services contribute to the development of a healthy workplace.
- **HPV vaccination administration** – Administered within the school vaccination program, female grade eight students are offered the complete HPV vaccination
series free of charge throughout the school year. If vaccination is missed, catch up clinics are offered at Public Health for these students up until the end of their grade 12 year.

- **Sexual Health Clinic Pap tests** – Region of Waterloo Public Health’s sexual health program includes clinic and counselling service, and Pap testing is offered to women aged 24 years and under.

### 17.2.3 Colorectal Cancer Screening

Colorectal cancer screening for average risk men and women is performed using an at-home stool test, also known as a fecal occult blood test (FOBT). FOBTs detect blood in stool that cannot be seen with the naked eye. This blood comes from polyps, small growths of tissue on the surface of the colon wall, that release a small amount of blood onto the stool as it passes by. It is important to identify and remove polyps early, as some can become cancerous. Even if polyps have already become cancerous, early identification can result in less treatment required, more successful outcomes of treatment, shorter recovery times, and a reduced likelihood of cancer spread.

FOBT kits can be obtained from a primary health care provider. Men and women without a primary health care provider can call Telehealth Ontario and request a test which will be mailed to them. The test involves taking three separate stool samples, on three different days, over a ten day period, and mailing these samples to a lab for analysis. Simple instructions are included in the test kit to make it easy for men and women to complete the test on their own, in the comfort of their own home. In Ontario, Cancer Care Ontario recommends that men and women starting at age 50 years complete an FOBT every two years.

Men and women with an increased risk of colorectal cancer (defined as having one or more first-degree relatives – parents, siblings or children – with colorectal cancer) should be screened through a procedure known as a colonoscopy. A colonoscopy examines the lining of the entire rectum using a camera that is inserted into the anus. Screening via colonoscopy for these individuals at increased risk should begin at age 50 years, or ten years earlier than the age at which their relative was diagnosed, whichever occurs first.

According to self-reported data from CCHS, in 2008 Ontario had one of the highest colorectal screening rates in Canada, with approximately 50 per cent of individuals aged 50 to 74 years reporting that they completed an FOBT in the past two years, and/or had a colonoscopy in the past five years (data not shown). This figure was significantly higher than the national screening rate of approximately 40 per cent (data not shown).

According to colorectal cancer screening rates provided by Cancer Care Ontario, in 2010/2011, 36.5 per cent of individuals in Waterloo Region aged 50 to 74 years completed at least one FOBT in a two-year period. This figure was higher than the provincial FOBT screening rate of 29.8 per cent. FOBT testing rates increased over time, from 18.7 per cent in Waterloo Region in 2004/2005 to 36.5 per cent in 2010/2011.
This upward trend was similar to that for the province as a whole (15.8 per cent in 2004/2005, up to 29.8 per cent in 2010/2011).

Colonoscopy rates were only available using self-reported CCHS data. In Waterloo Region in 2011/2012, 30.7 per cent of individuals aged 50 to 74 years reported having a colonoscopy or sigmoidoscopy in the past five years, which was similar to the provincial rate (31.6 per cent). The colonoscopy rates for both Waterloo Region and Ontario increased significantly from 2009/2010 to 2011/2012 (17.4 per cent up to 30.7 per cent and 27.2 per cent up to 31.6 per cent, respectively).

Self-reported CCHS data for 2007-2012 combined was also examined to further consider FOBT test and colonoscopy rates by sex, municipality, household income and education level in Waterloo Region. There was slight variation by sex, municipality, income and education, but no statistically significant differences were evident (data not shown). The lack of statistically significant differences is likely due to the relatively small sample sizes that were observed, however, and not necessarily because there were no true differences in the population.

Although Ontario has one of the highest colorectal screening rates in the country, half of eligible Ontarians are still not up-to-date with recommended colorectal screening.

Public health units across the province are mandated through the OPHS to collaborate with community partners to promote provincially approved screening programs. Using the local colorectal screening data Region of Waterloo Public Health has created tailored programming which includes:

- **The Cancer Screening Program** – A program that promotes the cancer screening guidelines and provides screening support to priority populations (e.g., assistance with appointment booking, route finding, transportation, etc.). This is accomplished through targeted information sessions at community housing sites and in other community spaces with lower screening rates.

- **Region of Waterloo Public Health - Project Health** – A program that provides a variety of health promotion services to workplaces to assist them in promoting screening guidelines to employees and developing supportive strategies to encourage screening (e.g., providing flexible work hours to allow employees to attend screening appointments). These services contribute to the development of a healthy workplace.
18.0 METHODOLOGY

18.1 Data Sources

This report combines the most current cancer incidence, mortality and survival data available, as well as information on hospitalization rates due to cancer. Risk factor and screening data was derived from local, provincial or national surveys, including, but not limited to, the Rapid Risk Factor Surveillance System (RRFSS) and the Canadian Community Health Survey (CCHS). The three most recent years or cycles of data, where available, were used for analysis. Information on cancer screening participation rates were also obtained from Cancer Care Ontario. Data included in this report is representative of all people who live in Waterloo Region, including the cities of Cambridge, Kitchener and Waterloo, and the townships of Woolwich, Wellesley, Wilmot and North Dumfries.

