Niagara Region Cancer Report
Incidence, Mortality and Temporal Trends 1986-2003

PLANNING, RESEARCH, EVALUATION AND POLICY DEVELOPMENT UNIT

Niagara Region Public Health Department

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OBJECTIVE

The goal of this report is to present cancer incidence and mortality, temporal trends and age-specific information for males and females in the Niagara Region from 1986 to 2003. Such information provides a useful input to the development, implementation, and evaluation of health promotion, prevention, treatment and other policies for cancer control.

This report was updated by Deborah Moore, Epidemiologist. Original report was created by Pia K. Muchaal, Epidemiologist, with assistance from Nicole Coffer and Angela McVittie, Planning, Research, Evaluation and Policy Unit. The presentation style for the data was adapted from 'Canadian Cancer Statistics 2001'.

Data Sources

The Ontario Cancer Registry is operated by Cancer Care Ontario (CCO), (which replaced Ontario Cancer Treatment and Research Foundation (OCTRF) in 1997. Cancer Care Ontario registers all newly diagnosed cases of cancer, except non-melanoma skin cancer. Although cancer is not a reportable disease in Ontario, the Cancer Act mandates CCO to record, compile and report cancer data (CCO, 2003).

Cancer Care Ontario relies on information obtained primarily from four major data sources:

1. Hospital discharge summaries which include diagnosis of cancer;
2. Pathology reports with mention of cancer;
3. Records of patients referred to CCO's eight Regional Cancer Centres or the Princess Margaret Hospital; and
4. Death certificates with cancer as the underlying cause of death.

All records, except pathology reports, are coded at the source and are submitted to CCO in machine-readable form. All hospital and private pathology laboratories send the pathology reports to CCO where staff code and enter the information into a computerized database. Duplicate records are identified and resolved via computerized record linkage and logic. The principle cancer data quality issues are consistency in classification and coding, completeness of registration, and validity of data recorded.

Cancer sites are coded according to the International Classification of Diseases, Ninth Revision (ICD9) (WHO, 1976). Invasive neoplasms are included in the ICD9 codes ranging from 140 to 208. Most of these three-digit codes describe the cancer site but some describe the morphology instead. ICD10 codes were used from the Provincial Health Planning Database for the calculation of Potential Years of Life Lost in 2002. The ICD9 and ICD10 codes and their respective descriptions are outlined in Appendix I. Actual data for new cases and deaths presented in this report are included in Appendices II and III.

Data Limitations

With few exceptions, variations in classification and coding practices generally have minimal effect on incidence rates. The main exceptions are in coding cancers of the lower sigmoid colon and recto-sigmoid junction to the colon (ICD 153) or rectum (ICD 154). The solution to this problem was to combine these sites into colorectal (ICD 153-154). The International Classification of Diseases (ICD9) is not well-adapted for consistent coding on non-Hodgkin's lymphomas. For this reason, the two codes for non-Hodgkin's lymphoma are combined (ICD9 200, 202). Similarly, oral cancers (ICD9 141-149), cancers of the brain and other central nervous system sites (ICD9 191-192), and the several types of leukemia (ICD9 204-208) are considered together. For analysis using ICD10 codes (PYLL), breast cancer is not specific to male or female as it is in ICD9.

The classification of two other cancer sites was changed during the period considered in this report and will influence apparent trends in incidence rates. In 1988, the Cancer Registry began to code borderline epithelial neoplasms of the ovary as malignancies. It is estimated that 10-15% of ovarian cancers are in this category. In 1989 classification was also changed for invasive papillary transitional carcinomas of the bladder. While these tumours are potentially malignant, they have not yet become invasive. The effect of this change was an apparent drop in incidence of approximately 25%. As a result of the change in coding it is inappropriate to compare bladder cancer rates before and after 1989.

Completeness of case ascertainment is the proportion of all incident cancers in the population included in the registry. Some cancers are not diagnosed, but this occurs infrequently in Ontario. Incompleteness is more likely as a result of gaps in case-finding procedures. Cancer Care Ontario uses percent death certificate only (%DCO) and the mortality/incidence ratio (%M/I), in addition to statistical techniques to estimate completeness of ascertainment. A death certificate only (DCO) case is one for which a death certificate is the only source of information about the diagnosis of cancer. The overall OCR %DCO rates are less than 2%. For cancers that are managed on an out-patient basis (lip and melanoma), %DCO is approximately 11%.

Statistical Analysis

SEERStat, a statistical software package developed for use with the Surveillance, Epidemiology, and End Results (SEER) Registry data[1], and modified to fit the Ontario Cancer Registry incidence and mortality data, was used to calculate cancer incidence, mortality, average annual percent change, and trends in the Niagara Region and Ontario. For the average annual percent change statistics, weighted least squares were used to complete the calculation. Cancer Care Ontario provided the Regional Niagara Public Health Department with a copy of the SEERStat software. The Potential Years of Life

[1] A programme of the United States National Cancer Institute

Lost (PYLLs) were determined based on data from Provincial Health Planning Database where ICD10 codes were used to classify disease.

Screening, Diagnosis and Treatment of Cancer

Traditionally the aim of 'prescriptive' screening is to detect disease in its initial stages in presumptively healthy members of a defined population (Last, 2001). The characteristics required for a screening test are: adequate sensitivity and specificity; evidence, ideally from randomized clinical trials, of lowered mortality of those undergoing the screening, and acceptance of the test by the target population (Armstrong, 2002). Furthermore, the cost of an on-going screening programme must be economically feasible and adequate follow-up diagnostic and treatment services must be available for the particular cancer (Armstrong, 2002). Therefore, not all cancers are easily screened, and not all screening tests are suitable for use in population-wide screening programmes.

Prior to 1997, the Ontario Cancer Treatment and Research Foundation (OCTRF) and the Ontario Cancer Institute/Princess Margaret Hospital (OCI/PMH) represented the formal cancer care system in Ontario. The OCTRF's primary responsibility was to deliver specialized treatment services (radiation and systemic therapy). Since assuming responsibility of the OCTRF in 1997, Cancer Care Ontario, as part of their mandate, have implemented a provincial cancer framework which is delivered through regional networks. CCO collaborates with all cancer stake-holders to create an integrated cancer control system.

Cancer treatment services are provided by the regional cancer centres (RCC), host hospitals, and community hospitals. The regional cancer centres deliver outpatient services and are responsible for 75% of the radiation treatment in the province, 50% of chemotherapy, and programmes in supportive care, prevention, screening, education and research. Host hospitals provide inpatient services including surgery and supportive care, diagnostic imaging, pathology and laboratory services and undertake research. Community hospitals take on a similar role as host hospitals (CCO, 2001).

Until the Niagara Region cancer centre is completed, cancer patients resident in the Region must travel to Hamilton and New York for radiation treatment.

Identification of Epidemiological Measures and Definitions

Incidence and Mortality

Cancer incidence is defined as the number of new cases identified in the Niagara Region during a specified calendar period and reported to the OCR. Cases with unknown age are included in the totals, but excluded from the individual age-specific groups. Due to the few pediatric cases (0-14 years) of cancer, specific statistics are not presented for the three youngest groups, but they are included in the Niagara totals. Cancer data for children and youth 0-19 was pooled and presented as a summary.

Cancer deaths are identified based on the underlying cause of death as reported by the certifying physician on the medical certificate of death. Information on deaths is obtained from the Office of the Registrar General of Ontario.

Incidence and mortality were calculated per 100,000 people per annum. Rates for the Niagara Region and Ontario were standardized based on the 1991 Canadian population.

Deaths to Cases Ratio

The mortality/incidence ratio (%M/I) is the number of deaths due to cancer in a given time period divided by the number of incident cases for the same period, expressed as a ratio or percent. The ratio is inversely associated with survival and can only be interpreted in the context of survival rates.

Age

The age of the patient at the time of diagnosis in completed years. The age-specific rates in this report were calculated for ages 0-19, 20-49, 50-69 and 70+.

Potential Years of Life Lost

The Potential Year of Life Lost (PYLL's) for 2002 is the ratio for a given period of the total years of life lost before age 75 to the total population under 75 years of age by ICD chapter (per 1,000).

According to the 2001 Statistics Canada census, there were 410,574 residents living in the Niagara Region, a 1.8% increase in the overall population compared to 5 years prior. The median age of the population was 40 years with 17% of the population over the age of 65; 42.8% and 57.2% are men and women respectively. Over 52% percent of the Niagara Region respondents in the 2001 census identified themselves as Canadian or British. Italians comprised 11.6% of the sample, French 4.1%, and German 5.7%. The remaining 26% identified as being of an ethnic origin other than those mentioned above.

While the general demographic distribution of the Niagara Region parallels the provincial profile, the population of Ontario increased by 6% between 1996 and 2001, and the proportion of people over the age of 65 comprised 13% of the population. The inherent impact of the slower rate of population growth and the increased proportion of people over the age of 65 is a general increase in cancer incidence and mortality.

Lifestyle and Behaviour

Tobacco use, diet (including alcohol consumption) and lack of physical activity are associated with over 50% of all cancer deaths in the industrial world (Targeting Cancer, 2003). In general, smoking tobacco accounts for 90% of lung cancers and 30% of all cancers could be prevented by not smoking (WCRF-AICR, 1997;Peto et al, 2004; AICR, 2007). In Ontario, with the implementation of the Smoke Free Ontario Act in 2006, the elimination of smoking in public places may lead to a potential decrease in number of smokers, most likely reducing the incidence and mortality from lung cancer. Alcohol consumption is a well-established cause of cancer of the upper aero-digestive tract (mouth, pharynx, larynx and oesophagus), liver and breast (WCRF, 2006). Dietary factors also contribute significantly to the effect on the risk of cancer. Approximately one-third of all cancers are directly related to diet (WCRF-AICR, 1997; AICR, 2007; Rohan et. al., 2007) and a cohort study completed by Calle et al. 2003 states that cancer death rates were 52% higher in men and 62% higher in women among the heaviest participants compared with those of normal weight. The dietary factors for which there is strong evidence of linkages to cancer are: insufficient intake of vegetables, fruit and wholegrain cereals; and high intake of alcohol. There is convincing data that a diet high in fruits and vegetables protects against cancers of the mouth, pharynx, oesophagus, stomach and lungs, and there is indication that they are also protective against cancers of the larynx, pancreas, breast and bladder (WCRF-AICR, 1997; AICR, 2007). Vegetables also reduce the risk of colorectal cancer (WCRF-AICR, 1997).

A lack of exercise and being overweight also increase the risk of cancer. In a comprehensive prospective investigation (1982-1996) involving almost one million participants in the United States, 4.2%-19.8% of deaths from cancer were attributable to obesity (Calle et al., 2003). Conversely, physical activity has been identified as a 'risk-mitigator' of colon cancer and may also reduce the risk of breast and lung cancers (WCRF-AICR, 1997).

A behavioural and lifestyle profile of the Niagara Region residents was determined through the Rapid Risk Surveillance Report (2006), a self-reporting survey conducted on 1202 Niagara residents 18 years of age and older. In this report, 39% of the respondents (N=1098) had a body mass index within the normal range (18.5-24.9) 34% of people were identified as 'overweight' (BMI 25.0-29.9) and 16.5% were obese (BMI 30+). Two trends were noted, body mass index increased with age and men were more likely to be overweight than women.

At the time of the survey (2005) 21% of those surveyed smoked, with 17% of them reporting daily use of tobacco. Thirty-one percent of all respondents had never smoked. Although there were no differences in the proportion of male and female smokers, there were variations according to education and income levels. Of those with a post-secondary degree, 39.8% (N=625) were currently smoking. This proportion increased to 45% for those with only a high school degree, but decreased to 35.6% for individuals who had not completed high school. As income increases percentage of everyday smoking decreases (N=625). Of those who reported an income less than $30,000, 40% smoke everyday. For those who make between $30,000 and $70,000, 34% smoke everyday, which drops to 28% for those who make more than $70,000.

Of the 485 (N=841) individuals who reported consuming alcohol at least one day per week 67% reported consuming 1-2 drinks per day of drinking, while 7% consumed 5 or more drinks per drinking day.

I. Current Incidence and Mortality (2003)

A total of 2274 cases of cancer were diagnosed in the Niagara Region in the year 2003. For both men and women 3 cancers comprised over half of the registrations. Of the total cancers in males, 57% of the cancers were prostate (28%), lung (15%), and colorectal (14%) (Table 1 and Figure 1.a). Similarly, 53% of all cancer in women were attributable to breast (28%), lung (13%), or colorectal cancers (12%) (Table 1 and Figure 2.a).

These 3 cancers also account for over 50% of all cancer deaths in both men (N=566) and women (N=488) in 2003. For both males and females, lung cancer comprised about one quarter of all cancer deaths (Figure 2.b & 1.b).

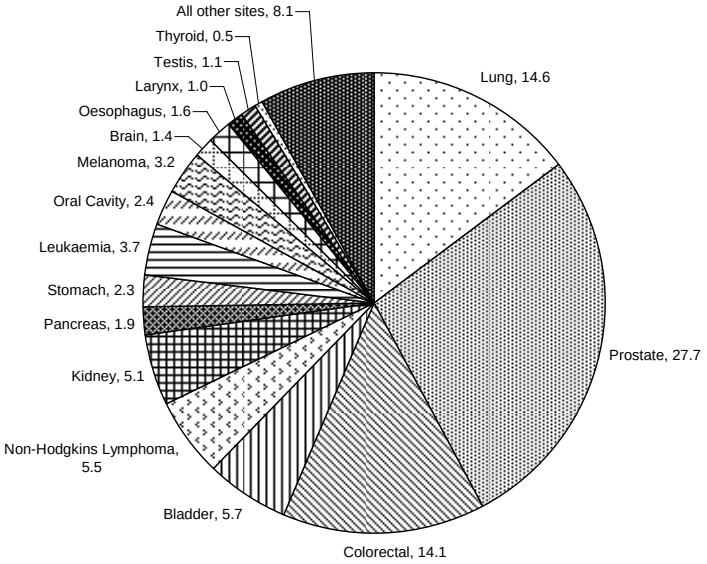
Table 1. New Cases and Deaths for Cancer Sites by Gender, Niagara Region, 2003.

	New Cases 2003			Deaths 2003		
Cancer	Total	Male	Female	Total	Male	Female
Lung	310	171	139	278	162	116
Prostate	324	324	-	69	69	-
Breast	292	*	289	97	0	97
Colorectal	290	165	125	117	71	46
Bladder	92	67	25	31	21	10
Uterus	57	-	57	11	-	11
Cervix	24	-	24	*	-	*
Non-Hodgkins Lymphoma	136	64	72	48	17	31
Kidney	89	60	29	34	25	9
Ovary	57	-	57	22	-	22
Pancreas	45	22	23	39	21	18
Stomach	39	27	12	31	22	9
Leukaemia	88	43	45	51	23	28
Oral Cavity	45	28	17	16	10	6
Melanoma	65	37	28	11	6	5
Brain	34	16	18	25	8	17
Oesophagus	27	19	8	25	20	5
Larynx	14	12	*	8	6	0
Testis	13	13	-	*	*	-
Thyroid	35	6	29	*	*	0
All other sites	198	95	48	168	85	58
Total	2274	1169	1045	1081	566	488

** Insufficient data*
- Not applicable

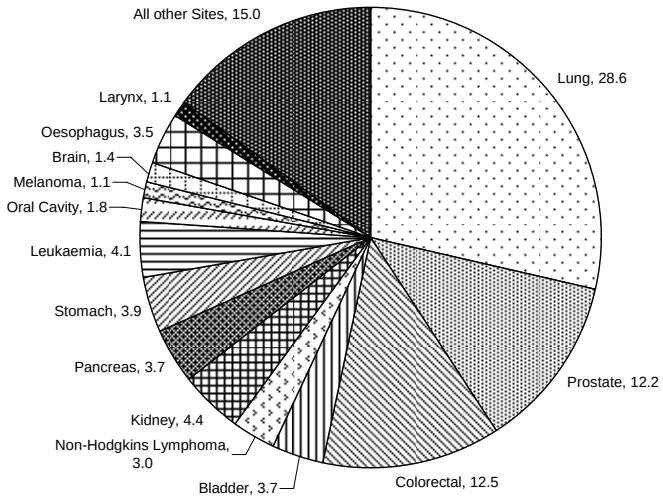
Data Source: *SEERStat, 2006*

Figure 1.a Percentage distribution of new cases for selected cancer sites, males, Niagara Region, 2003
(N=1169).



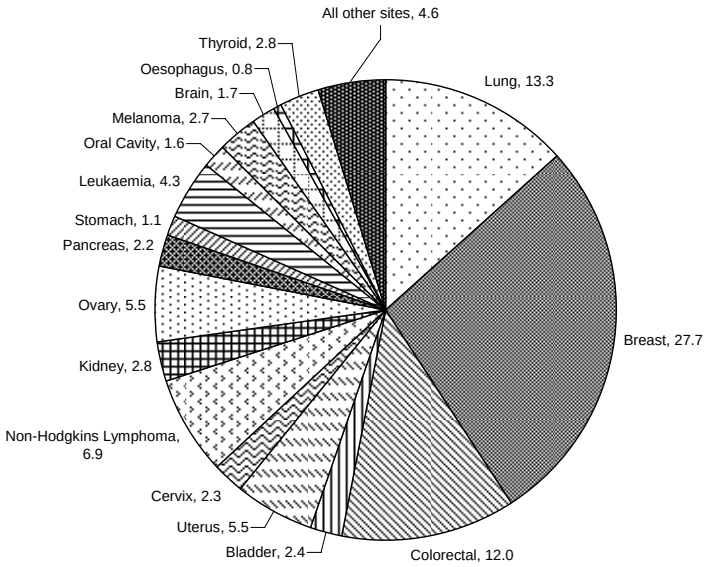
Data Source: *SEERStat, 2006*

Figure 1.b Percentage distribution of deaths for selected cancer sites, males, Niagara Region, 2003
(N=566)



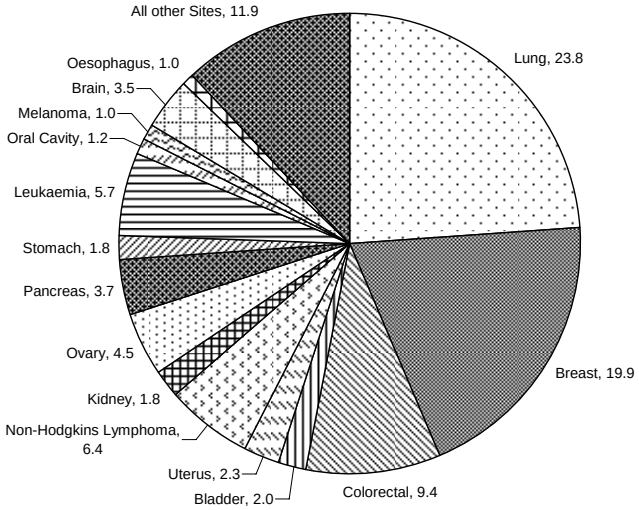
Data Source: *SEERStat, 2006*

Figure 2.a. Percentage distribution of new cases for selected cancer sites, females, Niagara Region, 2003
(N=1045)



Data Source: *SEERStat, 2006*

Figure 2.b Percentage distribution of deaths for selected cancer sites, females, Niagara Region, 2003
(N=488).