18.1.1 Ontario Cancer Registry (OCR)

Cancer incidence, mortality and survival data was obtained from Cancer Care Ontario, collected through the Ontario Cancer Registry (OCR), which is an electronic registry of newly diagnosed cancer cases and deaths in Ontario. The OCR is one of the largest cancer registries in the North America and contains information on all Ontario residents who have been newly diagnosed with cancer. The Registry is operated by Cancer Care Ontario under the authority of the Cancer Act of Ontario and the Personal Health Information Protection Act of Ontario. Currently, data is available from 1986 through 2009. It is population-based and includes about 97 per cent of all cancer cases in the province.

All cancers, except non-melanoma skin cancer, are collected in the OCR. As the reporting of cancer is not legally mandated in Ontario, the OCR relies on passive registration, administrative records, and computerized record linkage. The registry collects data from multiple sources, including:

- Cancer-related hospital discharge and day surgery records from the Canadian Institute for Health Information (CIHI)
- Cancer-related pathology reports from hospital and community laboratories
- Records from the Regional Cancer Centres, as well as Princess Margaret Hospital
- Death certificates with cancer identified as the underlying cause of death, received from the Ontario Registrar General.

Data from the OCR is disseminated via the Surveillance Epidemiology and End Results (SEER*Stat) database. SEER*Stat contains incidence and mortality data at the Census Division and Public Health Unit level back to 1986. In this report, Release 8.0.2 (February 2013) was used to extract data, which was current up to 2009. Cancer sites were coded according to the International Disease Classification of Disease, Ninth (ICD-
9) and Tenth Canadian (ICD-10-CA) Revisions, as well as primary site and histology data fields. The ‘site recode’ and ‘cause of death recode’ and morphology variables were used in this report because they each contain data over time that uses either ICD-9 or ICD-10-CA, as appropriate. Data was not reportable when the number of events was less than six.

18.1.2 IntelliHealth

IntelliHealth is a repository of health information that contains datasets within the Provincial Health Planning Database. It is maintained by the Ministry of Health and Long-term Care (MOHLTC) and contains information on a variety of health topics at the individual level, including hospital services, community care, medical services, vital statistics and population estimates and projections. The population estimates and projection were the primary source of data obtained for this report.

Population Estimates and Projections
Population data is used mainly in rate calculations and for reference purposes. Statistics Canada data and Ontario Ministry of Finance methodology are used to calculate population estimates and projections. Projections are based on the 2006 Census and are available by calendar year, sex and single year of age to 2031. Since population projections are based on assumptions and are “predictive” in nature, they are not an exact population estimate. Population estimates are based on the 1986, 1991, 1996, 2001 and 2006 census counts, while projections are extrapolated using the growth rates observed between the census years. The population estimates and projections in this report may differ from those presented elsewhere due to differences in methodology.

18.1.3 Canadian Community Health Survey (CCHS)

Some risk factor and screening data for this report was obtained from Statistics Canada’s CCHS (MOHLTC share file). The CCHS is a national population household survey conducted by Statistics Canada that provides timely, regular, cross-sectional estimates of health status, health determinants and health system utilization (including screening practices) for health regions across the country, including all health units in Ontario. Samples were derived from randomly selected respondents per household. All individuals over 12 years of age living in the country, with exception of those living on Indian Reserves, Canadian Forces Bases, and certain remote areas, and those who were institutionalized, were eligible to participate. The CCHS covers approximately 98 per cent of the Canadian population aged 12 years and older. In this report, data collected in 2005, 2007/08 and 2009/2010 was analyzed.

CCHS consists of self-reported data collected in telephone and in-person interviews, and is subject to sources of bias, including social desirability and recall bias. ‘Don't know’, refused and not stated responses were removed from analysis when they represented less than five per cent of the unweighted sample. In removing these responses from the denominator, the assumption is that the missing values are random, which is not always the case.
18.1.4 Rapid Risk Factor Surveillance System (RRFSS)

Additional risk factor information was derived from RRFSS, an on-going telephone survey occurring in various public health units across Ontario. On a monthly basis, a random sample of 100 Waterloo Region adults aged 18 years and older is interviewed regarding risk behaviours, knowledge, attitudes, and awareness about health-related topics. The Institute for Social Research (ISR) at York University conducts the survey on behalf of all RRFSS-participating health units. The content of the survey varies from year to year and data for some indicators is not available every year.

Similar to CCHS data, RRFSS survey data is based on self-reported data and is subject to sources of bias, including social desirability and recall bias. ‘Don't know’, refused and not stated responses were removed from analysis when they represented less than five per cent of the unweighted sample. In removing these responses from the denominator, the assumption is that the missing values are random, which is not always the case.

18.1.5 Cancer Screening Participation Rates

Information on cancer screening participation rates was obtained from Cancer Care Ontario, and included breast (mammography), cervical (Pap test) and colorectal (fecal occult blood test) cancer screening tests. The data was provided at the provincial and public health unit level for the years 2000 through 2011. The 2006 Canadian population was used as the standard population for calculating age-standardized rates for all cancer screening participation rates. A small proportion of cancer screening tests performed as a diagnostic test could not be excluded from the analysis.

Breast cancer screening participation rates were defined as the percentage of Ontario women aged 50 to 74 years old who completed at least one mammogram within a two-year interval. Each woman was counted once regardless of the number of mammograms performed in a two-year period. Breast cancer screening participation rates were calculated using data from the Ontario Breast Screening Program Integrated Client Management System, the Ontario Health Insurance Program (OHIP) Claims History Database, OCR, the Pathology Information Management System, and the Registered Persons Database.

Cervical cancer screening (Pap test) participation rates were defined as the percentage of Ontario screen-eligible women, 20 to 69 years old, who completed at least one Pap test in a three-year period. Each woman was counted once regardless of the number of Pap tests performed in a three-year period. Cervical cancer screening participation rates were calculated using data from the Cervical Screening Program (Cytobase), the OHIP Claims History Database, OCR, the Pathology Information Management System, and the Registered Persons Database.

Colorectal cancer screening (fecal occult blood test, or FOBT), participation rates were defined as the percentage of Ontario individuals, 50 to 74 years old, who completed at least one FOBT in a two-year period. Colorectal cancer screening participation rates...
were calculated using data from the Laboratory Reporting Tool, the OHIP Claims History Database, OCR, the Pathology Information Management System, and the Registered Persons Database.

18.2 Data Analysis

Ontario and Waterloo Region cancer data from the Ontario Cancer Registry was analysed using the SEER*Stat application. SEER*Stat is a statistical software tool originally developed by the National Cancer Institute in the United States. This software permits calculation of cancer statistics, such as frequencies, rates, survival and prevalence. In this report, we analysed the following cancer data for Waterloo Region and Ontario:

- Incidence and mortality data at the provincial level for 1986 to 2009
- Incidence and mortality data at the public health unit level for 1986 to 2009
- Survival data at the provincial and public health unit level for 1986 to 2007

All analyses for cancer data were stratified by age, sex and cancer site. The SEER*Stat “recode” variables were used to define the major cancer site groupings for analysis. These groupings are based on the globally standardized classification system of the ICD. Data was suppressed due to both confidentiality and statistical concerns when there were fewer than six cases or deaths, and when rates were based on counts less than six.

In order to compare cancer incidence and mortality trends over time in Waterloo Region, and to compare to trends in Ontario, age-standardized rates are presented in this report. As age can be a factor in whether a person acquires cancer and how the cancer progresses, it is helpful to control for differences in age distribution when comparing two populations, or the same population over time. Age-standardization is a technique that minimizes the effect of differences in age between populations so that findings can be attributed to factors other than age.

For this report, when comparisons between Waterloo Region and Ontario were made, rates were directly age-standardized using the 1991 Canadian Standard population from Statistics Canada. For each cancer site, age-standardized incidence and mortality rates were presented for Waterloo Region and Ontario on a yearly basis and refer to the number of new cases of cancer (incidence) or cancer deaths (mortality) per 100,000 people. Age-standardized rates and associated confidence intervals were calculated in the SEER*Stat application.

Age-standardized incidence (SIR) and mortality (SMR) ratios with 95 per cent confidence were also calculated for each cancer site. These statistics are useful when age-specific rates are unstable due to small numbers for the population of interest. The SIR is a ratio of the observed number of cancer cases in Waterloo Region to an expected number of cases based on Ontario’s age-specific rates. The SMR is
calculated similarly using cancer deaths instead of cases. An SIR or SMR of one implies that cancer incidence or mortality in Waterloo Region is equal to that of Ontario. An SIR or SMR greater than one indicates that the rate is higher in Waterloo Region versus Ontario, whereas an SIR or SMR less than one indicates that the rate is lower in Waterloo Region.

Since most estimates are subject to natural variation, the 95 per cent confidence intervals were used to determine whether and SIR or SMR was statistically different from the reference. While SIRs and SMRs highlight certain cancer sites for which rates may differ between two populations, it is also important to examine trends over time using age-standardized rates.

Finally, ten-year age-specific incidence and mortality rates were calculated in SEER*Stat for Waterloo Region and Ontario for each cancer site. Age-specific rates allow us to examine which age groups are most likely to be affected by certain types of cancer and to determine for which age groups Waterloo Region differs significantly from Ontario. For most cancer sites, the following age groups (in years) were used to present age-specific rates: 0-19, 20-44, 45-64, 65-74 and 75 years and older.

In order to better interpret trends over time, the annual per cent change (APC) in cancer incidence and mortality rates was calculated in SEER*Stat for each cancer site using age-standardized rates over time. The APC represents a hypothetical constant linear change based on the trend line that best fits the data. It does not necessarily represent the actual per cent change difference between any particular years within the data. The APC was considered statistically significant if the p-value was less than 0.05. A positive APC corresponds to an increasing trend and a negative APC corresponds to a decreasing trend. Single year-end points were used with calculating the trend in SEER*Stat. When rates were not reportable for several years due to small counts and suppression of data for certain cancer sites, the average annual age-standardized incidence or mortality rates were examined, representing four time periods: 1986-1991, 1992-1997, 1998-2003, and 2004-2009.