Data Source: *SEERStat, 2006*

II. Time Trends in Incidence and Mortality (1986-2003)

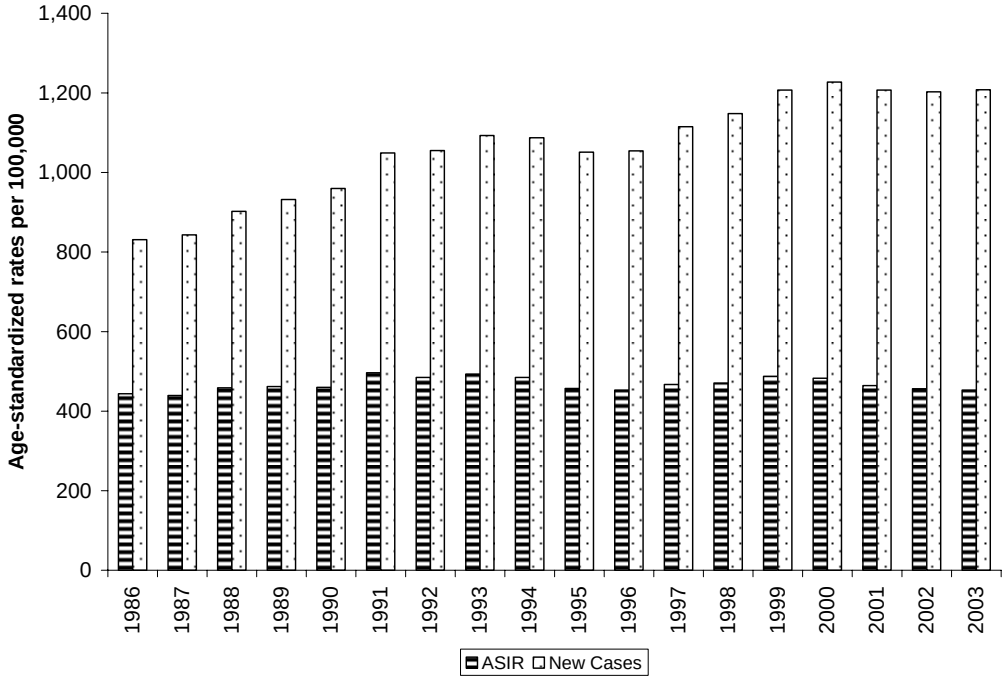
A. All Cancer sites

Males

The number of cases and deaths of a disease provides an indication of the burden of illness on the health care system and the demands on the communities. Between 1986 and 2003 the overall number of cancer registrations of males increased nearly 50% from 831 to 1208 cases with an estimated annual change in rates of 0.1% (CI = -0.3, 0.4) (Figure 3a). In early 1990's the age-standardized rates peaked at 497 cases per 100,000, while the lowest rates (453 cases per 100,000) occurred in 2003. (Figure 3a).

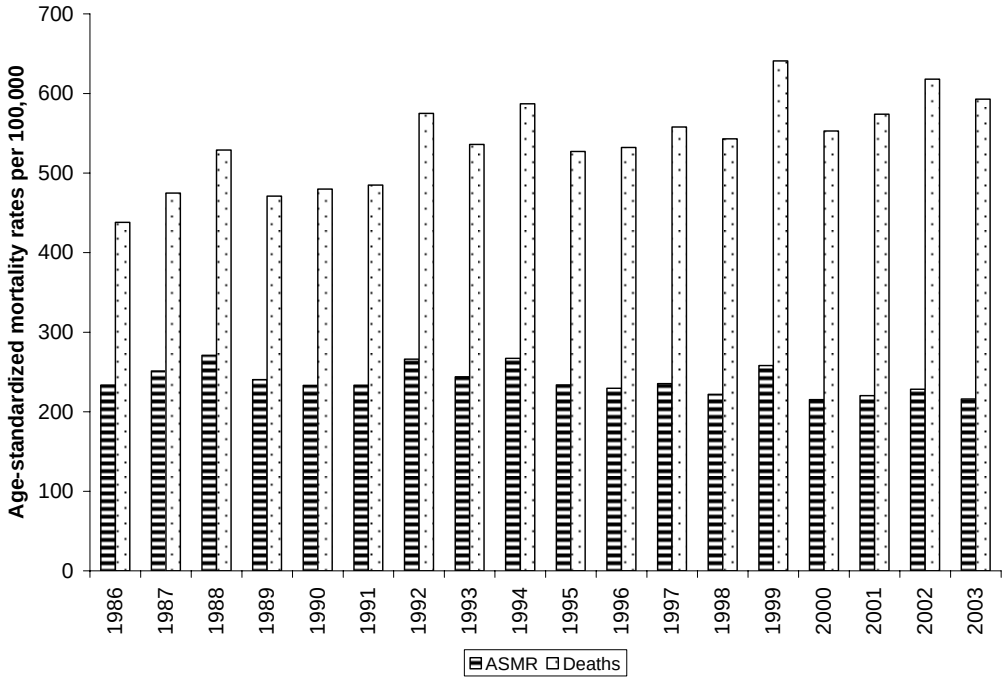
The increase in incidence during this period is at least partly due to the detection of prostate cancers following trans-urethral resection of the prostate (TURP) for suspected benign prostatic hypertrophy. The second rise in cases in the late 1990s most likely reflects the aging population of the Niagara Region. Cancer deaths over the same period range from 438 to 641, the mortality rate as identified by the annual percentage change significantly decreased (AAPC = -0.7%; CI = -1.3, -0.1) (Figure 3b). The age-standardized rates peaked in 1988 (270.8 deaths per 100,000) and decreased to 216 deaths per 100,000 in 2003. The 35% increase in cancer deaths in conjunction with a decreasing age-standardized mortality rate mirrors the demographic shifts in the population.

Figure 3 a. New cases and age-standardized incidence rates for all male cancers, Niagara Region (1986-2003)



Source: SEERStat, 2006 *Rates Standardized to 1991 Canadian Population*

Figure 3b. Deaths and age-standardized mortality rates for all male cancers, Niagara Region (1986-2003)

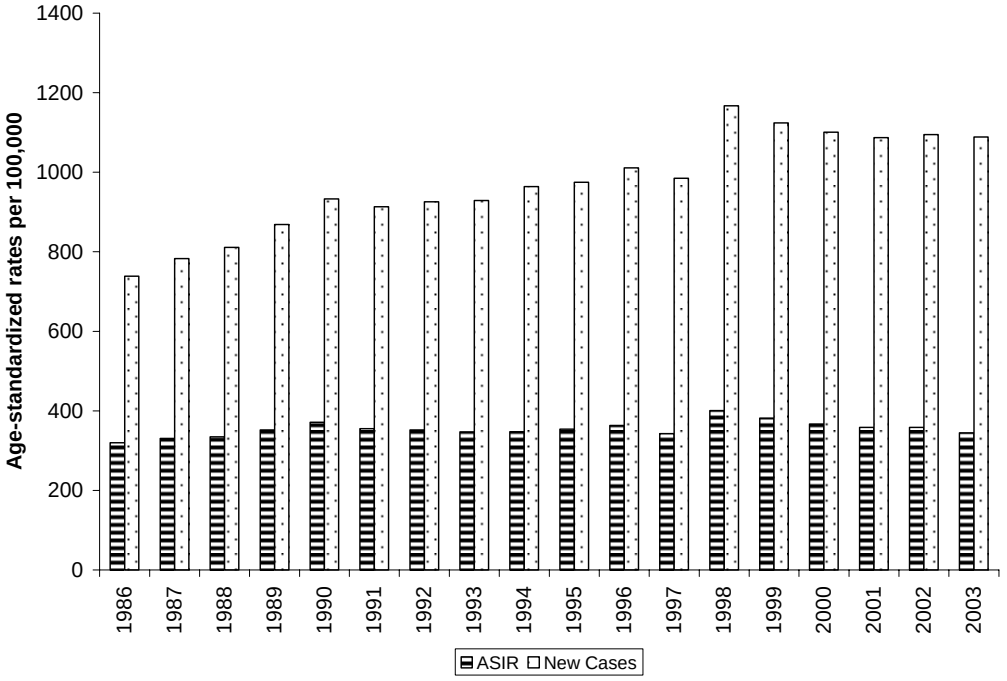


Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Females

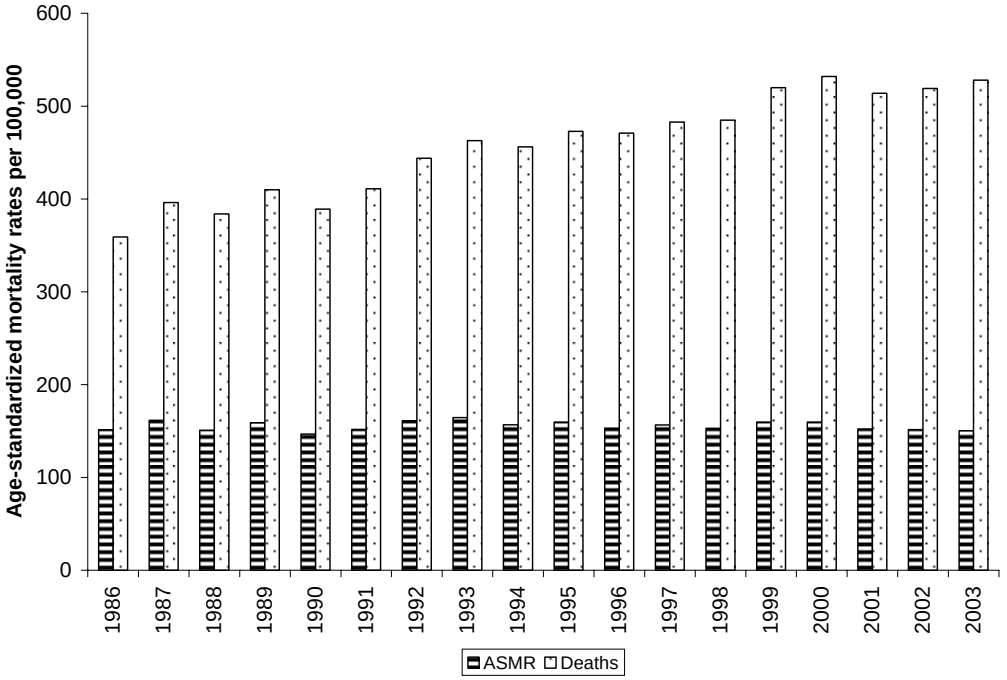
The number of cancer cases in females increased by 47% between 1986 and 2003 and the age-standardized rates were slightly raised (320-400 cases per 100,000; AAPC = 0.5; CI = 0, 0.9) (Figure 4a). The increase in cases combined with the slight increase of rates during this period may be a reflection of an aging population, and highlights the demands on the health care system. The number of deaths in females increased 47% between 1986 and 2003 and the mortality rate significantly increased (146-164 deaths per 100,000) with an AAPC of 1.2; CI = 0.9, 1.5, emphasizing the demographic trends of an aging population.

Figure 4a. New cases and age-standardized incidence rates for all female cancers, Niagara Region (1986-2003)



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 4b. Deaths and age-standardized mortality rates for all female cancers, Niagara Region (1986-2003)



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

B. Comparison of temporal trends for selected cancer sites in the Niagara Region

Trends of incidence and mortality rates between 1986 and 2003 for selected sites are shown for men in Figure 5.a and Figure 5.b and for women in Figures 6.a and 6.b. Average annual percent changes (AAPC) for the cancer sites are presented in section C.

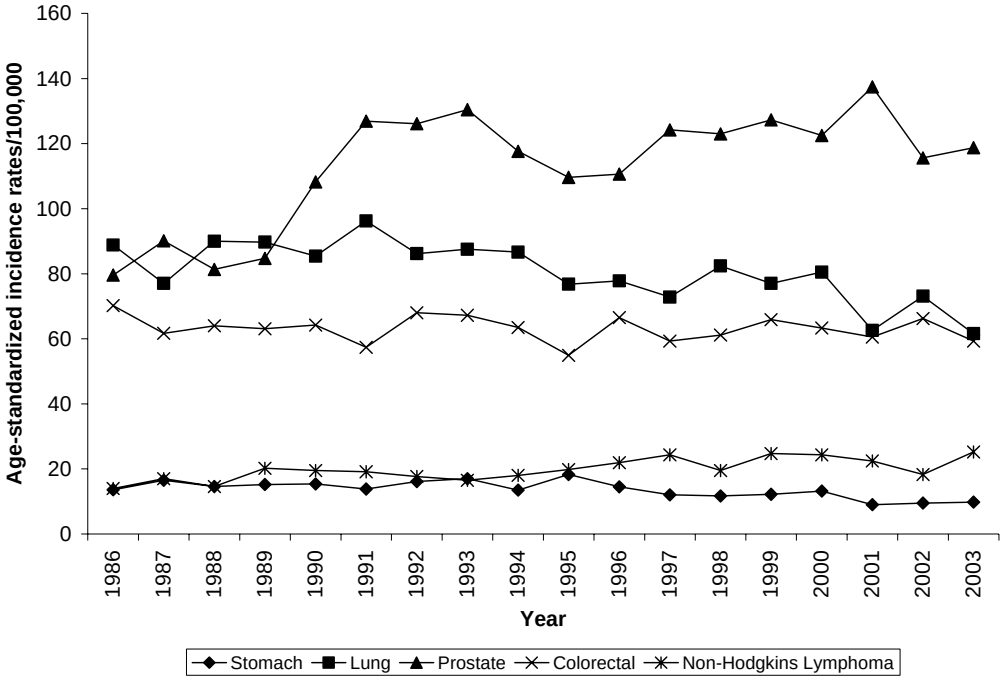
Males

Incidence

Among men, only prostate cancer and Non-Hodgkin's lymphoma showed significant increasing trends between 1986 and 2003. The standardized incidence of cancer of the prostate increased steadily in the Niagara Region at an average annual rate of approximately 1.8%, from 80 cases per 100,000 (1986) to 119 cases per 100,000 (2003). The increase in incidence prior to 1990 is at least partly due to the detection of cancers following trans-urethral resection of the prostate (TURP) for suspected benign prostatic hypertrophy. Between 1988 and 1993, the rate of prostate cancer increased by 60%. This spike in cases diagnosed is most likely attributable to detection as a result of the Canada-wide introduction of prostate-specific antigen test in 1988. Since 1997 rates have not varied significantly. Between 1986 to 2003, the incidence of Non-Hodgkin's lymphoma, the only other cancer in men besides prostate cancer showing a significant escalation in incidence, increased from 14 cases per 100,000 to 26 cases per 100,000 (AAPC = 1.8; CI = 0.4, 3.1).

Rates for other cancers sites in men in the Niagara Region have remained constant or have otherwise declined. In contrast to trends in women, in men, lung cancer incidence rates have been decreasing. From 1986 to 2003 the decrease has been approximately 31% (AAPC = -1.6; CI = -2.4, -0.90). Colorectal cancer has remained relatively stable with no significant change in incidence. When assessing colon and rectal cancer independently, there is still no significant change, although the trend seems to be decreasing for both. The incidence of stomach cancer has remained constant between 1986 and 2000 averaging 15 cases yearly per 100,000, but dropped to approximately 10 cases per 100,000 between 2001 and 2003. Overall there has been a significant decrease in stomach cancer incidence (AAPC = -2.7; CI = -4.1, -1.2).

Figure 5 a. Age-standardized incidence rates (ASIR) for selected cancer sites, males, Niagara Region, 1986-2003



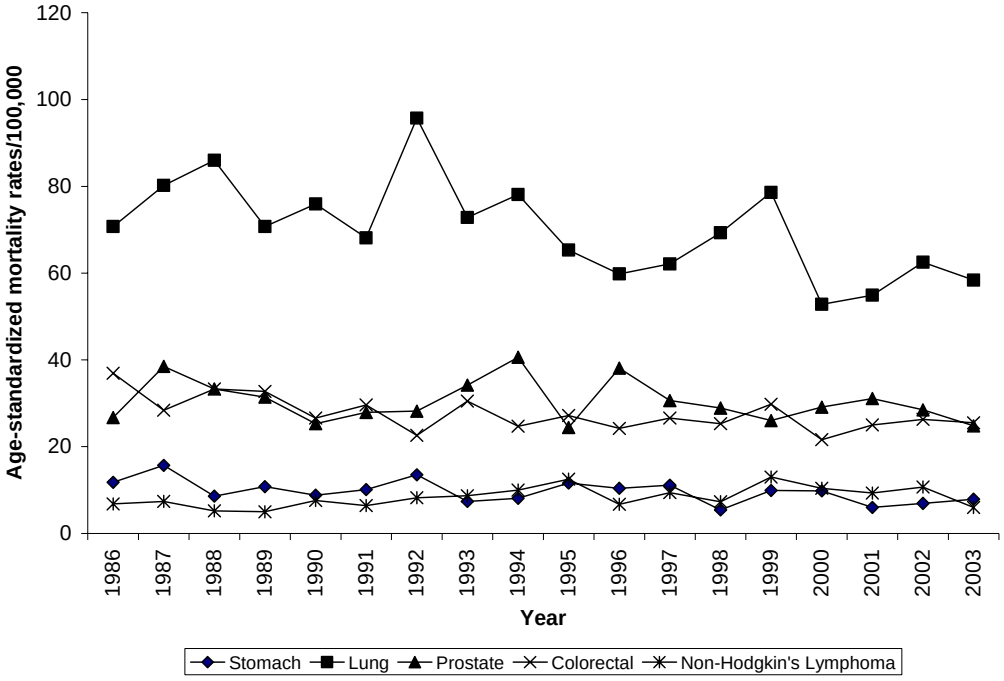
Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Mortality

Despite the prominent increase in incidence of prostate cancer and Non-Hodgkin's lymphoma (NHL) there only appears to be a marginally significant increase in the NHL mortality, where yearly rates doubled between 1986 and 2003 (AAPC = 2.5; CI = 0.1, 5.1). Deaths from prostate cancer have remained stable during the same period, at approximately 30 cases per 100,000 per year.

Mortality rates of lung cancer, colorectal cancer, and stomach cancer have been declining. A reduction of 1.9% (CI = -3.1, -0.07) per year has occurred in lung cancer rates. Overall, deaths from colorectal cancer have fallen, on average, by 1.6% annually (CI = -2.6, -0.6) and stomach cancer rates continue to show a prominent decline of approximately 2.8% (CI = -4.9, -0.7) per year.

Figure 5 b. Age-standardized mortality rates (ASMR) for selected cancer sites, males, Niagara Region, 1986-2003



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Females

Incidence

Among women in the Niagara Region, only Lung cancer and Non-Hodgkin's Lymphoma had a significant increase in incidence between 1986 and 2003. Lung cancer incidence rates increased at an average of 1.3% per annum (CI = 0, 2.6) with an increase of 34 cases per 100,000 to a peak of 58 cases per 100,000 over this time period. Previous data showed an increase of 2.5% between 1979 and 2000, therefore overall, the lung cancer rates may be decreasing as we go further past the year 2000, but comparison must be taken with caution due to the differences in data between the two time periods. An increase occurred in the incidence rates of Non-Hodgkin's Lymphoma (AAPC = 2.2; CI = 0.1, 4.3) with an increase of 9 cases per 100,000 to a peak of 23 cases per 100,000 over this time period.

Although the rates from 1979 to 2000 are not comparable with rates from 1986 to 2003, previous findings of thyroid cancer are noteable. Thyroid cancer comprised only 0.1% of all new cancer cases in the last 21 years in the Niagara Region, but there was a 156% increase in the rates of thyroid cancer (AAPC = 3.8; CI = 1.8, 5.8). Incidence continues to remain low relative to other cancers[2,3] and rates are not calculable for the period between 1986 and 2003. Comparable increases in thyroid cancer are evident at the provincial and national levels. This increase is most likely a consequence of the improvement in detection technologies such as ultrasound and needle biopsy that have led to identifying early stage tumours more frequently.

Overall, there was no statistically significant increase in breast cancer incidence (AAPC = 0.4; CI -0.4, 1.2). From figure 6a, there was a steady increase in breast cancer incidence between 1986 and 1998, but since there has been a steady decrease. Changing reproductive histories (women choosing to bear children later in life), and the introduction of screening programs including mammography may partially account for the increase in rates between 1986 and 1998, but better awareness and change in lifestyle may account for the decrease over the last 5 years.

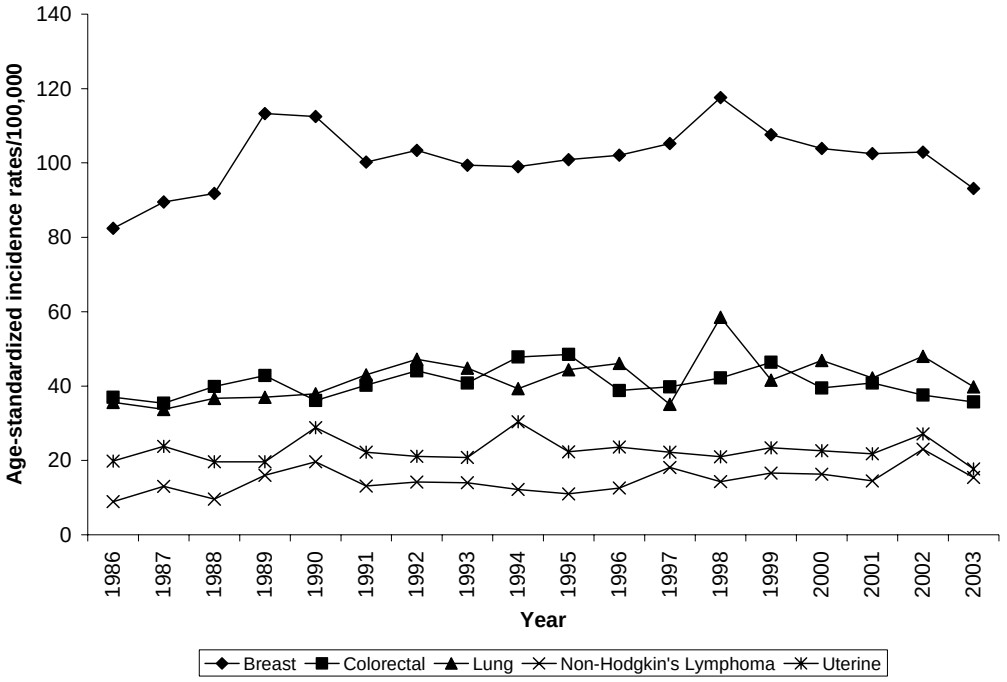
Colorectal cancer is the third most common cancer in women. While the number of new cases rose by 64% (a decrease of 17% from the period 1979-2000), the age-standardized incidence rates remained stable during the period considered in this report.

Cancer of the uterus is the fourth most common cancer in women in the Niagara Region and the most common malignancy of the female genital system. Between 1986 and 2003 there were a total of 1126 cases of uterine cancer. Standardized incidence rates in the Region remained stable.

[2] Incidence rates for thyroid cancer were calculated for the period between 1986 and 2003.

[3] Due to the very low incidence rates thyroid cancer trends are not included in the graphs 6a & 6b.

Figure 6a. Age-standardized incidence rates (ASIR) for selected cancer sites, females, Niagara Region, 1986-2003

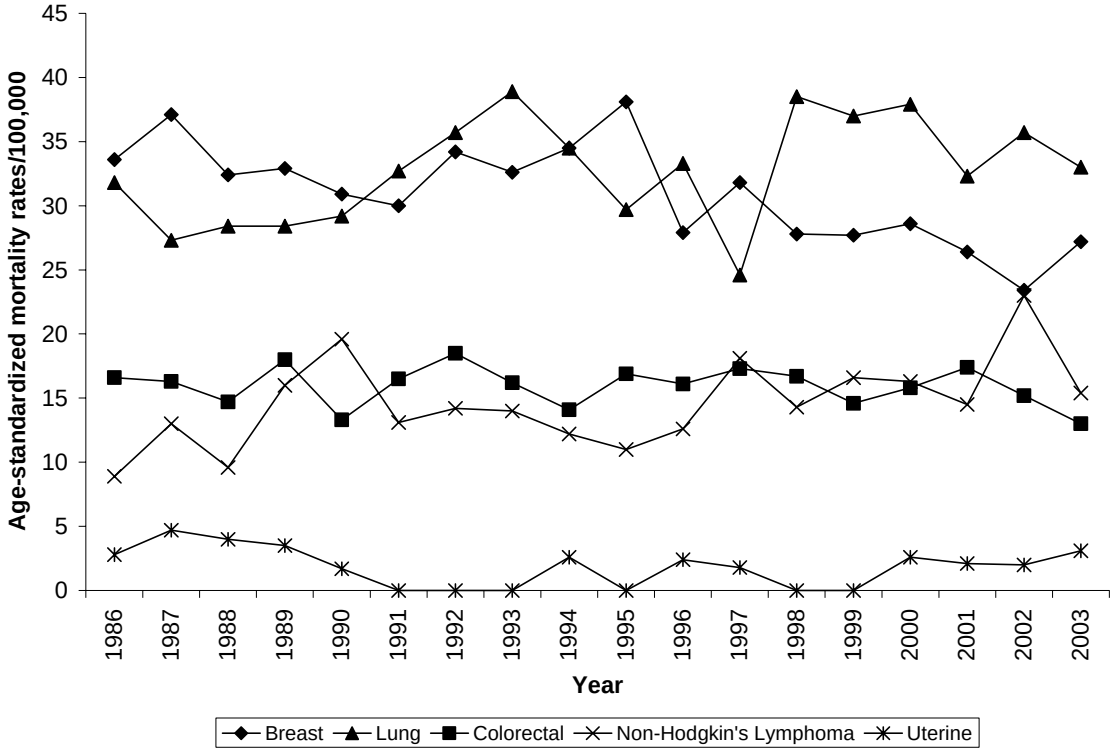


Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Mortality

As a result of improved detection and treatment methods, stable or increasing rates in incidence have not generally been accompanied by an increase in mortality rates. Of all deaths from cancers among women, only Non-Hodgkin's Lymphoma mortality has risen significantly (AAPC = 2.5; CI = 0.1, 5) and the only noteworthy decline was in breast cancer (AAPC = -1.7; CI = -2.6, -0.8). Treatment and screening methods for breast cancer have improved greatly and may be the reason for the reduction in mortality.

Figure 6 b. Age-standardized mortality rates for selected cancer sites, females, Niagara Region, 1986-2003



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

C. Average Annual Percentage Change in Incidence and Mortality of Selected Cancers (Niagara Region, 1986-2003)

Table 2. Average annual percentage change in incidence and mortality (Niagara Region, 1986-2003)

	AAPC Incidence 1986-2003		AAPC Mortality 1986-2003	
	Male	Female	Male	Female
All Cancers	0.1	0.5*	-0.7*	-0.1
Oral	-2.8*	-1.3	-1	~
Stomach	-2.7*	-4.0*	-2.8*	-4.5*
Colorectal	-0.3	0	-1.6*	-0.2
Pancreas	-0.9	-1.1	-0.4	0
Lung	-1.6*	1.3*	-1.9*	1
Melanoma of the Skin	-0.4	-1.4	-1.2	~
Breast	n/a	0.4	~	-1.7*
Cervix	n/a	-0.9	~	~
Uterus	n/a	0	~	~
Ovary	n/a	1.7	~	1.2
Prostate	1.8*	n/a	-0.9	n/a
Urinary Bladder	-2.4*	-0.9	~	~
Kidney	1.7	0.5	0.6	~
Thyroid	~	~	~	~
Hodgkin Lymphoma	~	~	~	~
Non-Hodgkin Lymphoma	1.8*	2.2*	2.5*	2.5*
Leukemia	-2	0.1	-2.5*	0.4

n/a Not applicable Data Source: *SEERStat, 2006*

* Significant at $p < 0.05$; note that statistical significance in AAPC refers to an increase or decrease over time not to differences between males and females.

~ low numbers, statistic could not be calculated

Due to changes in bladder cancer classification in 1988, bladder cancer is not included in this table.

D. Comparison of Niagara Region with Provincial Temporal Trends in Incidence and Mortality

This section describes the 10 most common cancers in males and females living in the Niagara Region and provides a comparison with provincial temporal trends.

Prostate Cancer

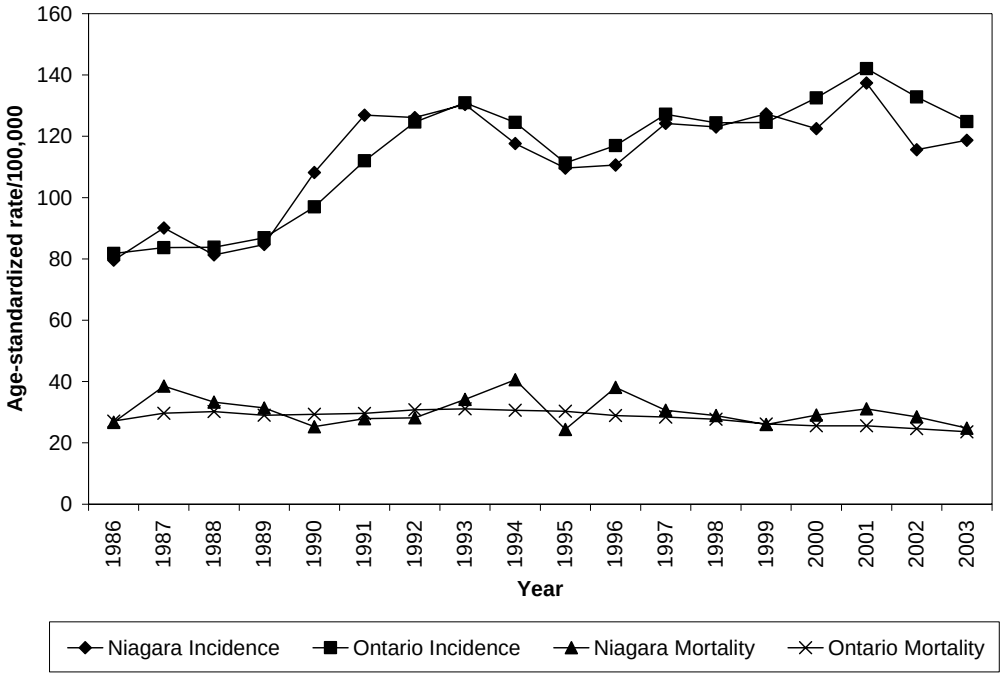
The incidence of cancer of the prostate increased steadily in the Niagara Region at an average annual rate of approximately 3.8%, from 80 cases per 100,000 (1986) to 119 cases per 100,000 (2003) (Figure 7). In the 5-year period between 1988 and 1993, the rate of prostate cancer increased by 60%. This spike in cases diagnosed is at least partly due to the detection of cancers following trans-urethral resection of the prostate (TURP) for suspected benign prostatic hypertrophy in addition to improved detection as a result of the Canada-wide introduction of prostate-specific antigen test in 1988. While an increase in rates is also evident at the provincial level, regional rates appear to be slightly lower than Ontario's between 1986 and 2003. Since 1997 rates have not varied significantly.

The only fully established risk factors for prostate cancer are increasing age, African-American ethnicity, and family history of the disease. Research has almost conclusively established a link for male hormones (androgens) in the causation of prostate cancer, but the effects of these hormones are not fully understood. Although no lifestyle factors (including diet and exercise) have been conclusively established as prostate cancer risk or protective factors, there is some evidence that a diet high in animal fat may account for differences noted in the incidence between different countries (NCI[a], 2007).

Localized prostate cancer is normally treated with radical prostatectomy or radiation therapy. There are 2 tests available to detect prostate cancer in the absence of symptoms, the digital rectal exam (DRE) and a blood test for prostate-specific antigen (PSA). However, conditions other than prostate cancer may result in elevated levels of PSA. Not all men with moderately elevated levels of PSA have prostate cancer, and some men with prostate cancer have normal levels of PSA. A combined approach using PSA and DRE is most valuable in detecting prostate cancer. However, a biopsy is the method to definitively diagnose cancer of the prostate (NCI[b], 2007).

Although PSA is currently the best serum marker for prostate cancer, there is no evidence presently from random clinical trials that screening of prostate cancer using PSA decreases mortality (Armstrong, 2002).

Figure 7. Temporal trends of Prostate Cancer, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991Canadian Population*

Breast Cancer

In the Niagara Region (NR), breast cancer results in the largest number of new cancer cases in women, in addition to being the one of the primary causes of cancer mortality. Between 1986 and 2003 significant increasing time trends are evident in the incidence of breast cancer (Figure 8). During this period there was a 13% increase in the incidence rate, but this was not statistically significant (APC= 0.4; CI = -0.4, 1.2). The increase may be due in part to the rising number of screening mamographies, in addition to changing reproductive histories as a result of bearing children at a later age.

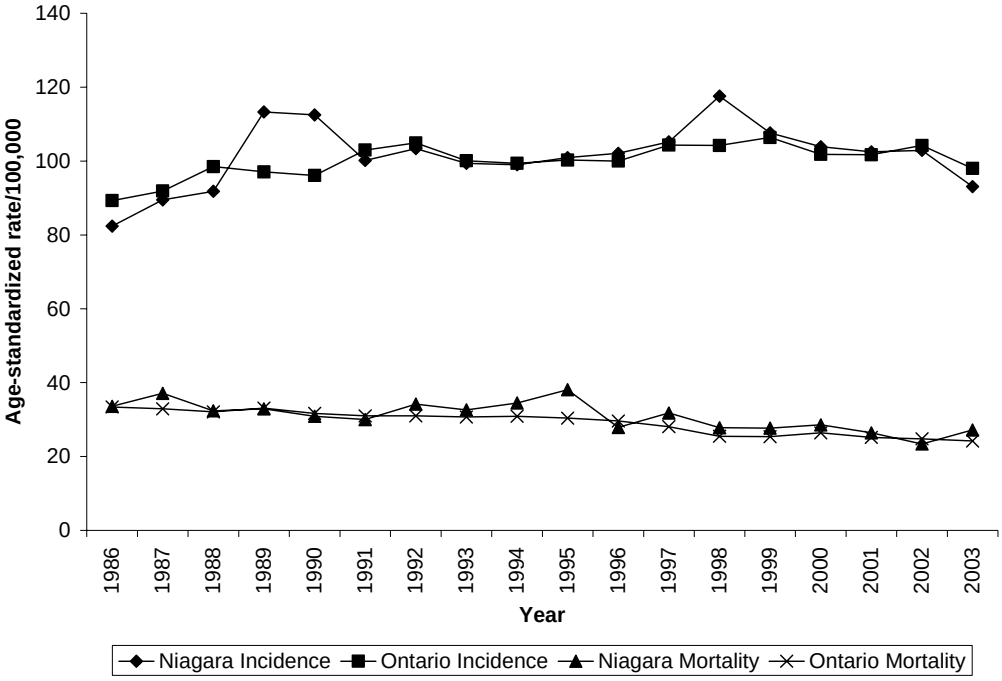
While the incidence of breast cancer rose, the rate of women dying from the disease declined by approximately 19% from 33.6/100,000 to 27.2/100,000 (APC = -1.7; CI = -2.6, -0.8).

The likelihood of a woman developing breast cancer increases rapidly with age, making age the most significant risk factor for breast cancer. Other risk factors include family history of breast cancer, a history of breast cancer in one breast, a history of certain types of benign breast disease, and high levels of radiation exposure to the chest. Other well-established, but weak risk factors include obesity in post-menopausal women and various reproductive risk factors (age at first parity 30+ years of age), early onset of menstruation, late onset of menopause). Demographic factors that increase the risk of developing breast cancer include living in an urban area, belonging to a higher socioeconomic class, and being born in North America or Northern Europe (NCI[c], 2007).

Behavioural risks: the use of post-menopausal estrogen replacement therapy, high intake of dietary fat, alcohol use and physical inactivity have been linked to the risk of breast cancer (NCI[c], 2007).

Early detection through mammography in women over the age of 50 has been shown to reduce mortality by approximately 30%. A breast-cancer screening programme is established in Ontario for women 50-69 years.