Relative survival ratios were calculated in SEER*Stat for Waterloo Region and Ontario and were shown by single years up to five-years post diagnosis, based on the cancer incidence database using the Kaplan-Meier method. Advancing age of cases does not explain patterns in relative survival ratios, as the rates describe the per centage of patients who were alive for a specified period of time after their disease was diagnosed, in relation to the per centage of the general population of the same age and sex that were also alive over that same time period. Relative survival ratios were presented only up to 2002 because the dataset ended in 2007, and the additional years were required for follow-up for five years post diagnosis. Relative survival ratios were calculated for Waterloo Region and Ontario and for two time periods separated by almost a decade: 1986-1990 and 1998-2002. The purpose of showing the two time periods was to illustrate whether there were changes in relative survival over time.
When available, cancer risk factor and screening data was analyzed. Most risk factor data was derived from national and local surveys, including CCHS and RRFSS. For analysis of the CCHS and RRFSS survey data all estimates, confidence intervals, and coefficients of variation were calculated using SAS. To compare the differences in the outcomes for populations living in Waterloo Region with the provincial average, and longitudinally over time, two estimates were considered statistically significantly different when the corresponding 95 per cent confidence intervals did not overlap.

18.3 Limitations of the Data

While the OCR database allowed for local data comparisons with Ontario rates, comparisons with other health units can be problematic due to inconsistencies in data collection and reporting across regional treatment centres. Also, some cases may be excluded or double-counted due to migration across health unit boundaries.

For some cancers, diagnostic techniques and detection methods have changed over time. For other cancers, diagnostic classification has changed over time. Both of these may account for some of the trends in cancer incidence, mortality and survival ratios over time. As such, an observed increase in the morbidity or mortality of some cancers may not reflect a true change in cancer burden over time.

Annual variation in age-standardized rates was consistently much more pronounced and pervasive among data for Waterloo Region than Ontario, primarily because of the smaller population size in Waterloo Region. Provincially, trends tend to appear smoother over time because of the larger number of cases. When the rates are based on a small number of cases, wide variation from year to year occurs more often, as was the case in Waterloo Region for some cancers. For any year between 1986 and 2009, when the number of incidents or deaths was five or less, results could not be disclosed.

Other limitations in this report derive from data quality. There may simply be missing data because of underreporting of cancer cases and classification errors compromising validity. However, this incompleteness should not be any different for Waterloo Region than the rest of Ontario, so comparisons should not be affected. In addition, there may be some differences in the data that arose when shifting from ICD-9 and ICD-10 diagnostic codes. This report uses the SEER ‘site recode’ variable and ‘cause of death recode’ which has been derived, accounting for these differences. However, some differences may still have been missed in the transition between ICD-9 and ICD-10.

A further limitation is the time delay associated with examination of survival ratios, such that survival data is not as recent as the rest of the data in this report. The most current year for which we could investigate five-year survival was 2002. Although we have data on cancer incidence and mortality as recent as 2009, examination of five-year survival ratios requires an additional five years of follow-up data.
Finally, while the OCR allowed for local data comparisons with Ontario rates, the local data presented in this report only relates to cases residing in Waterloo Region. Therefore, caution should be used when attempting to generalize these results beyond Waterloo Region. Since the SEER*Stat data changes somewhat with every release, it is likely that a subsequent report or release of data would show a different number of events than what we have reported here, either for Waterloo Region or the province, and these changes may extend as far back as 1986.

There are also limitations to the CCHS and RRFSS risk factor and screening data described in this report. These figures are based on self-reported data collected through telephone surveys. Self-reported data may be subject to social desirability bias, where respondents tend to report socially desirable health behaviours more frequently, a source of bias that, within this report, might result in inflated cancer screening rates or reduced rates of behaviours that increase risk for cancer. The data may also be subject to recall bias, where respondents may have difficulty accurately remembering events or behaviours that occurred weeks, months or years in the past.
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103. Canadian Cancer Society. Screening for cervical cancer.  


105. Canadian Cancer Society. Screening for colorectal cancer.  

APPENDIX A: GLOSSARY OF TERMS

**Age-standardization:** A method of adjusting rates to minimize the effects that different age compositions have on populations. This method is used when comparing two or more populations. For example, an older population would be more likely to have higher rates of chronic diseases compared to a younger population. Standardizing controls for these differences.

**Age-standardized incidence rate:** The number of new cases of a given type of cancer diagnosed during a specified time period per 100,000 population, directly standardized to the 1991 Census population of Canada, by five-year age groups.

**Asymptomatic:** Without symptoms.

**Average:** See “Mean”.

**Biopsy:** Process of removing tissue from patients for diagnostic examination.

**Body Mass Index (BMI):** an anthropometric measure of body mass, defined as weight in kilograms divided by height in meters squared.

**Cancer:** General term frequently used to indicate any of various types of neoplasms, most of which invade surrounding tissues, may metastasize to several sites, and are likely to recur after attempted removal and to cause death of the patient unless adequately treated; especially, any such carcinoma or sarcoma, but, in ordinary usage, especially the former.

**Carcinogen:** Any cancer-producing substance or organism.

**Chemotherapy:** Treatment of disease by means of chemical substances or drugs.

**Chronic disease:** An illness that results from the transmission of an infectious agent or its toxins from an infected person, animal, or reservoir to a susceptible host, either directly or indirectly through an intermediate plant or animal host, vector or inanimate objects.

**Colonoscopy:** The examination of the large colon and the distal part of the small bowel with a camera.

**Confidence interval:** A calculated range of values in which the actual value (such as mean, proportion or rate) is contained with a certain degree of confidence. For the purposes of this report 95 per cent confidence intervals were used, meaning that there is a 95 per cent probability that the actual value falls within this range.