Figure 8. Temporal trends for Breast Cancer, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991Canadian Population*

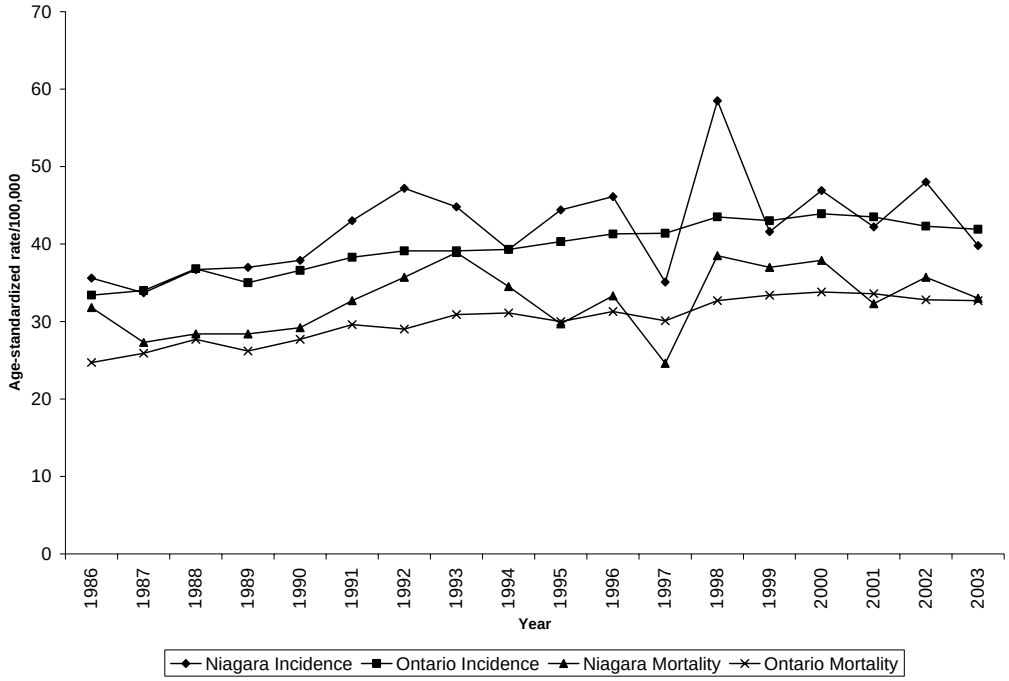
Lung Cancer

Among women in the Niagara Region, lung cancer incidence rates have increased significantly, approximately 1.3% per year since 1986 (CI: 0, 2.6) (Figure 9). With increasing incidence, the mortality rates have remained stable. When comparing women to men, the rates in women are nearly half of those in men but incidence rates in men are decreasing at approximately 1.7 % per year (CI: -2.5, -0.9) (Figure 10). Mortality in men has also been decreasing at approximately 1.9% per year (CI: -3.1, -0.7), while the mortality rates in women have remained stable. The patterns for both men and women in the Niagara region follow very similar patterns to Ontario for both incidence and mortality.

Lung cancer includes tumours of the trachea, bronchi and lung. Virtually all lung cancers arise in epithelial tissue, and most originate from the lining of the bronchi. Active and passive exposure to tobacco smoke is the foremost cause of lung cancer, but a small proportion is the result of occupational exposures to known asbestos and benzene. Long-term exposure to particulate matter (air pollution) increases the mortality risk of lung cancer (Jerrett et al., 2005; Krewski et al, 2005; Pope et al., 2002).

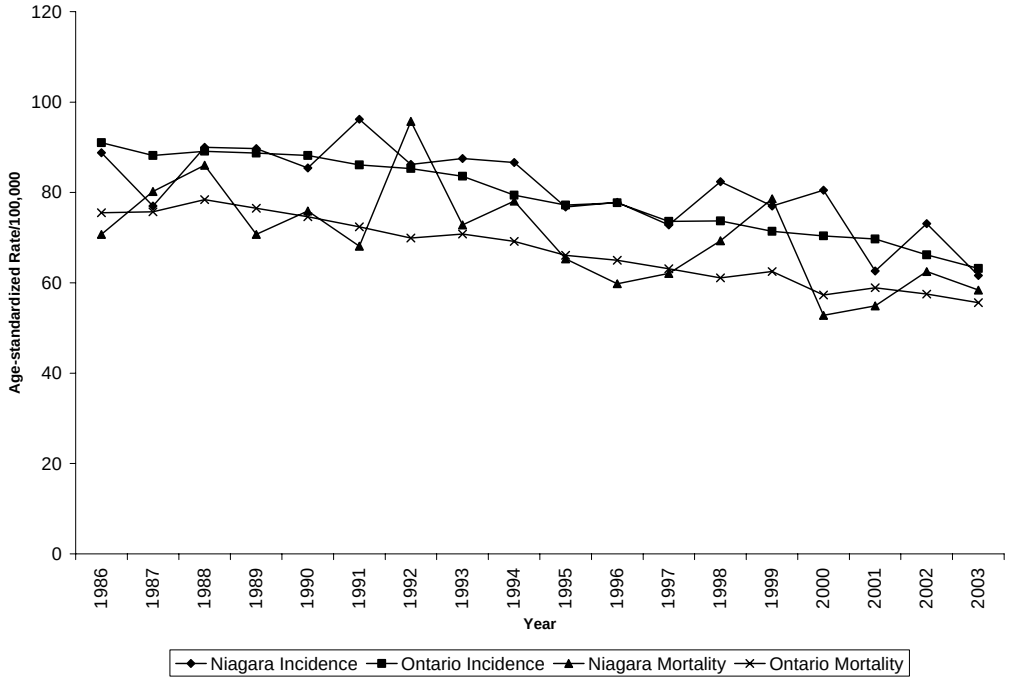
There is a strong incentive to identify an appropriate screening test for lung cancer, since once it's diagnosed the prognosis is poor [5 year relative survival ratio: 15% (Canadian Cancer Statistics, 2007)]. However, there are no prescribed screening programmes for lung cancer since evidence indicates that screening does not impact the risk of fatal lung cancer. Also, lung cancer screening leads to a high number of false positives, thus an increase in invasive follow-up testing (Canadian Cancer Society, 2006; Armstrong, 2002; Fontana et al., 1996). Reduction/elimination of cigarette smoking would prevent the majority of lung cancers.

Figure 9. Temporal trends of Lung Cancer in females, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to Canadian 1991 Population*

Figure 10. Temporal trends in Lung Cancer in males, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991Canadian Population*

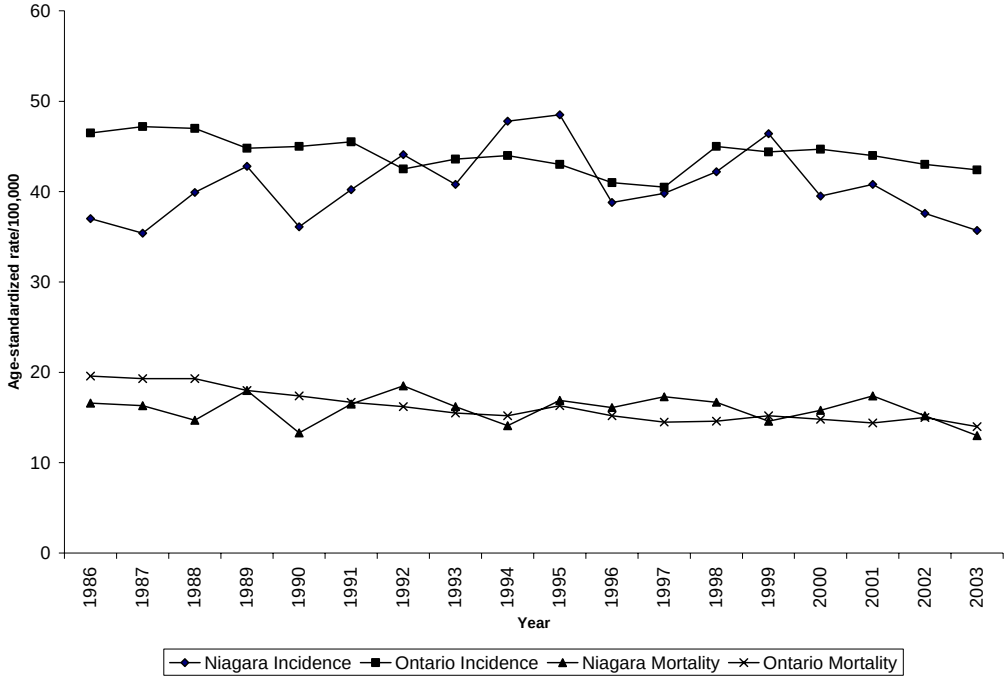
Colorectal Cancer

While there hasn't been a statistically significant change in the incidence of colorectal cancer in women (Figure 11) or men (Figure 12) in the Niagara Region, the downward trendline parallels that of Ontario's decreasing trends. In the Niagara Region, the mortality rate for men has significantly decreased at approximately 1.6% per year between 1986 and 2003 (CI = -2.6,-0.6), while the mortality rate for females has remained relatively stable.(Figures 11 & 12). Regional incidence rates for colorectal cancer in women residing in Niagara is slightly lower than provincial rates.

Risk factors for colorectal cancer include: 1. Age, most people who have colorectal cancer are over age 50; 2. A high fat, high calorie and low fibre diet; 3. lack of physical activity; 4. Certain kind of polyps are believed to lead to colorectal cancer; 5. Personal history-people who have had colorectal cancer, as well as ovarian, uterine, or breast cancers, have a slightly increased risk for colorectal cancer; 6. Family history-individuals with first-degree relatives who have had colorectal cancer have an increased risk for colorectal cancer; and 7. Ulcerative colitis-people with ulcerative colitis (inflamed lining of the colon) (WCRF-AICR, 1997; WCRF-AICR, 2007; NCI[d], 2007).

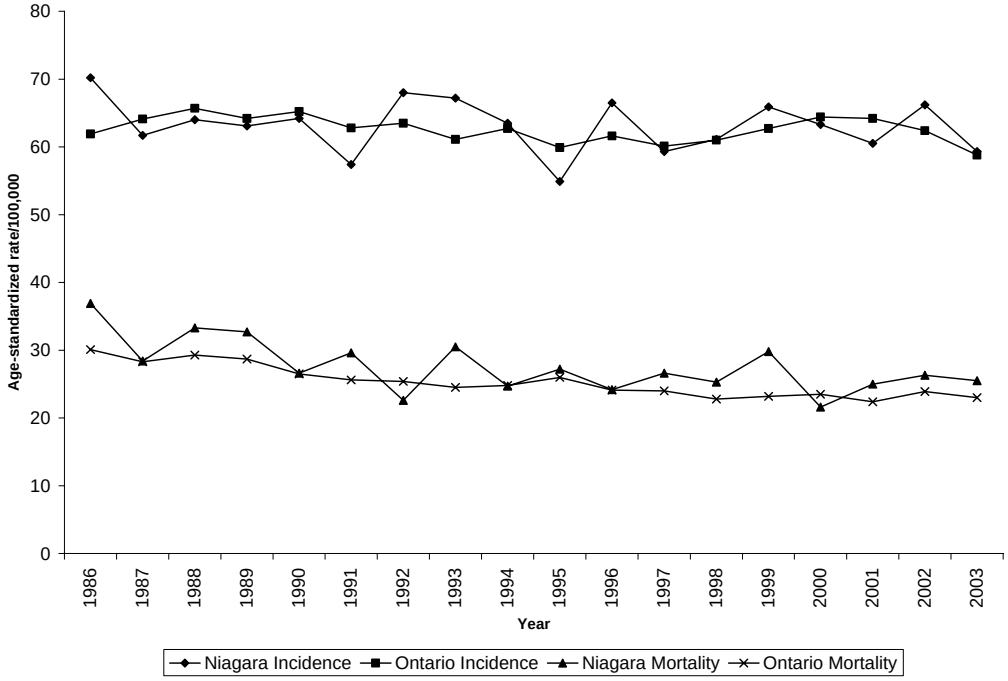
Stool markers and virtual colonoscopy are potential screening modes (Armstrong, 2002). In the United States randomized controlled trials (RCT) have shown the efficacy of screening for colorectal cancer using the fecal occult blood test and follow-up with colonoscopy (NCI[e], 2007). In Spring 2007 a population based colorectal screening program will be implemented in Ontario (CCO, 2007[a]). With this program, we may start seeing a decrease in mortality, as cancers may be caught earlier, thus being able to start treatment earlier. (CCO, 2007[b]).

Figure 11. Temporal trends in Colorectal Cancer in females, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 12. Temporal trends in Colorectal Cancer in males, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991Canadian Population*

Stomach Cancer

Niagara Region incidence rates of stomach cancer are declining in both women (AAPC = -4.0; CI = -6.4, -1.6) and men (AAPC = -2.6; CI = -4.1, -1.2)(Figure 13 & 14). Niagara Region is closely following the decreasing pattern of incidence in Ontario. Mortality rates of stomach cancer in both men (AAPC = -2.8; CI = -4.9, -0.7) and women (AAPC = -4.5; CI: -7.2, -1.7) continue to show a prominent decline, also reflecting trends in provincial rates.

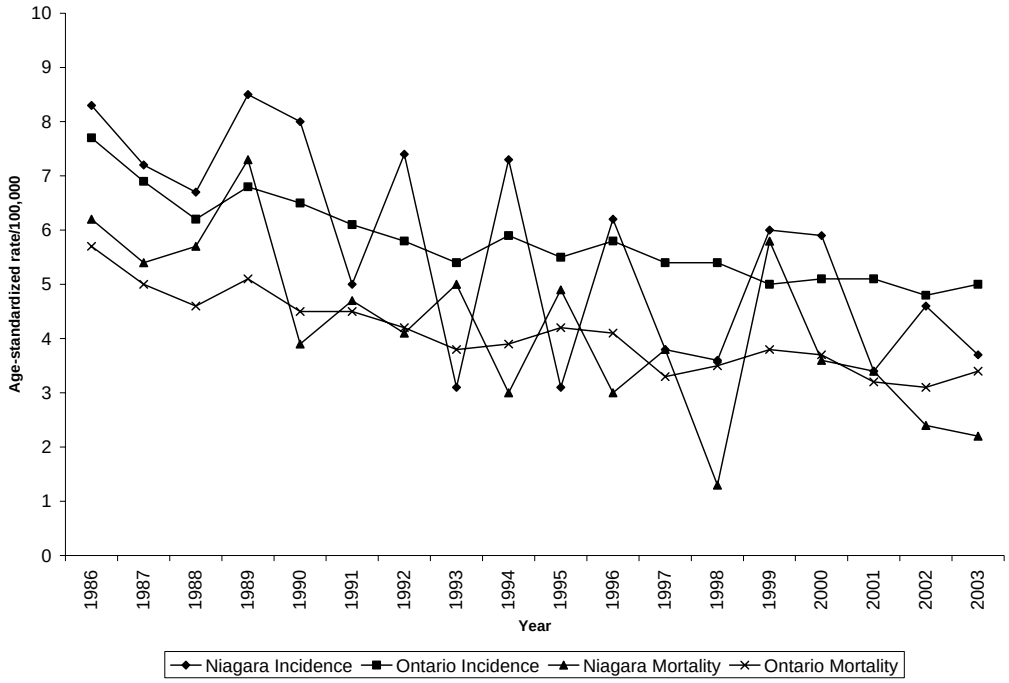
The most common form of cancer affecting the stomach is adenocarcinoma, (arising from the innermost layer of the stomach). The tumour tends to spread through the wall of the stomach and from there into the adjoining organs (pancreas and spleen) and lymph nodes.

Factors that increase an individual's risk of contracting the disease are: 1. Long term infection with *Heliobacter pylori*; 2. A diet high in smoked foods, salted fish and meat, and pickled vegetables. On the other hand, eating whole grain products, fresh fruits and vegetables that contain vitamin A and C appear to lower the risk; 3. Tobacco use; 4. previous stomach surgery; 5. Pernicious anemia; 6. Menetrier's disease (also known as hypertrophic gastropathy); 6. Gender-men are more likely to be affected by stomach cancer than women; 7. ethnicity-the rate is higher in Hispanics and African Americans than in non-Hispanic whites. The highest rates are seen in the Asian/Pacific Islanders; 8. age-there is a sharp increase in stomach cancer after the age of 50 years; 9. Type A Blood-the reason for this is unknown; 10. familial cancer syndromes and a family history of stomach cancer (Mayo Clinic[a], 2004).

There is evidence from Japan, where the incidence of gastric cancer is high, that screening of individuals over 40 years of age with barium x-ray increases survival rates. In Canada, the incidence of stomach cancer is relatively low and there are presently no screening guidelines (Armstrong, 2002).

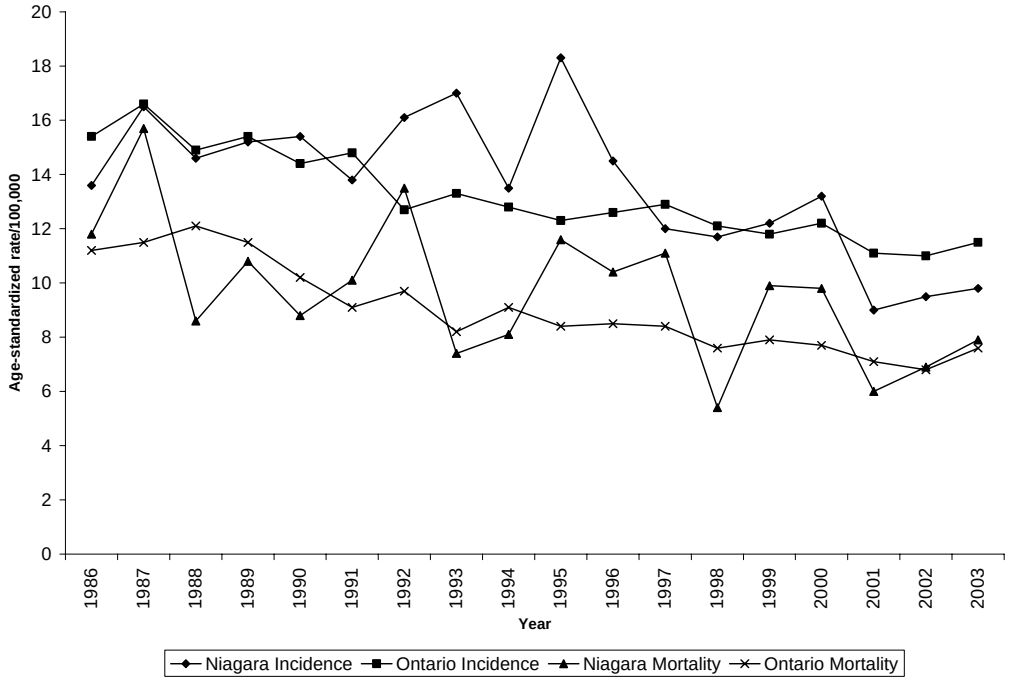
Investigations are underway into potential screening tools: genetic mutations to identify high risk patients, tumour markers, and the eradication of *H. pylori* (Armstrong, 2002).