**Dysplasia:** Abnormal tissue development.
**Esophagus:** The portion of the digestive canal between the pharynx and stomach.

**Estrogen:** Steroidal compounds, the primary female sex hormone.

**Histology:** The science concerned with the minute structure of cells, tissues, and organs in relation to their function.

**Hormone:** A chemical substance formed in one organ or part of the body and carried in the blood to another organ or part; depending on the specificity of their effects, hormones can alter the functional activity, and sometimes the structure, of just one organ or tissue or various numbers of them.

**Hysterectomy:** Surgical removal of the uterus.

**Immunocompromised:** Incapable of developing a normal immune response, usually as a result of disease (e.g., cancer), irradiation, malnutrition, or immunosuppressive medication.

**Incidence:** The number of new events (such as new cases of a disease) among a population during a specified period of time.

**Incidence rate:** The rate at which new events, or new cases, occur in a specified time in a defined population that is “at risk” of experiencing the condition or event.

**Leukemia:** Any of several cancers of the bone marrow that prevent the normal manufacture of red and white blood cells and platelets, resulting in anemia, increased susceptibility to infection, and impaired blood clotting.

**Light physical activity:** Includes activities such as light household cleaning, cooking and leisurely walking.

**Lymphoma:** Any neoplasm of lymphoid tissue; in general use, synonymous with incidence lymphoma.

**Malignant:** having the property of locally invasive and destructive growth and metastasis.

**Mammography:** Examination of the breast using low dose X-Rays with the goal of early detection of breast cancer.

**Mean:** The mean or average is the sum of all the individual values in a set of measurements divided by the total number of values in the set of measurements.

**Median:** The median is the value that divides a set of numbers exactly in half when they are placed in order from lowest to highest. In other words, half of the values occur before the median and half of the values occur after the median.
Melanoma: A malignant neoplasm, derived from cells that are capable of forming melanin, arising most commonly in the skin of any part of the body, or in the eye, and, rarely, in the mucous membranes of the genitalia, anus, oral cavity, or other sites.

Menopause: The permanent cessation of menstruation.

Metastasis: The spread of a disease process from one part of the body to another, as in the appearance of neoplasms in parts of the body remote from the site of the primary tumor; results from dissemination of tumor cells by the lymphatics or blood vessels or by direct extension through serous cavities or subarachnoid or other spaces.

Moderate- to vigorous-intensity physical activity (MVPA): Causes a person to sweat and breathe harder or be out of breath (e.g., skating, brisk walking, bike riding, playground activities, running/jogging, rollerblading, swimming, cross-country skiing).

Modifiable risk factor: Behaviours, biological factors or environmental conditions that have the potential to be changed for the purpose of reducing risk of developing cancer. Examples include tobacco use, alcohol consumption, nutrition, physical activity, exposure to ultraviolet radiation, and occupational exposures.

Morbidity: A diseased state.

Mortality: An estimate of the proportion of the population that dies during a specified period.

Myeloma: A tumor composed of cells derived from hemopoietic tissues of the bone marrow.

Neoplasm: An abnormal tissue that grows by cellular proliferation more rapidly than normal and continues to grow after the stimuli that initiated the new growth cease.

Non-modifiable risk factor: Biological factors or conditions that cannot be changed for the purpose of reducing risk of developing cancer. Examples include age, sex, family history of cancer and other diseases, personal history of cancer or other diseases, and certain reproductive factors.

Obese: Persons having BMI greater than or equal to 30.

Overweight: Persons having BMI between 25 to 30.

Polyp: A general descriptive term used with reference to any mass of tissue that bulges or projects outward or upward from the normal surface level.

Potential years of life lost: A measure of the relative impact of various diseases that highlights the loss to society as a result of youthful or early deaths. The figure for potential years of life lost due to a particular cause is the sum, over all persons dying
from that cause, of the years that these persons would have lived had they reached a specific age (usually life expectancy).

**Prevalence:** The number of individuals with a disease or condition in a specific population at a designated time.

**Primary prevention:** Avoidance of the development of a disease.

**Prognosis:** A forecast of the probable course and/or outcome of a disease.

**Proportion:** A proportion is a type of ratio in which the numerator is included in the denominator. A proportion is calculated by dividing the number of people with a common characteristic at a given time period by the total population that shares the same event in the same time period.

**Range:** The range describes the spread of scores. It often represents the difference between the largest and smallest items in a set of numerical values. In this report, it is used to describe the highest and lowest numerical values.

**Relative survival ratio (RSR):** An RSR is a measure of the impact of cancer on life expectancy. It is the proportion of people with cancer who survive five years beyond their diagnosis, relative to the survival ratio expected in a comparable group of people in the general population.

**Risk factor:** An aspect of someone's behaviour or lifestyle, a characteristic that a person was born with, or an event that s/he has been exposed to that is associated with acquiring a disease.

**Screening:** Examination of a group of usually asymptomatic individuals to detect those with a high probability of having a given disease, typically by means of an inexpensive diagnostic test.

**Secondary prevention:** Focus on early disease detection, thereby increasing opportunities for interventions to prevent progression of the disease and emergence of symptoms.

**Sedentary activity:** Includes any time spent sitting or lying down (e.g., watching television, playing computer or video games, office work, car travel).