Figure13. Temporal trends in Stomach Cancer in females 1986-2003, Niagara Region and Ontario



***Data Source**: SEERStat, 2006* *Rates Standardized to 1991Canadian Population*

Figure 14. Temporal trends in Stomach Cancer in males, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991Canadian Population*

Pancreatic Cancer

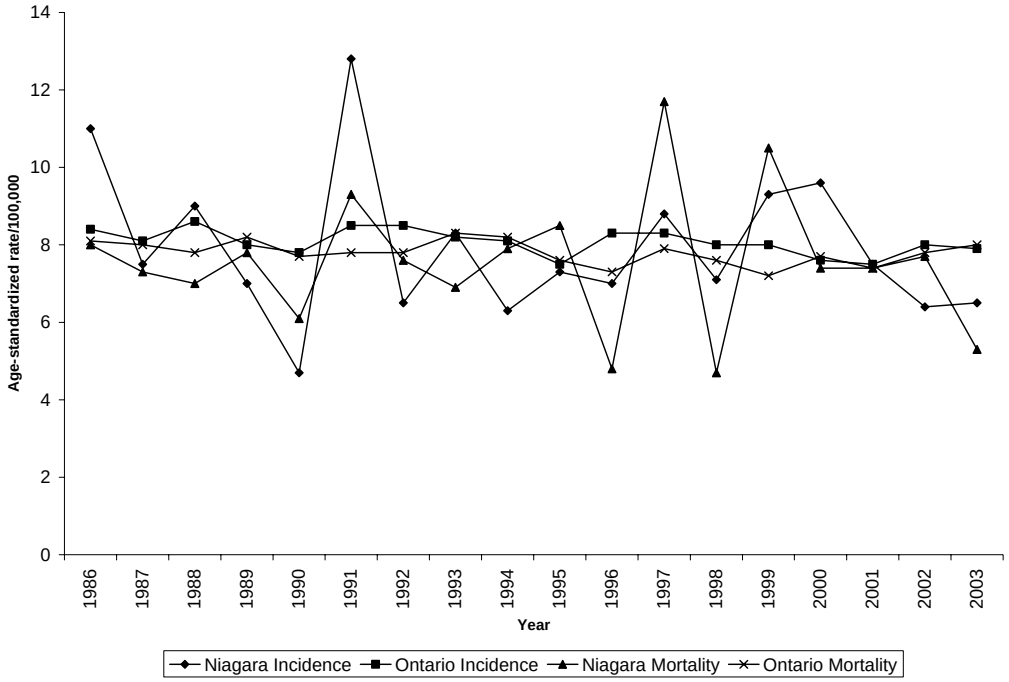
While rates of incidence and mortality in the Niagara Region have remained unchanged between 1986 and 2003, a significant decreasing trend is evident in male and female incidence, as well as male mortality at the provincial level (Figures 15 & 16).

There are 2 types of pancreatic cancer: Most pancreatic tumors originate in the exocrine duct cells or in the acinar cells. Adenocarcinomas, account for nearly 95 percent of pancreatic cancers. Tumors that begin in the islet cells (endocrine tumors) are much less common.

In pancreatic cancer, damage to DNA seems to result from a combination of inherited (genetic) and environmental factors. Smoking is the primary risk factor for pancreatic cancer. Thirty percent of pancreatic cancers result from smoking and a diet high in animal fat and low in fruits and vegetables. A sedentary lifestyle (excess weight and lack of activity) may increase the risk of pancreatic cancer by affecting the body's ability to metabolize glucose. Approximately 10% of pancreatic cancers result from an inherited tendency. Studies show that a higher risk of developing pancreatic cancer exists: 1. For people who have a close relative (parent or sibling); 2. An individual with familial adenomatous polyposis, non-polyposis colon cancer, familial breast cancer associated with the BRCA2 gene, hereditary pancreatitis, and familial atypical multiple mole and melanoma syndrome is at greater risk. In addition, people who work with petroleum compounds, including gasoline and other chemicals have a higher incidence of pancreatic cancer than people not exposed to these chemicals. (NCI[f], 2007; CCO, 2003).

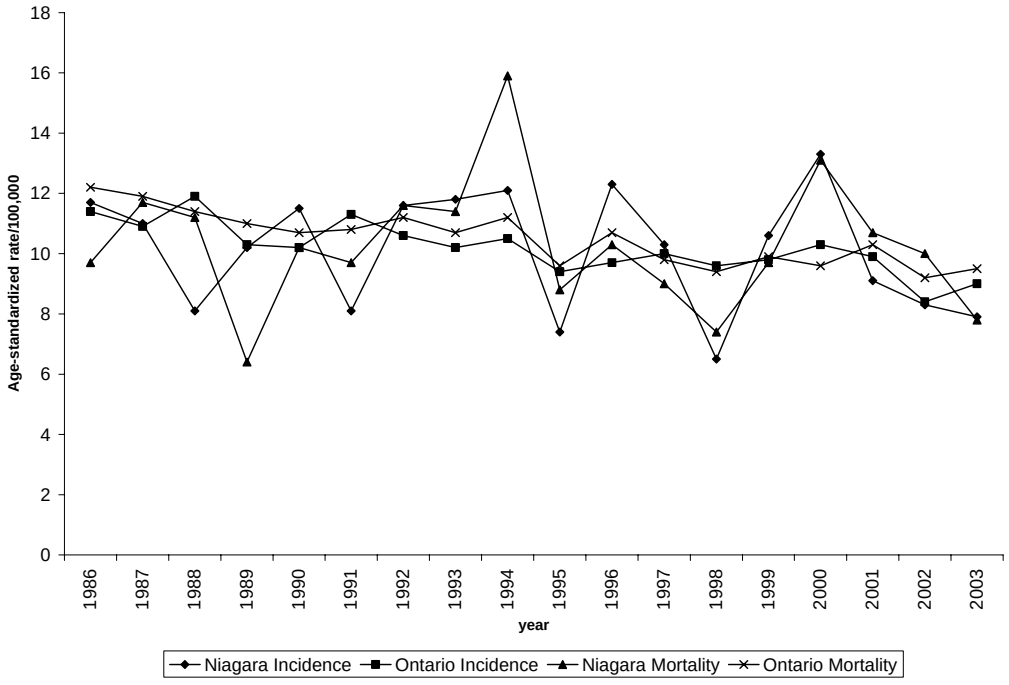
Detecting pancreatic cancer in its early stages is extremely difficult. Signs and symptoms usually don't appear until the cancer is large or has spread to other tissues. By virtue of the location of the pancreas, small tumours can't be seen or felt during routine exams providing ample opportunity for the cancer to spread. There are presently no screening guidelines available for pancreatic cancer. Due to the high case fatality rate of pancreatic cancer, investigations are underway to identify sensitive/specific tumour makers to screen individuals who are at high risk of developing cancer of the pancreas (Armstrong, 2002).

Figure 15. Temporal trends in Pancreatic Cancer in females, 1986-2003, Niagara Region and Ontario



Data Source*: SEERStat, 2006* *Rates Standardized to 1991Canadian Population*

Figure 16. Temporal trends in Pancreatic Cancer in males, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

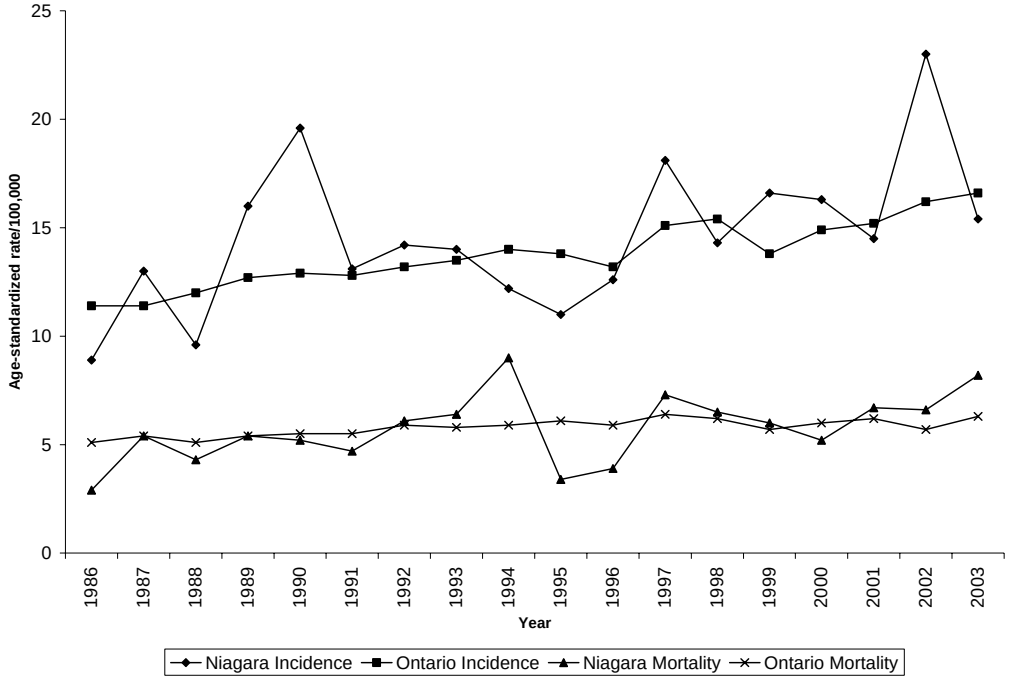
Non-Hodgkin's Lymphoma

An increase in both incidence and mortality of non-Hodgkin's lymphoma are evident provincially and regionally. In women, a gradual increase occurred in the incidence rates (AAPC = 2.2; CI = 0.1, 4.3) (Figure 17) and this was also accompanied by a parallel increase in deaths approximately 2.5% per year (CI = .01-5.0) at the regional level. Although a slightly smaller affect, there was a significant increasing trend provincially in female mortality (Figure 17). The incidence of Non-Hodgkin's lymphoma, is the only other cancer in men (in the Niagara Region) besides prostate cancer, showing a significant escalation in incidence from 14 cases per 100,000 to 26 cases per 100,000 (AAPC = 2.4; CI = 1.2, 3.6) (Figure 18). Mortality rates also doubled (AAPC = 2.5; CI = 0, 5.1) 1986 and 1999, but has since been decreasing. (Figure 18).

Lymphoma is a cancer of the organs and the cells of the lymphatic system that comprise the immune system. Hodgkin's and Non-Hodgkin's Lymphoma (NHL) are the 2 types of lymphoma. NHL is defined as "a heterogeneous group of diseases consisting of neoplastic proliferation of lymphoid cells that usually disseminate throughout the body (Merck Manual online). Essentially NHL is a result of T and B-lymphocytes forming malignant tumours in the lymphatic system and elsewhere in the body.

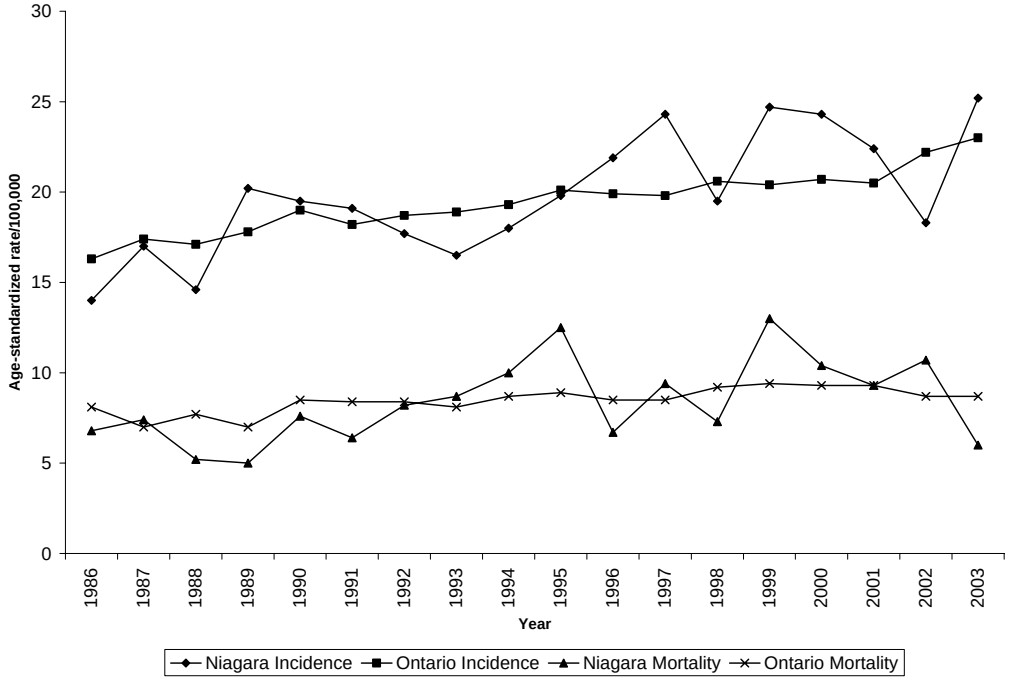
The causes of Non-Hodgkin's lymphoma are unknown. Findings from studies and clinical trials have highlighted several potential risk factors including: age; defective immune systems; infection with HIV/AIDS or Epstein-Barr virus; exposure to dilantin (anti-seizure drug); carcinogens, chemicals, and environmental pollutants; radiation and chemotherapy; and genetics (those born with deficient immune systems) (NCI[g], 2007).

Figure 17. Temporal trends of Non-Hodgkin's Lymphoma in females, 1986-2003, Niagara Region and Ontario



Data Source*: SEERStat, 2006* *Rates Standardized to1991 Canadian Population*

Figure 18. Temporal trends of Non-Hodgkin's Lymphoma in males, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

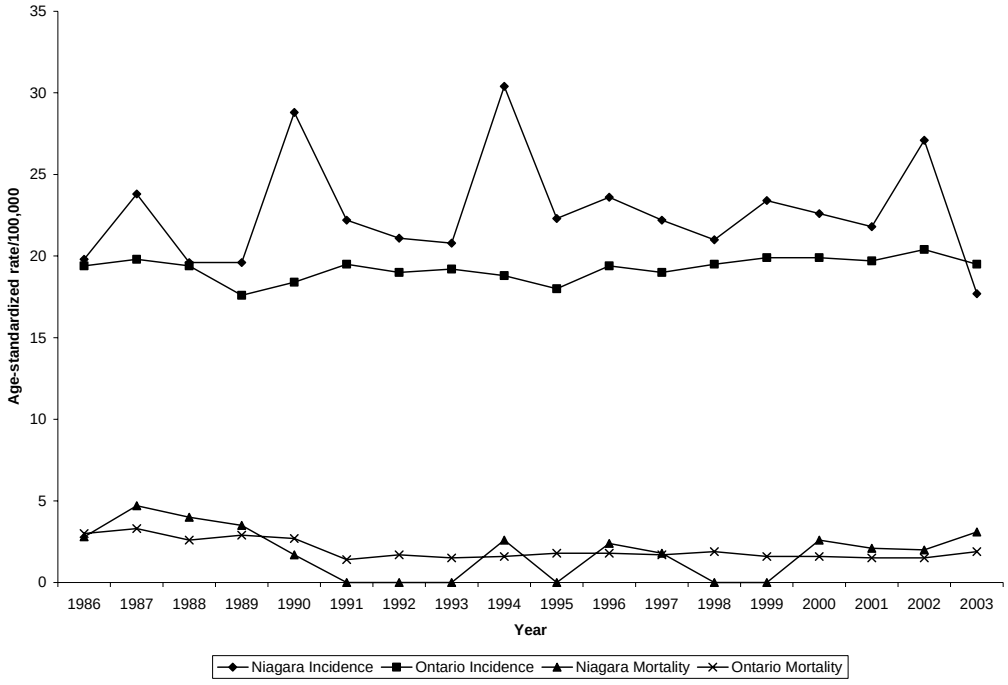
Uterine Cancer

Cancer of the uterus is the fourth most common cancer in women in the Niagara Region and the most common malignancy of the female genital system. Between 1986 and 2003 there were a total of 1126 cases of uterine cancer. Incidence rates in the region remained stable (range = 20 - 31 females per 100,000) (Figure 19). During the same period, there were only 120 deaths. Mortality trends could not be calculated due to very few deaths. Declines in mortality were noted at the provincial level, but there was no change in incidence (Figure 19).

Uterine cancer comprises tumours arising from the endometrium (endometrial cancer) and the myometrium (uterine sarcoma). The most common type of uterine cancer is endometrial cancer. Factors that increase the risk of developing uterine cancer are: 1. age – most cancers are in women over the age of 50 years; 2. the presence of endometrial hyperplasia; 3. obesity and accompanying high levels of estrogen; 4. long-term and high dose usage of estrogen replacement therapy; 5. race – White women are more at greater risk than African-American; (NCI[h], 2007).

There is insufficient evidence to establish a decrease in mortality from endometrial cancers with use of endometrial sampling or trans-vaginal ultrasound (NCI[h], 2007).

Figure 19. Temporal trends in Uterine Cancer, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to1991 Canadian Population*

Ovarian Cancer

In the Niagara Region, age-standardized incidence (AAPC = 1.5; CI = -0.2, 3.3) and mortality rates (AAPC = 1.3; CI = -0.8, 3.4) of ovarian cancer between 1986 and 2003 have varied without any significant changes (Figure 20). But in Ontario, there has been a significant decrease in mortality from ovarian cancer (AAPC = -0.5; CI -0.9, -0.1).