**Socio-demographic:** A variety of individual characteristics that may influence health status. Socio-demographic factors include age, sex, ethnicity, marital status, socioeconomic status and others.

**Standardized incidence ratio (SIR):** An SIR is the ratio of the number of cases observed in the population of interest to the number of cases that would be expected in relation to a standard population. An age-standardized SIR is where the population of
interest has the same age-specific incidence rates as the standard population. For the purposes of this report, Ontario was used as the standard population used for the calculation of expected rates.

**Standardized mortality ratio (SMR):** An SMR is the ratio of the number of deaths observed in the population of interest to the number of deaths that would be expected in relation to a standard population. An age-standardized SMR is where the population of interest has the same age-specific mortality rates as the standard population. For the purposes of this report, Ontario was used as the standard population used for the calculation of expected rates.

**Surveillance:** The on-going, systematic collection, collation, analysis and interpretation of data with prompt dissemination of the results to those who need to know, particularly those who are in a position to take action.

**Trends:** Trends are changes in frequencies, proportions or rates of a disease, or an event observed over time. Trends may be irregular, flat or move in one direction. Trends can be expressed in many forms, including tables, graphs and pie charts.

**Virus:** A term for a group of infectious agents, which with few exceptions are capable of passing through fine filters that retain most bacteria, are usually not visible through the light microscope, lack independent metabolism, and are incapable of growth or reproduction apart from living cells.
## APPENDIX B: LIST OF CANCER SITES AND ICD-O-3 CODES

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Cancer sites included</th>
<th>ICD-O-3 Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>Oral Cavity and Pharynx</td>
<td>C00.0 to C4.9, C7.9 to C11.9, C12.9 to C13.9, C14.0, C14.2 to C14.9</td>
</tr>
<tr>
<td>Stomach</td>
<td>Stomach</td>
<td>C16.0 to C16.9</td>
</tr>
<tr>
<td>Colorectal</td>
<td>Colon excluding Rectum, Rectum and Rectosigmoid Junction</td>
<td>C18.0 to 18.9, C19.9, C20.9, C26.0</td>
</tr>
<tr>
<td>Liver</td>
<td>Liver</td>
<td>C22.0</td>
</tr>
<tr>
<td>Pancreatic</td>
<td>Pancreas</td>
<td>C25.0 to C25.9</td>
</tr>
<tr>
<td>Lung</td>
<td>Lung and bronchus</td>
<td>C34.0 to C34.9</td>
</tr>
<tr>
<td>Melanoma</td>
<td>Melanomas of the skin</td>
<td>C44.0 to C44.9, M-8720 to M-8790</td>
</tr>
<tr>
<td>Breast (Female)</td>
<td>Breast</td>
<td>C50.0 to C50.9</td>
</tr>
<tr>
<td>Cervical</td>
<td>Cervix uteri</td>
<td>C53.0 to C53.9</td>
</tr>
<tr>
<td>Ovarian</td>
<td>Ovary</td>
<td>C56.9</td>
</tr>
<tr>
<td>Uterine</td>
<td>Corpus and Uterus, not otherwise specified</td>
<td>C54.0 to C54.9, C55.9</td>
</tr>
<tr>
<td>Prostate</td>
<td>Prostate</td>
<td>C61.9</td>
</tr>
<tr>
<td>Testicular</td>
<td>Testis</td>
<td>C62.0 to C62.9</td>
</tr>
<tr>
<td>Bladder</td>
<td>Urinary Bladder</td>
<td>C67.0 to C67.9</td>
</tr>
<tr>
<td>Kidney</td>
<td>Kidney and renal pelvis</td>
<td>C64.9, C65.9</td>
</tr>
<tr>
<td>Thyroid</td>
<td>Thyroid</td>
<td>C73.9</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>Non-H Hodgkin lymphoma</td>
<td>M-9590 to M-9596, M-9670 to M-9719, M-9727 to M-9729; M-9823, all sites except C42.0, .1, .4; M-9827, all sites except C42.0, .1, .4</td>
</tr>
<tr>
<td>Leukemia</td>
<td>Lymphocytic Leukemia, Myeloid and Monocytic Leukemia, Other Leukemia</td>
<td>M-9733; M-9742; M-9800 to M9801; M-9805; M-9820; M-9826; M9830 to M-9837; M9840; M-9860 to M-9861; M-9863; M9866 to M-9867; M-9870 to M-9876; M-9910; M-9920; M-9930 to M-9931; M-9940; M-9945; M-9946; M-9948; M-9963 to M-9964; M-9983; M-9827 sites C42.0, .1, .4</td>
</tr>
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<td>Cancers of the Neck and Head</td>
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| All Cancers | All Invasive sites | All Invasive sites |


Note: Leukemia, Lymphoma, multiple myeloma, mesothelioma, and Kaposi sarcoma morphology types M-9050 to M-9055; M-9140; M-9590 to M-9989 are excluded from all other specific organ sites.
## APPENDIX C: SUPPLEMENTARY DATA TABLES

### Table C.1. Number of cases for all cancers combined, by age group, sex and year, Waterloo Region, 1986-2009

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^ Data suppressed due to suppressed data when there were 1 to 5 cases.

Table C.2. Number of cases for all cancers combined, by age group, sex and year, Ontario, 1986-2009

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## Table C.3. Age-standardized incidence rate* for all cancers combined, by age group, sex and year, Waterloo Region, 1986-2009

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^ Data suppressed due to suppressed data when there were 1 to 5 cases.

* Rate per 100,000 people.

Table C.3. Age-standardized incidence rate* for all cancers combined, by age group, sex and year, Waterloo Region, 1986-2009 (continued)

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^ Data suppressed due to suppressed data when there were 1 to 5 cases.

* Rate per 100,000 people.

Table C.4. Age-standardized incidence rate* for all cancers combined, by age group, sex
and year, Ontario, 1986-2009
Age group
(years)
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20.2
18.8
16.2
16.6
20.6
18.9
16.8
18.5
15.7
15.6
16.8
17.2
10-19
17.4
16.2
18.0
16.2
17.8
18.2
18.6
16.7
17.4
20.1
16.3
18.0
20-29
35.8
42.2
38.4
38.6
43.5
41.2
42.0
41.7
41.8
38.6
38.0
40.2
30-39
70.8
72.4
74.5
73.8
77.1
76.6
76.7
78.0
82.9
78.7
81.0
71.1
40-49
179.5 181.8 185.0 179.0 188.7 188.7 180.9 177.2 181.9 176.0 178.8 165.7
50-59
598.4 599.4 604.7 591.0 588.9 600.3 617.8 627.2 615.4 587.3 602.7 633.8
60-69
1,477.5 1,515.0 1,567.6 1,546.1 1,618.3 1,643.9 1,672.0 1,734.8 1,758.1 1,601.8 1,668.0 1,706.7
70-79
2,662.6 2,752.7 2,743.2 2,784.2 2,751.3 2,898.1 3,015.3 2,966.8 2,858.9 2,767.6 2,795.8 2,861.8
80+
3,665.4 3,721.9 3,594.9 3,486.0 3,693.5 3,821.6 3,696.6 3,598.5 3,483.4 3,395.8 3,360.6 3,343.5
Females 0-9
15.7
18.2
14.8
12.8
17.5
13.1
12.3
15.9
15.1
15.8
16.8
15.7
10-19
18.0
14.8
16.7
15.1
17.0
17.7
15.6
18.1
14.8
16.6
17.1
17.3
20-29
44.3
47.4
45.1
45.3
45.0
45.1
42.7
44.5
48.9
47.9
48.8
50.1
30-39
119.2 122.6 127.2 118.2 116.7 119.2 120.7 122.1 120.5 127.5 117.5 127.7
40-49
319.7 308.3 324.1 295.4 314.0 307.5 317.7 303.7 302.8 311.1 308.6 312.5
50-59
608.2 619.1 640.4 615.7 626.7 667.0 659.7 643.3 630.6 660.1 634.7 663.8
60-69
1,004.3 1,042.1 1,094.5 1,064.1 1,084.6 1,119.0 1,112.6 1,079.4 1,084.9 1,116.2 1,094.6 1,101.0
70-79
1,507.0 1,529.0 1,561.3 1,506.2 1,533.1 1,613.2 1,568.4 1,556.4 1,583.8 1,496.6 1,594.6 1,562.4
80+
1,785.2 1,831.2 1,848.8 1,843.1 1,871.1 1,858.7 1,741.4 1,887.3 1,850.6 1,824.4 1,824.5 1,852.1
Total
0-9
18.0
18.5
15.6
14.7
19.1
16.1
14.6
17.2
15.4
15.7
16.8
16.5
10-19
17.7
15.5
17.4
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20-29
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43.4
45.1
30-39
95.1
97.6 101.0
96.1
97.0
98.1
98.9 100.2 101.8 103.1
99.3
99.3
40-49
248.9 244.5 254.0 236.8 251.1 248.1 249.5 240.9 242.9 244.3 244.5 239.9
50-59
603.0 609.0 622.3 603.1 607.6 633.4 638.6 635.1 622.9 623.9 618.7 648.8
60-69
1,222.1 1,259.7 1,313.0 1,287.3 1,332.7 1,363.2 1,375.5 1,389.3 1,405.7 1,348.4 1,369.7 1,393.0
70-79
1,991.9 2,045.4 2,058.5 2,045.1 2,048.9 2,158.1 2,182.6 2,154.7 2,125.3 2,037.4 2,107.0 2,120.9
80+
2,386.5 2,442.3 2,408.7 2,377.9 2,470.0 2,511.4 2,387.1 2,458.0 2,399.9 2,348.0 2,338.0 2,355.3
* Rate per 100,000 people.
Source: Cancer Care Ontario - SEER*Stat – OCRIS (May 2012) October 2012 release. Database:
(Statistics Canada, Ontario Ministry Finance), Ontario MOHLTC: IntelliHEALTH ONTARIO, extracted
March 2012.
Sex
Males

Cancer in Waterloo Region: A Population Health Status Report 2014

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1998
21.3
14.1
41.7
73.2
169.3
616.2
1,673.9
2,832.4
3,400.8
18.9
14.5
50.8
125.3
314.1
687.6
1,128.9
1,642.3
1,912.4
20.1
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242.6
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* Rate per 100,000 people.

Table C.5. Number of deaths for all cancers combined, by age group, sex and year, Waterloo Region, 1986-2009

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^ Data suppressed due to suppressed data when there were 1 to 5 cases.