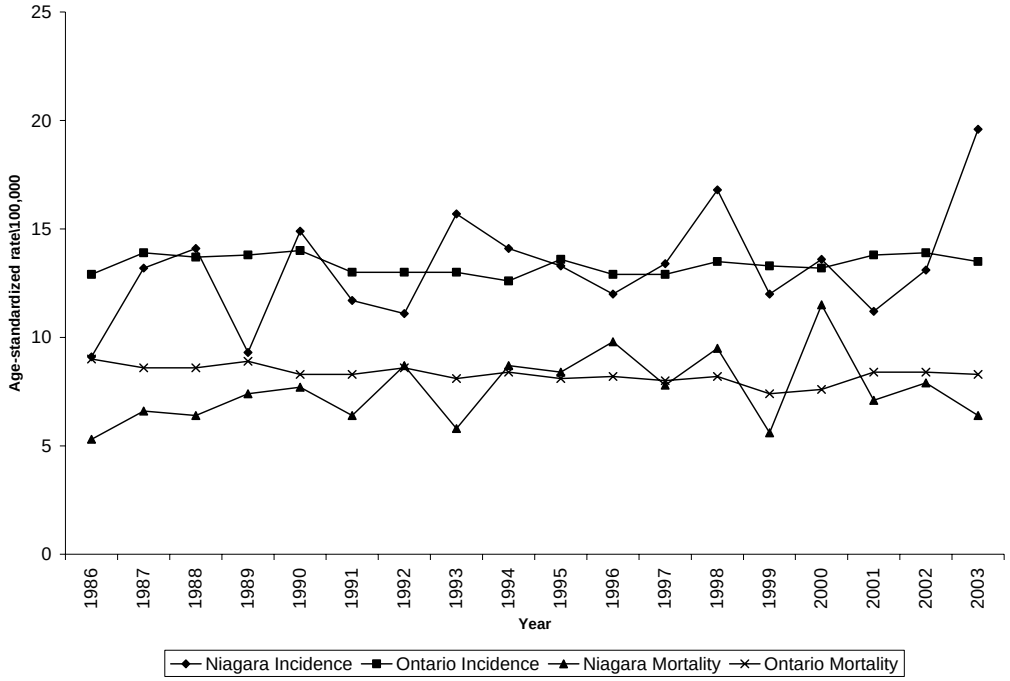
More than 90% of ovarian tumours arise from the epithelial cells that form the surface of the ovary. These are the same cells that line the peritoneal cavity and the outside of the bowel and uro-genital systems. Tumours spread when there is local shedding into the peritoneal cavity followed by implantation into the peritoneum. Approximately 15% of tumours are of low malignant potential and are deemed to be borderline tumours (NCI[i], 2007).

The risk factors for ovarian cancer are not clearly understood; however, a number of aspects have been associated with either an increased or decreased likelihood of developing the disease. Factors identified as (potentially) protective are reproductive factors such as the use of oral contraceptives, hysterectomy, and tubal ligation. A decreasing trend in the risk of ovarian cancer was observed among women with full term pregnancies, breast-feeding and the use of oral contraceptives (Medline). It is estimated that 5%-10% of all ovarian cancer case result from a hereditary predisposition. A diet high in saturated fat may also be a risk factor for ovarian cancer (NCI[i], 2007).

Recommendations for the prevention of ovarian cancer are hampered due to the uncertainty surrounding the origin and risk factors of the disease. Prophylactic oophorectomy (removal of ovaries) has been suggested as a preventative measure in women from families with hereditary ovarian cancer syndrome, but currently there is insufficient evidence to promote or discourage this approach. Bimanual exams, trans-abdominal and trans-vaginal ultra-sound, and tumour markers CA 125 have been identified as potential screening tools (Armstrong, 2002).

Survival rates are much higher when ovarian cancer is diagnosed in an early or localized stage. Therefore screening has been considered with the hope of being able to detect women in the asymptomatic stage of disease. However, there is currently no evidence to support that screening high risk individuals for ovarian cancer reduces mortality (Armstrong, 2002).

Figure 20. Temporal trends in Ovarian Cancer, 1986-2003, Niagara Region and Ontario



Data Source*: SEERStat, 2006* *Rates Standardized to Canadian 1991 Population*

Cancer of the Uterine Cervix

Cervical cancer incidence and mortality have declined provincially during the last 20 years (Figure 21). Mortality rates in the Niagara Region could not be calculated for all years between 1986 and 2003, but previous data (1979-2000) shows a similar trend. Incidence rates in the Region have declined by 1%. However, this decreasing trend is not statistically significant, most likely due to the few numbers of cervical cases (Figure 21).

Cervical cancer is one of the most common malignant diseases of women. Through the adoption of Papanicolaou smear (Pap smear) screening, Canada has been one of the pioneer countries in reducing the incidence of cervical cancer, but most provinces have yet to follow national guidelines calling for implementation of a programme-based cytology screening (CCO, 2003). In most provinces, early detection still depends on opportunistic screening that relies on cytology tests done at the discretion of family physicians. Cervical cancer consists of two general histological varieties: squamous cell carcinomas and adeno-carcinomas. Although prevalence of the squamous cell carcinomas has decreased in response to screening, the proportion of the latter among all cervical cancers has increased, because Pap cytology is generally ineffective to detect these adenocarcinomas and their precursor lesions.

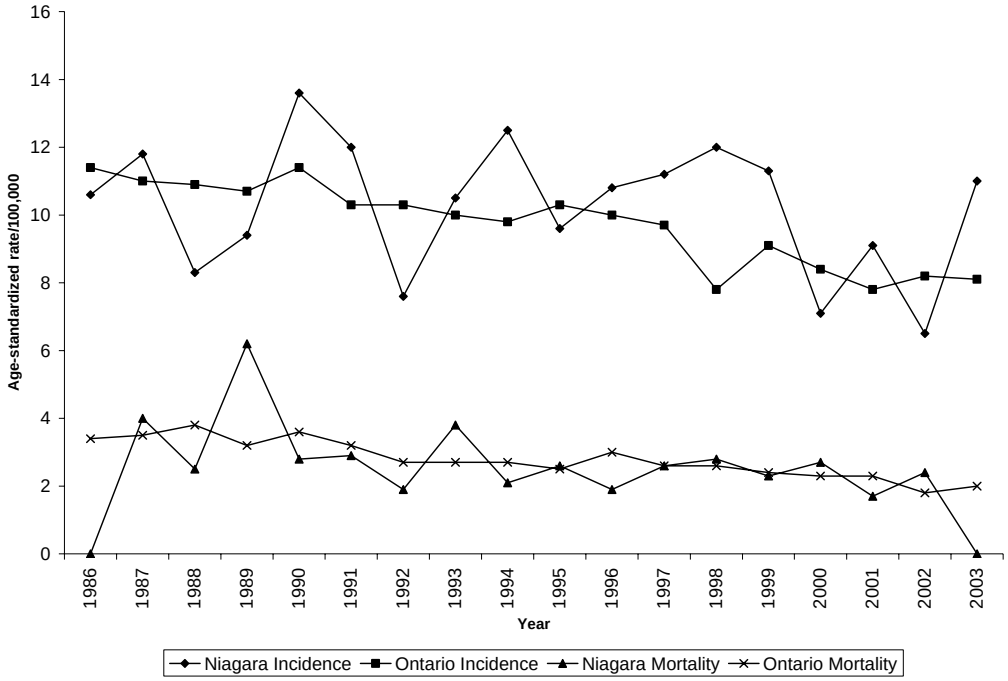
Unlike most other cancers, cervical cancer has a central causal factor: oncogenic forms of the human papilloma virus (HPV) infection. HPV is acknowledged as a cause of this disease and of its precursor lesions (Armstrong, 2002; Wallboomers, 1999; IARC, 1995). Sexual behaviours that lead to potential HPV exposure (intercourse before the age of 16, multiple partners) increase the risk of cervical cancer. The risk also increases for women who smoke tobacco and are HIV infected (NCI[j], 2007).

Primary prevention can be achieved through health education (sexual behaviour modification) and vaccination to prevent HPV infection. One vaccine has been created and approved by the FDA (Merck's Gardasil). This vaccine protects against HPV strains 6, 11, 16 and 18, which lead to almost 70% of cervical cancer cases and 90% of genital warts (Health Canada, 2007; NCSL, 2007).

The Pap test has been available for the last 50 years to screen asymptomatic women for pre-cancerous cervical lesions. Despite its low sensitivity (29%-56%) it has never been subjected to evaluation by random clinical trials. Yet, several studies have shown a decline in incidence and mortality as a result of its implementation. A liquid based cytology procedure, now in place in Ontario, allows for the inclusion of all cellular cervical material collected and facilitates the reading of slides (Armstrong, 2002).

The demonstrated relationship between the presence of oncogenic HPV and cervical cancer has led to considering the addition of HPV testing. Other possible screening tests being developed are techniques to identify proteins in abnormal precursor malignant cells (Armstrong, 2002).

Figure 21. Temporal trends in Cancer of the Uterine Cervix, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to Canadian 1991 Population*

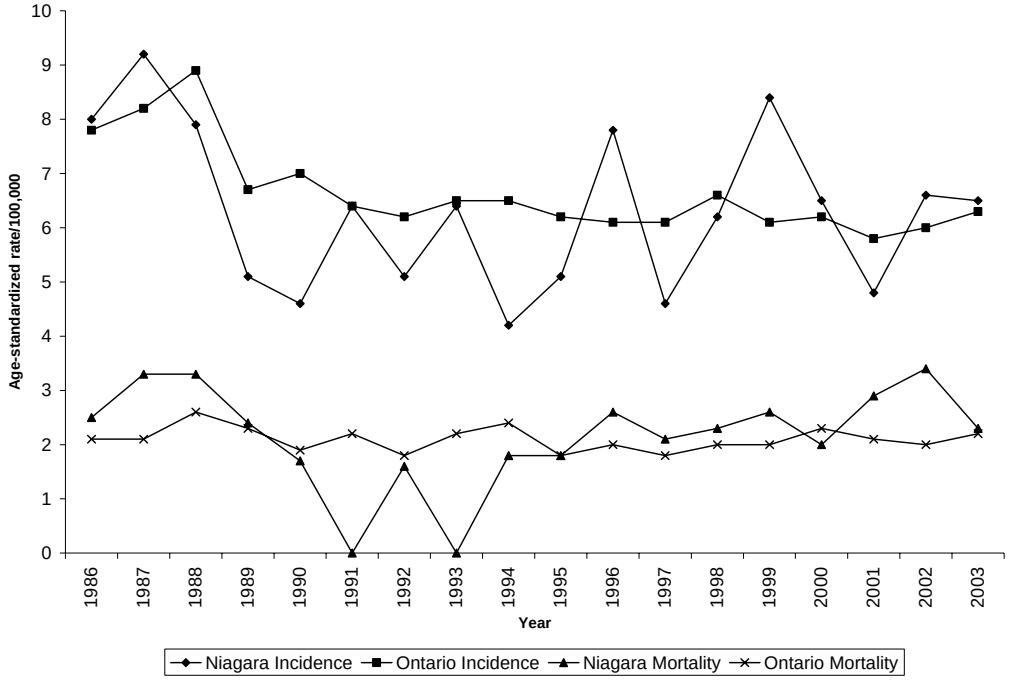
Bladder Cancer

In 1989, the Registry changed the code used for tumours identified as invasive papillary transitional carcinomas. While potentially malignant, the tumours have not yet become invasive. The effect of this change was an apparent drop in incidence of approximately 25%. As a result of the change in coding it is inappropriate to compare bladder cancer rates before and after 1989. Therefore, the statistics for average annual percentage change for the period 1986-2003 are not presented in this section.

The incidence rates of bladder cancer are between 2.5 to 7 times greater in men compared to women. Similarly, mortality rates in men are 10-fold higher than in women. Since 1989, provincial incidence rates for both men and women have been declining significantly by approximately 1% per year, however, there is not yet evidence for a similar trend in the Niagara Region. Mortality rates remain unchanged.

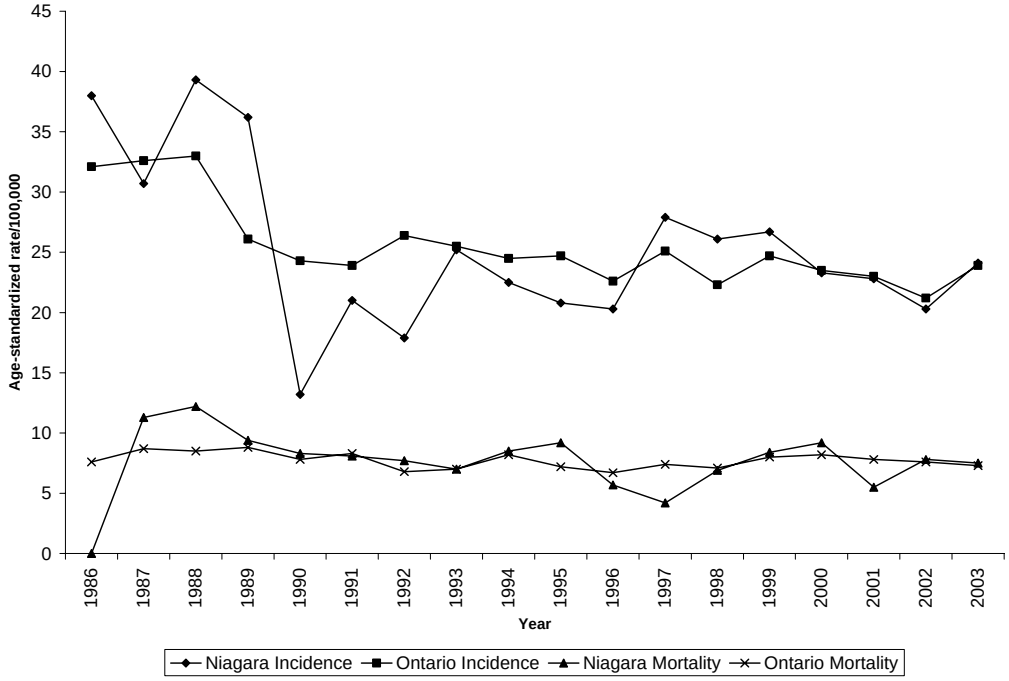
Numerous chemicals are suspected bladder cancer forming agents, but only cigarette smoking and occupational exposure to a certain class of organic chemicals called aromatic amines (beta-naphthylamines, xenylamine, 4-nirtobiphenyl, benzidine) are well-established risk factors. Bladder cancer due to aromatic amine exposure has been documented in the textile, leather, rubber, dye, paint, hairdressing, and organic chemical industries. Smoking increases the risk of bladder cancer; in most cases the risk from smoking increases the chance of bladder cancer two- to five-fold. Other factors increasing the risk of this cancer are: 1. increasing age; 2. race-caucasians are twice as likely to develop the disease compared to blacks and Hispanics; Asians have the lowest rates of bladder cancer; 3. chronic or repeated bladder infections/inflammations; 4. family history of the disease; and 5. personal history (previous occurrence of bladder increases the likelihood of a re-occurrence) (NCI[k], 2007).

Figure 22. Temporal trends in Bladder Cancer in females, 1986-2003, Niagara Region and Ontario



Data Source*: SEERStat, 2006* *Rates Standardized to Canadian 1991 Population*

Figure 23. Temporal trends in Bladder Cancer in males, 1986-2003, Niagara Region and Ontario



Data Source*: SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Melanoma

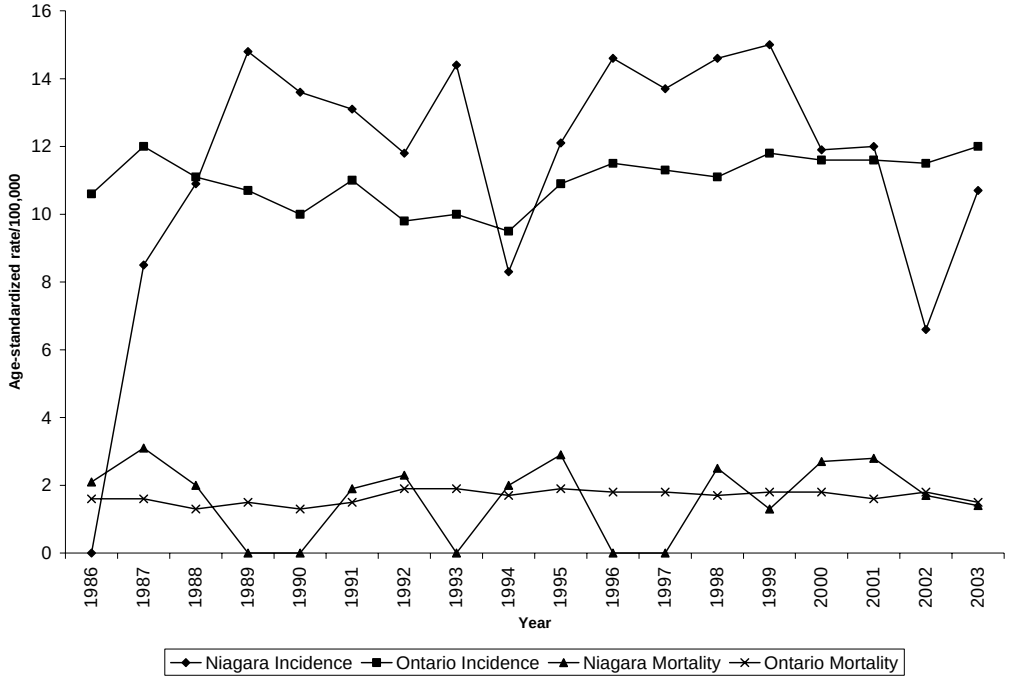
The three major types of skin cancer are basal cell, squamous cell and melanoma. Basal cell and squamous cell are superficial, slow growing and treatable if found early. Melanoma affects the deeper layers of the skin and has the potential to metastasize. Only data on melanoma is presented in this section.

At the provincial level, between 1986 and 2003, the incidence rates of melanoma in females have increased 13%, while the mortality rates have decreased 6.4% although not siginificantly (Figure 24). In men, the incidence and mortality rates increased 31.6% and 22% respectively (Figure 25) In the Niagara Region there is no evidence of temporal trends in rates (in either of the sexes) during this time period, perhaps due to the few numbers of cases and deaths (Figures 24 & 25).

Risk factors associated with melanoma are: 1. fair skin – individuals with less pigment have less protection against damaging ultraviolet radiation; 2. history of sunburns – the risk of melanoma increases every time the skin is exposed to a sunburn; 3. long-term exposure to sun; 4. living in sunny climates and/or high-altitudes; 5. the presence of a abnormally sized or shaped (dysplastic) mole; 6. family history or previous occurrence of skin cancer. Approximately 8%-12% of Canadian cases have a family history of melanoma (Eng et al. (2001) in Armstrong 2002); 7. Weakened immune system; 8. Xeroderma pigmentosum, a rare genetic disorder that increases sensitivity to light and predisposes the individual to melanoma (Mayo Clinic[b], 2007).