Table C.5. Number of deaths for all cancers combined, by age group, sex and year, Waterloo Region, 1986-2009 (continued)

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^ Data suppressed due to suppressed data when there were 1 to 5 cases.
Table C.6. Number of deaths for all cancers combined, by age group, sex and year, Ontario, 1986-2009

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Table C.7. Age-standardized mortality rate* for all cancers combined, by age group, sex and year, Waterloo Region, 1986-2009

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Females

| | 0-9 | ^ | 0.0 ^ | ^ | ^ | ^ | ^ | 0.0 ^ | ^ | 0.0 | ^ | ^ | ^ |
| 10-19 | ^ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | ^ | ^ | ^ |
| 20-29 | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ | 0.0 | ^ | ^ |
| 30-39 | 28.1 | 23.8 ^ | ^ | ^ | ^ | 30.4 | 17.6 | 20.1 | 19.8 ^ | ^ | 29.2 ^ | ^ | ^ |
| 40-49 | 95.9 | 54.6 | 107.2 | 113.8 | 103.3 | 79.1 | 101.5 | 76.1 | 73.3 | 106.1 | 75.4 | 62.6 | 96.5 | |
| 50-59 | 341.2 | 286.4 | 242.8 | 244.6 | 235.4 | 218.4 | 269.8 | 219.9 | 197.8 | 222.0 | 224.5 | 159.2 | 226.9 | |
| 60-69 | 472.8 | 424.7 | 396.2 | 448.8 | 581.2 | 550.2 | 432.6 | 401.6 | 484.6 | 484.5 | 406.8 | 429.2 | 503.3 | |
| 70-79 | 782.2 | 916.9 | 669.1 | 1,035.7 | 879.7 | 774.3 | 689.8 | 770.9 | 1,016.0 | 850.1 | 852.9 | 768.2 | 919.2 | |
| 80+ | 1,391.8 | 1,457.0 | 1,058.5 | 1,211.7 | 1,260.6 | 1,066.5 | 1,199.6 | 1,146.8 | 1,274.4 | 1,221.8 | 1,398.8 | 1,361.9 | 1,147.8 | |

Total

| | 0-9 | ^ | ^ | ^ | ^ | ^ | ^ | 0.0 ^ | ^ | 0.0 | ^ | ^ | ^ |
| 10-19 | ^ | 13.8 | 10.1 | 9.5 ^ | ^ | ^ | ^ | 10.3 ^ | ^ | ^ | 0.0 ^ | ^ | ^ |
| 20-29 | ^ | 24.6 | 23.9 | 13.2 | 12.6 | 21.1 | 16.0 | 28.5 | 22.5 | 13.8 | 10.8 | 23.6 | 15.4 | 8.0 |
| 30-39 | 72.5 | 56.1 | 89.6 | 88.4 | 84.2 | 71.0 | 82.6 | 72.2 | 72.8 | 79.6 | 69.9 | 73.7 | 72.9 | |
| 40-49 | 283.0 | 280.0 | 261.0 | 255.5 | 245.7 | 233.2 | 265.3 | 236.2 | 194.9 | 253.1 | 237.4 | 190.8 | 219.6 | |
| 50-59 | 631.0 | 575.0 | 593.2 | 603.9 | 660.6 | 685.7 | 532.9 | 540.2 | 607.4 | 582.9 | 522.1 | 525.9 | 523.6 | |
| 60-69 | 1,075.7 | 1,149.1 | 865.2 | 1,163.5 | 1,060.6 | 1,097.2 | 1,017.0 | 1,067.8 | 1,194.4 | 1,137.9 | 1,113.8 | 1,064.0 | 1,139.8 | |
| 70-79 | 1,533.2 | 1,848.4 | 1,472.3 | 1,510.0 | 1,646.1 | 1,525.2 | 1,723.7 | 1,590.0 | 1,777.2 | 1,612.0 | 1,675.4 | 1,631.2 | 1,459.0 | |

Note: Data suppressed due to suppressed data when there were 1 to 5 cases.
* Rate per 100,000 people.
**Table C.7. Age-standardized mortality rate* for all cancers combined, by age group, sex and year, Waterloo Region, 1986-2009 (continued)**

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<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>Total (1986-2009)</th>
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<td>20-29</td>
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^ Data suppressed due to suppressed data when there were 1 to 5 cases.
* Rate per 100,000 people.
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* Rate per 100,000 people.

Table C.8. Age-standardized mortality rate* for all cancers combined, by age group, sex and year, Ontario, 1986-2009 (continued)

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<td>530.3</td>
<td>511.3</td>
<td>493.4</td>
<td>488.6</td>
<td>469.7</td>
<td>469.2</td>
<td>441.7</td>
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<td>1,098.7</td>
<td>1,115.1</td>
<td>1,085.0</td>
<td>1,066.8</td>
<td>1,048.5</td>
<td>1,063.0</td>
<td>1,032.1</td>
<td>1,017.9</td>
<td>995.6</td>
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<td>982.5</td>
<td>1,079.9</td>
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<td>1,828.0</td>
<td>1,858.1</td>
<td>1,803.1</td>
<td>1,797.1</td>
<td>1,775.5</td>
<td>1,787.5</td>
<td>1,733.4</td>
<td>1,717.4</td>
<td>1,717.7</td>
<td>1,755.1</td>
<td>2,117.7</td>
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* Rate per 100,000 people.