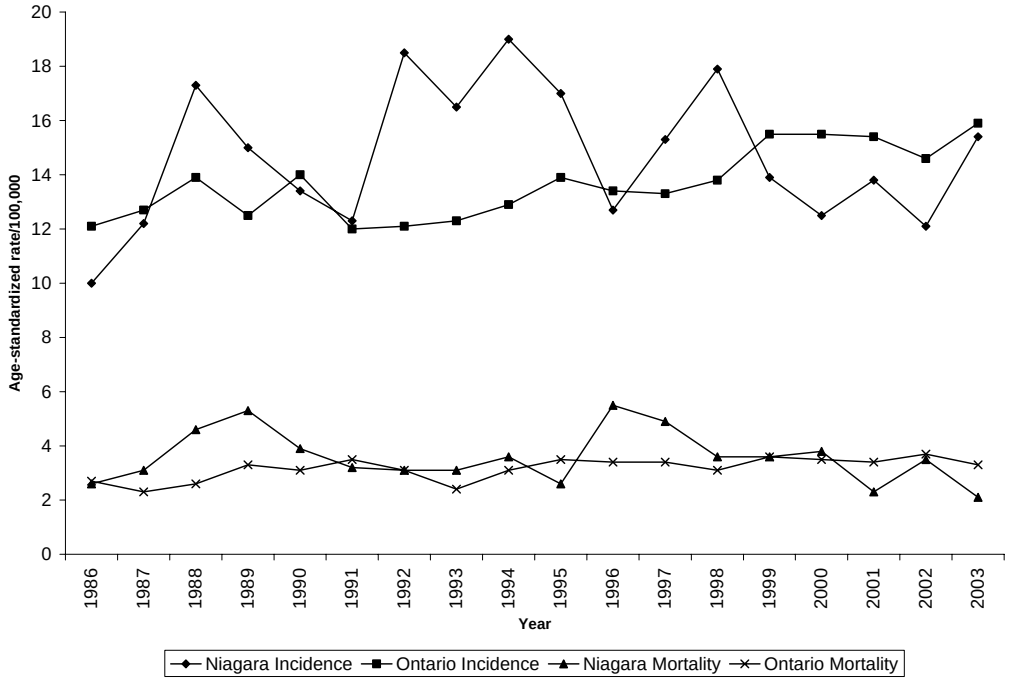
There are no screening programmes for melanoma. Although some experts advocate a full body visual inspection by a trained individual, there is no evidence for decreased mortality using this approach. Future recommendations may include genetic testing.

Figure 24. Temporal trends in Melanoma in females, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 25. Temporal trends in Melanoma in males, 1986-2003, Niagara Region and Ontario



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

E. Age-standardized Incidence and Mortality by Age Groups for all Cancers (Niagara Region and Ontario, 1986-2003)

This section shows temporal trends by 4 broad age groups for all cancer sites combined (Figures 28 – 31) for Niagara Region and the province of Ontario. The probability of cancer increases with age, and this is evident in the fact that in Niagara Region, between 1986 and the year 2003, over 46% of cancer cases and 58% of cancer deaths occurred in people over 70 years of age. In contrast, only 0.9% of incident cases and less than 0.5% of deaths took place before the age of 20.

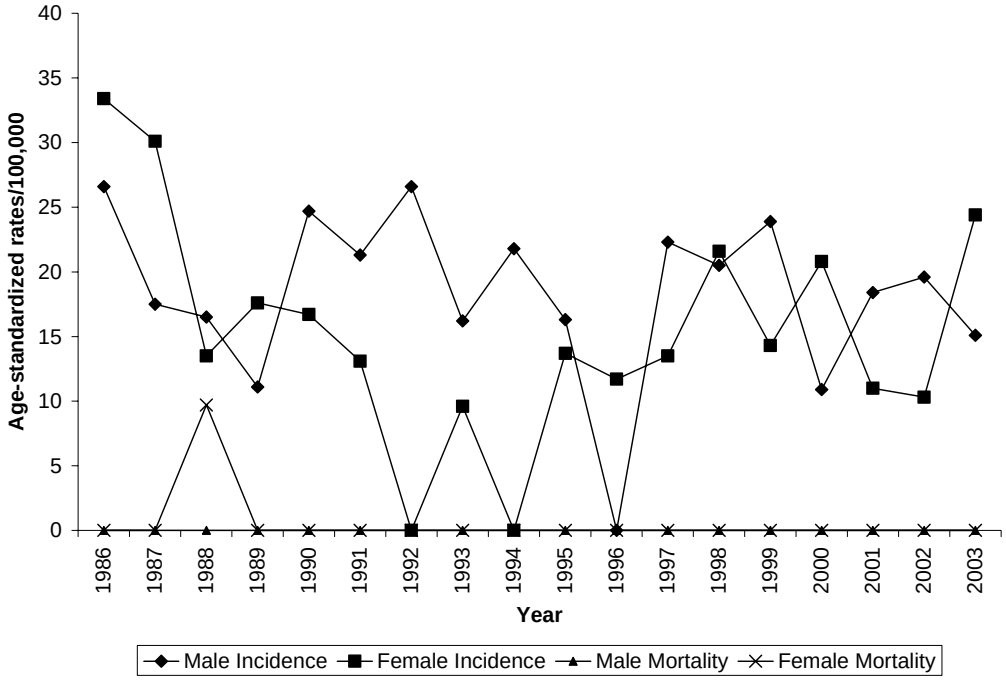
Within Niagara's 0 – 19 year age group, incidence and mortality rates varied due to low numbers (Figure 28a) and no temporal pattern was apparent. Ontario incidence rates remained stable for both males and females in this age category, but mortality rates significantly decreased 2.4% (CI = -3.6, -1.1)and 2.9% (CI = -4.4, -1.4) per year for males and females respectively. (Figure 28b).

In Niagara, the incidence rates for the 20-49 year age group have remained relatively stable. Overall, in the same age group, there has been a decline in mortality rates of 1.5% per year (CI = -2.6,-0.4), but when males and females are separated there is no significant change for males and a marginally significant decrease for females of 1.7% per year (CI = -3.3, 0) (Figure 29a). Provincial rates show a significant increase in female incidence rates (AAPC = 0.4; CI = 0.2, 0.7), but a decrease in both male and female mortality rates. (AAPC = -1.9; CI = -2.2, -1.6 and AAPC = -2.1; CI = -2.4, -1.9 for males and females respectively(Figure 29b)

Niagara women aged 50-69 show a significant increase in cancer incidence of approximately 0.7% per year (CI = 0.1, 1.4), while the rates in men remain relatively stable. Men of the same age group show a significant decrease in mortality of approximately 1.4% per year (CI = -2.3, -0.5), while the rates in women remain stable (Figure 30a). Ontario incidence rates are increasing for both men and women at slightly greater than 0.5% per year, but the mortality rates are decreasing at the same time. The decrease for men is approximately two-fold that of females at 1.8% per year (CI = -2, 1.6) (Figure 30b).

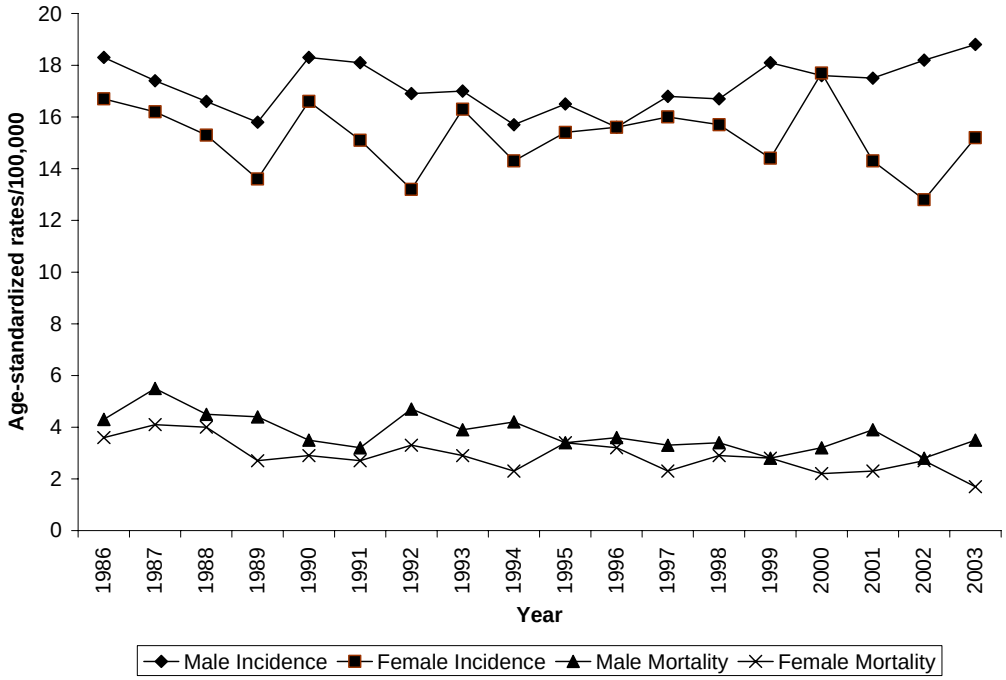
Age-standardized incidence rates in men over the age of 70 years are almost twice as common as in women of the same age group. In Niagara, the incidence rates for both men and women have remained relatively stable, but there has been a significant increase in mortality rates of 0.7% per year (CI = 0.1, 1.2). (Figure 31a). In Ontario, the incidence in men is decreasing at 0.4% per year (CI = -0.6, -0.1), while increasing in females at 0.3% per year (CI = 0.2, 0.5). The same pattern is noted in mortality where men have a decreasing mortality rate of 0.5% per year (CI = -0.7, -0.3) and women have an increasing rate of 0.4% per year (CI = 0.2, 0.6) (Figure 31b).

Figure 28 a. Temporal trends of age group 0 - 19 in the Niagara Region (1986-2003)



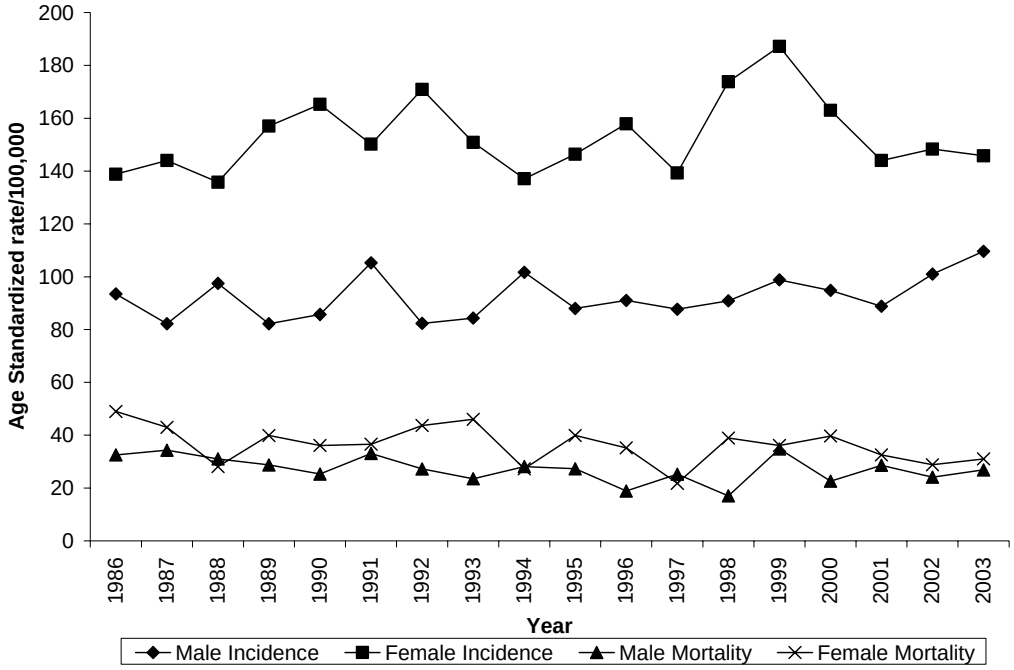
Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 28 b. Temporal trends of age group 0 - 19 in Ontario (1986-2003)



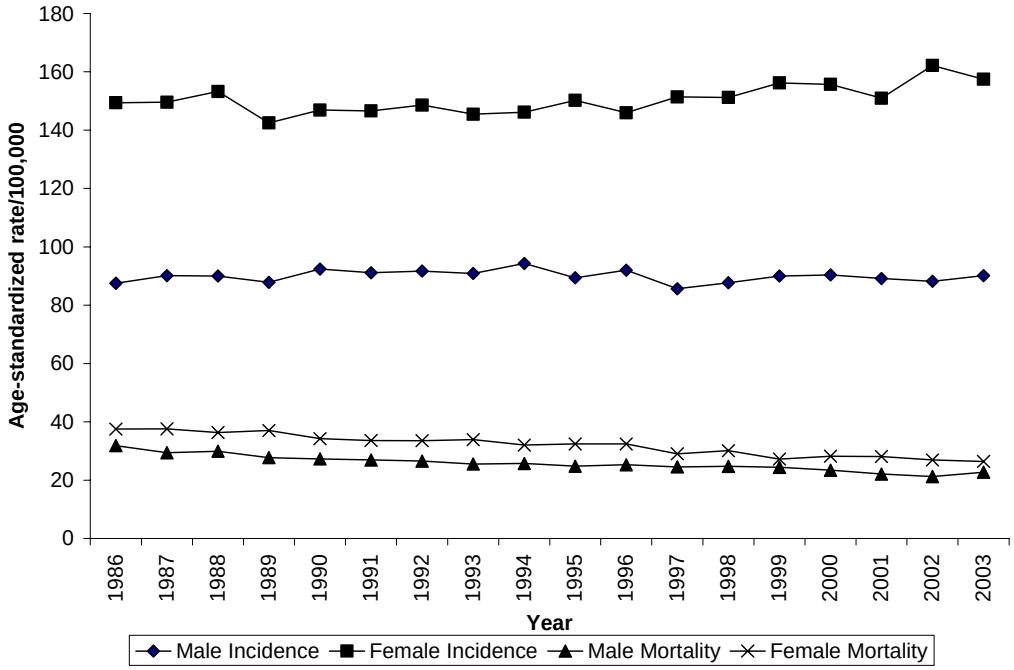
Data Source: SEERStat, 2006 *Rates Standardized to 1991 Canadian Population*

Figure 29 a. Temporal trends of age group 20-49 in the Niagara Region (1986-2003)



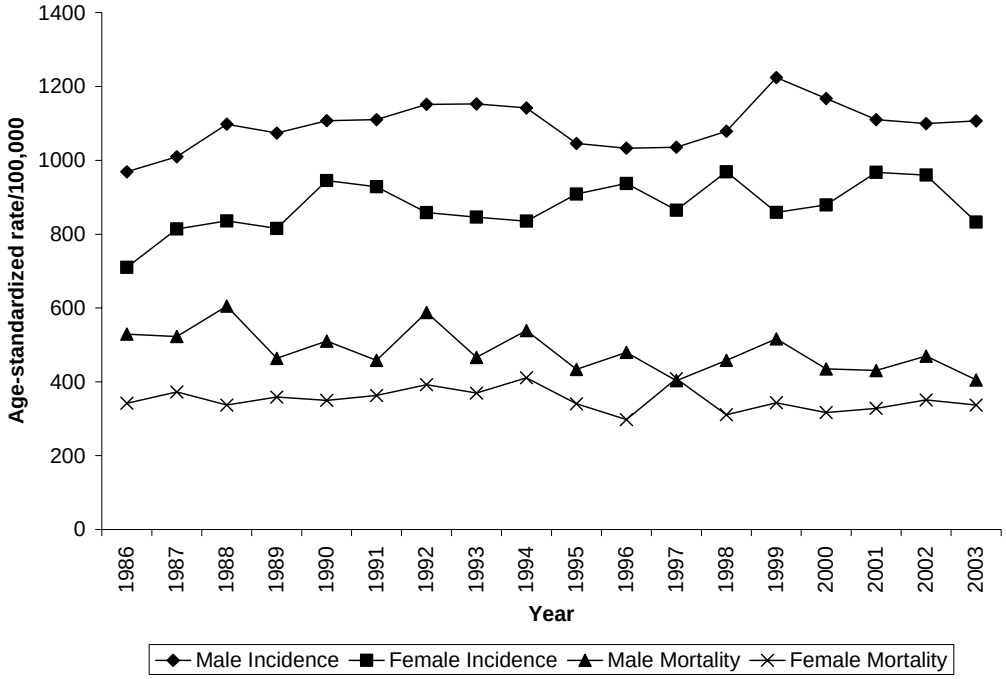
Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 29 b. Temporal trends of age group 20-49 in Ontario (1986-2003)



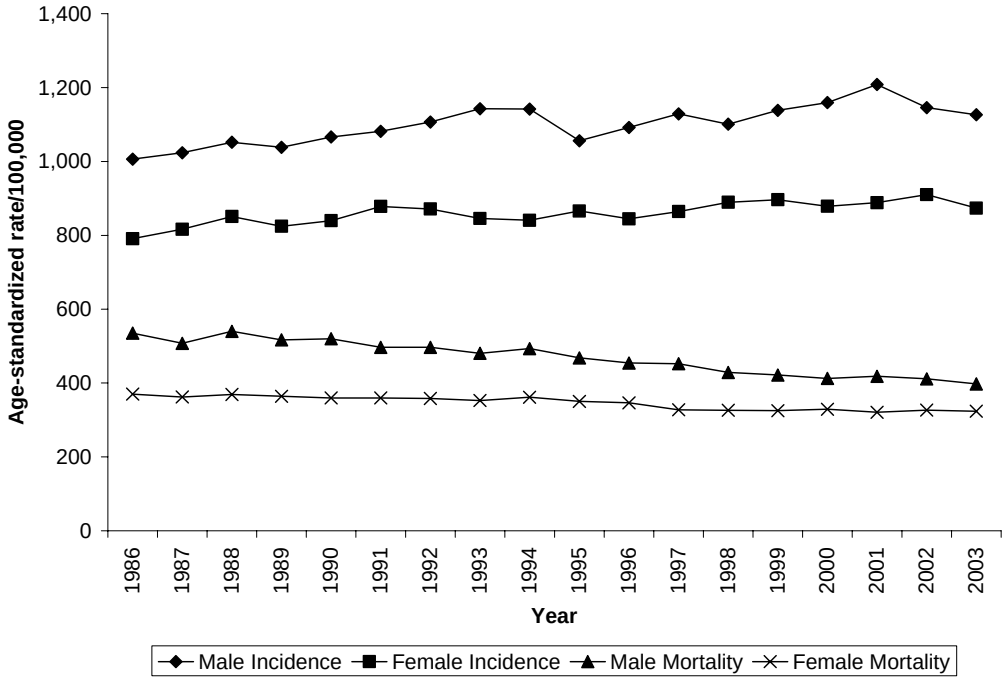
Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 30 a. Temporal trends of age group 50-69 in the Niagara Region (1986-2003)



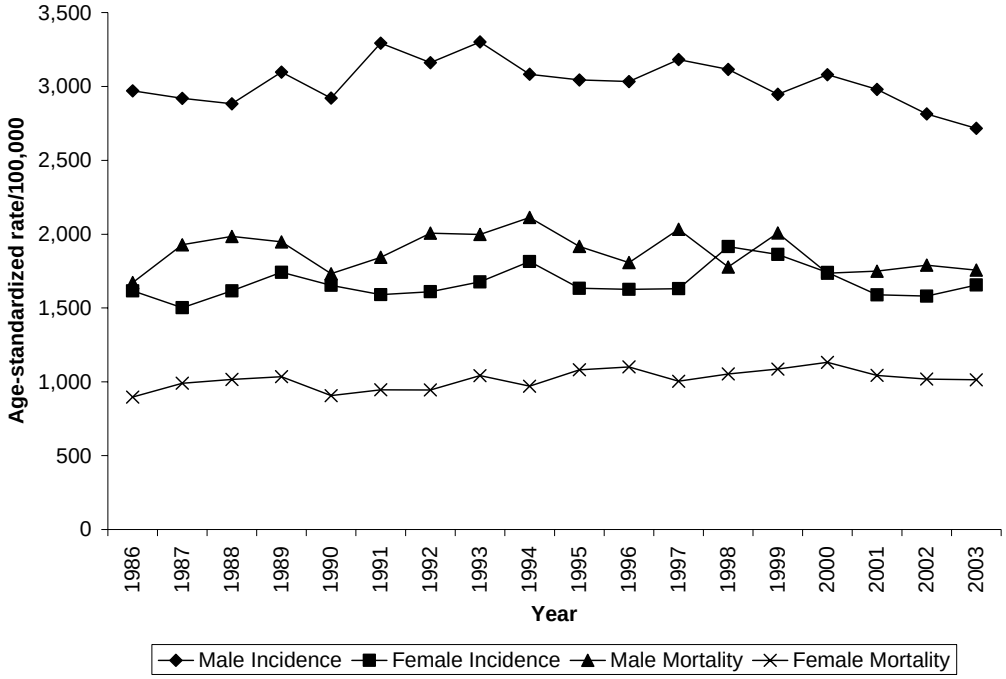
Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 30 b. Temporal trends of age group 50-69 in Ontario (1986-2003)



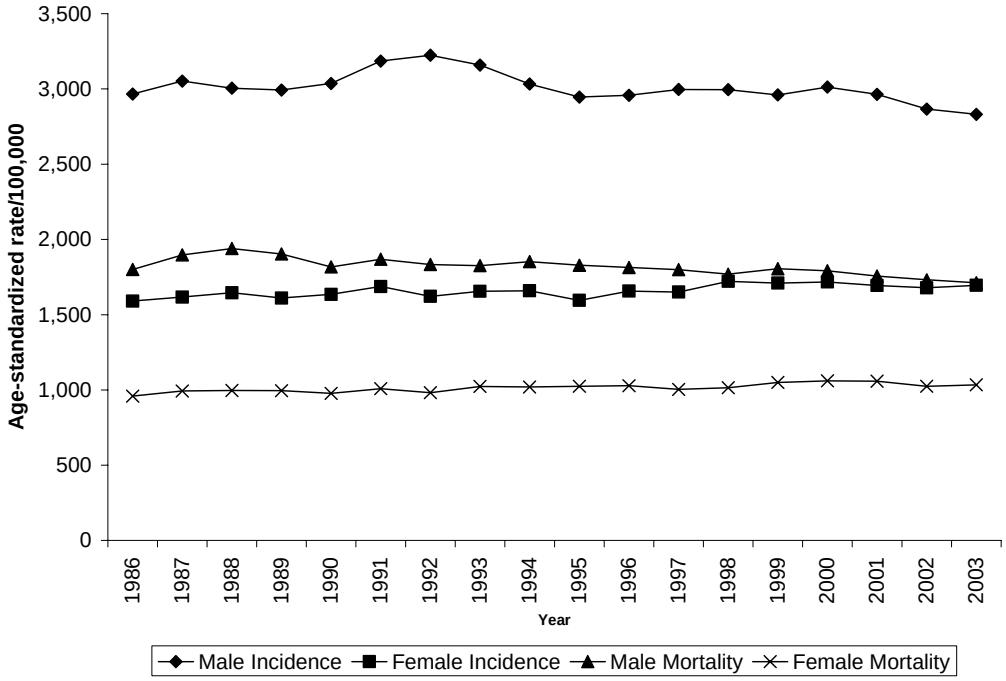
Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 31 a. Temporal trends of age group 70+ in the Niagara Region (1986-2003)



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

Figure 31 b. Temporal trends of age group 70+ in Ontario (1986-2003)



Data Source: *SEERStat, 2006* *Rates Standardized to 1991 Canadian Population*

F. Potential Years of Life Lost Due to Cancer

Cancer is the leading cause of Potential Years of Life Lost (PYLL) for both men and women accounting for 35% of the total PYLLs (Figure 32).

Premature mortality is higher for cancers that are common, begin earlier in life, and have a poor prognosis (a death to case ratio greater than 50%). The three main cancers in women (lung, breast and colorectal) comprise 50% of PYLLs due to cancer (Table 3). The years of life lost from lung and breast cancers reflect the relatively young age at which women die of breast cancer and the high mortality rates of lung cancer among women within the region.

Among men, lung cancer was responsible for almost one third of PYLLs. Despite the high incidence of prostate cancer, the years of life lost encompass only 5% of all PYLLs from cancer (Table 3). Although Non-Hodgkin's Lymphoma incidence and mortality rates have remained the same between 1979-2001 and 1986-2003, PYLLs have nearly decreased by half (7% to 4%) from 1999 to 2002.

Table 3. Potential Years of Life Lost[1]

	Male PYLLs	%	Female PYLLs	%
All Causes	11920		7694	
All Cancers	3565	100.0	3412	100.0
Lung	1132	31.8	882	25.8
Breast	-	-	542	15.9
Colorectal	386	10.8	271	7.9
Ovary	-	-	241	7.1
Cervix	-	-	168	4.9
Non-Hodgkins Lymphoma	145	4.1	150	4.4
Melanoma	91	2.6	110	3.2
Pancreas	126	3.5	89	2.6
Leukaemia	73	2.0	69	2.0
Bladder	121	3.4	46	1.3
Stomach	42	1.2	34	1.0
Kidney	106	3.0	32	0.9
Oral Cavity	127	3.6	26	0.8
Uterus	-	-	11	0.3
Prostate	176	4.9	-	-
Hodgkin's Lymphoma	*	*	*	*

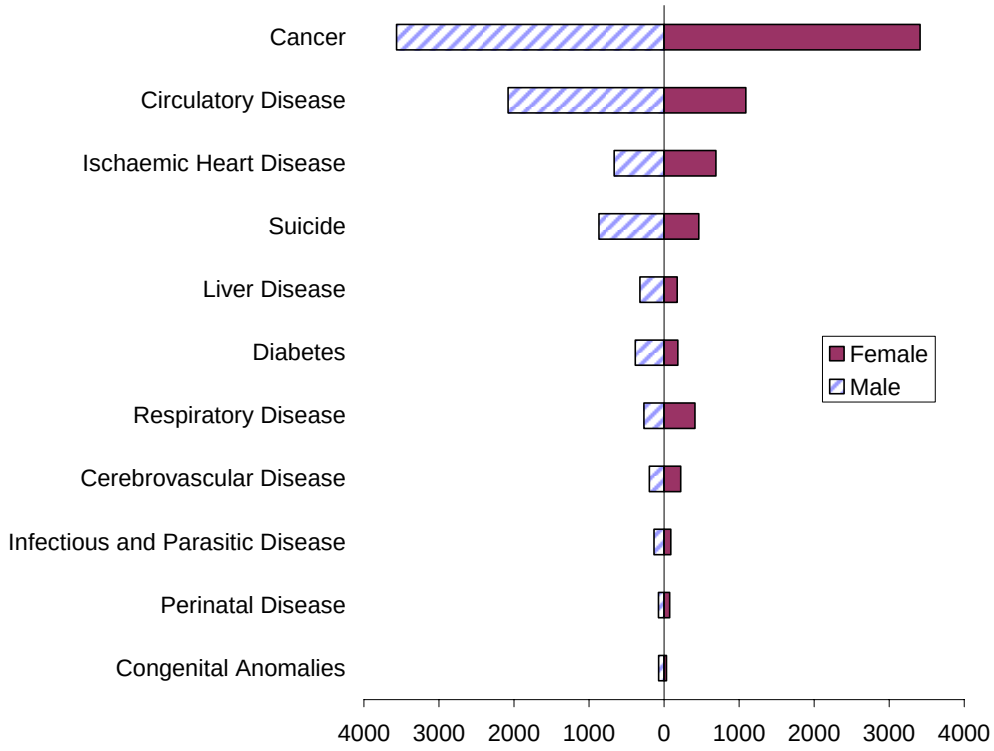
[1] Calculation based on deaths before 75 years

Data source: *PHPD, 1999*

- Not applicable

* No lives lost

Figure 32. Potential Years of Life Lost in 2002 by Cause



Data Source: *PHPD, 2002*

Cancer is the leading cause of premature deaths in the Niagara Region, responsible for approximately 36% of all early deaths. Regional age-adjusted incidence and mortality rate have remained relatively stable over the last 2 decades, but it is the total number of new cases and deaths that directly impact the burden on the health care system. As the size and average age of the population in the Niagara Region increases, there will be a parallel increase in burden of illness.

The most common cancers in the Region in men are prostate, colorectal, and lung. Breast cancer, in addition to colorectal and lung, are the most frequent cancers afflicting women. While the mortality rates of prostate cancer, breast cancer, and colorectal cancers have been decreasing since 1986, the incidence of breast and lung cancer in women and prostate cancer in men is on the rise. Incidence rates of colorectal cancer remain unchanged for both men and women.

For many individual cancers, epidemiologic studies demonstrate that the prevention of cancer, that is, the reduction of mortality via a decrease in incidence, can be achieved through lifestyle modification. Risk reduction includes alterations in diet, reduction/elimination of tobacco use, modification of alcohol consumption and increased physical activity. Considering that over 50% of Niagara respondents (RRFSS, 2006) are either overweight or obese and almost a quarter of them smoke daily (RRFSS, 2006), behavioural interventions alone have the potential to mitigate the incidence of cancer in the Niagara Region.

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DESCRIPTION OF ACRONYMS

AAPC	Average Annual Percentage Change
ASIR	Age-Standardized Incidence Rate
ASMR	Age-Standardized Mortality Rate
CCO	Cancer Care Ontario
DCO	Death Certificate Only
ICD9	International Classification of Diseases version 9
OCTRF	Ontario Cancer Treatment and Research Foundation
OCI	Ontario Cancer Institute
OCR	Ontario Cancer Registry
PMH	Princess Margaret Hospital
PYLL	Potential Years of Life Lost
RCC	Regional Cancer Centres
RN	Regional Niagara
SEERStat	Surveillance, Epidemiology, and End Results (Statistics)
TURP	Trans-Urethral Resection

Appendix I International Classification of Disease

Table 1: ICD 9 Cancer codes

Site	ICD-9
Oral (buccal cavity and pharynx)	**140 – 149**
Lip	140
Tongue	141
Salivary Gland	142
Floor of Mouth	144
Pharynx	146,147,148
Other and Unspecified	143,145,149
Digestive organs	**150-159**
Esophagus	150
Stomach	151
Small Intestine	152
Large Intestine	153
Rectum	154
Liver and Billary Passages	155, 156
Pancreas	157
Other and Unspecified	158, 159
Respiratory system	**160-165**
Larynx	161
Lung	162
Other and Unspecified	160,163,164,165
Bone tissue and skin	**170-172**
Bone	170
Connective Tissue	171
Skin (melanoma)	172
Breast	**174-175**
Genital organs	**179-187**
Cervix	180
Body of Uterus	182
Ovary	183
Prostate	185
Other & Unspecified	179,181,184,186,187
Urinary glands	**188-189**
Bladder	188
Kidney and other urinary	189
Eye	**190**
Brain and central nervous system	**191-192**
Endocrine glands	**193-194**
Thyroid	193
Other Endocrine	194
Leukemia	**204-208**
Other blood and lymph tissues	**200 - 203**
Hodgkin's Disease	201
Multiple Myeloma	203
Non-Hodgkins Lymphoma	200, 202
All other and unspecified sites	**195-199**

Note: ICD-9 refers to the Ninth Revision of the International Classification of Diseases. Figures exclude non-melanoma skin cancer (ICD-9 173). Further information is available at: http://www.hc-sc.gc.ca/hpb/lcdc/webmap (select cancer button)
Data Source: Cancer Bureau, CCDPC, Health Canada

Table 2: ICD 10 Cancer codes

Site	ICD-10
Lip, Oral Cavity and Pharynx	**C00-C14**
Lip	C00
Tongue	C01-C02
Gum	C03
Floor of Mouth	C04
Palate	C05
Mouth - unspecified	C06, C14
Parotid Gland	C07
Salivary Glands	C08
Tonsil	C09
Oropharynx	C10
Nasopharynx	C11
Sinus	C12
Hypopharynx	C13
Digestive Organs	**C15-C26**
Oesophagus	C15
Stomach	C16
Small Intestine	C17
Colorectal	C18-C21
Liver	C22
Gallbladder	C23
Biliary - other	C24
Pancreas	C25
Digestive Organs - other	C26
Respiratory and Intrathoracic Organs	**C30-C39**
Nasal Cavity	C30
Accessory Sinus	C31
Larynx	C32
Trachea	C33
Bronchus and Lung	C34
Thymus	C37
Heart	C38
Respitory System - other	C39
Bone and Articular Cartilage	**C40-C41**
Bone, Articular Cartilage of Limbs	C40
Bone - other	C41
Melanoma of the Skin	C43
Skin - other	C44
Mesothelial and Soft Tissue	**C45-C49**
Mesothelioma	C45
Kaposi's Sarcoma	C46
Peripheral Nerves and Automoic Nervous System	C47
Retroperitoneum and Peritoneum	C48
Connective and Soft Tissue	C49
Breast	C50
Female Genital Organs	**C51-C58**
Vulva	C51
Vagina	C52
Cervix Uteri	C53
Corpus Uteri	C54
Uterus - unspecified	C55
Ovary	C56
Site	ICD-10
Female Genital Organs - unspecified	C57
Placenta	C58
Male Genital Organs	**C60-C63**

Penis	C60
Prostate	C61
Testis	C62
Male Genital Organs - unspecified	C63
Urinary Organs	**C64-C68**
Kidney	C64
Renal Pelvis	C65
Ureter	C66
Bladder	C67
Urinary Organs - unspecified	C68
Eye, Brain and other parts of Central Nervous System	**C69-C72**
Meninges	C71
Spinal Cord, Cranial Nervs and other parts of cns	C72
Thyroid and other Endocrine Glands	**C73-C75**
Thyroid	C73
Adrenal	C74
Other Endocrine Glands and related structures	C75
ill-defined, secondary and unspecified sites	**C76-C80**
ill-defined sites	C76
Secondary and unspecified malignant neoplasm of lymph nodes	C77
Secondary malignant neoplasm of respiratory and digestive organs	C78
Secondary malignant neoplasm of other sites	C79
Lymphoid, Haematopoietic and related tissue	**C81-C96**
Hodgkin's disease	C81
Follicular [nodular] non-Hodgkin's lymphoma	C82
Diffuse non-Hodgkin's lymphoma	C83
Peripheral and cutaneous T-cell lymphomas	C84
Other and unspecified types of non-Hodgkin's lymphoma	C85
Malignant immunoproliferative diseases	C88
Multiple myeloma and malignant plasma cell neoplasms	C90
Malignant neoplasms of independent (primary) multiple sites	C97
In situ neoplasms	D00-D09
Benign neoplasms	D10-D36
Neoplasms of uncertain or unknown behaviour	D37-D48

Note: ICD-10 refers to the Tenth Revision of the International Classification of Diseases. Further information is available at: http://www.who.int/classifications/apps/icd/icd10online/
Data Source: Cancer Bureau, Health Canada, WHO

Appendix II: Actual Data for New Cases and Deaths

Table 1. Temporal Trends in Incidence for All Cancers

	Males		Females	
Year	Rate	Count	Rate	Count
1986	443.7	831	320.0	739
1987	439.0	843	330.9	783
1988	458.5	902	334.9	811
1989	461.8	932	352.2	869
1990	459.6	960	371.6	933
1991	496.6	1,049	355.6	913
1992	484.3	1,055	352.4	926
1993	493.2	1,093	347.3	929
1994	484.6	1,087	347.7	964
1995	457.0	1,051	353.9	975
1996	453.1	1,054	363.1	1,011
1997	467.2	1,115	342.6	985
1998	470.7	1,148	400.8	1,167
1999	487.8	1,207	382.2	1,124
2000	482.5	1,227	366.7	1,101
2001	464.4	1,207	358.8	1,087
2002	456.0	1,203	358.6	1,095
2003	452.8	1,208	345.1	1,089

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 2. Temporal Trends in Mortality for All Cancers

	Males		Females	
Year	Rate	Count	Rate	Count
1986	233.6	438	151.3	359
1987	251.1	475	161.6	396
1988	270.8	529	150.8	384
1989	240.4	471	159.1	410
1990	233	480	146.7	389
1991	233.4	485	151.8	411
1992	266.1	575	161	444
1993	243.9	536	164.5	463
1994	267.3	587	156.7	456
1995	233.7	527	159.7	473
1996	229.4	532	153.1	471
1997	235.4	558	156.5	483
1998	221.8	543	152.9	485
1999	258.1	641	159.7	520
2000	215.2	553	159.6	532
2001	220.4	574	152.1	514
2002	228.3	618	151.6	519
2003	216	593	150.3	528

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 1. Prostate Cancer

Year	ASIR	ASMR
1986	79.6	26.7
1987	90.1	38.5
1988	81.3	33.3
1989	84.7	31.4
1990	108.2	25.3
1991	126.9	27.9
1992	126.1	28.2
1993	130.4	34.2
1994	117.6	40.6
1995	109.6	24.4
1996	110.6	38.1
1997	124.2	30.6
1998	123	28.9
1999	127.3	26
2000	122.5	29.1
2001	137.4	31.1
2002	115.6	28.5
2003	118.7	24.8

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 2. Breast Cancer

Year	ASIR	ASMR
1986	82.4	33.6
1987	89.5	37.1
1988	91.8	32.4
1989	113.3	32.9
1990	112.5	30.9
1991	100.2	30
1992	103.4	34.2
1993	99.4	32.6
1994	99	34.5
1995	100.9	38.1
1996	102.1	27.9
1997	105.2	31.8
1998	117.6	27.8
1999	107.6	27.7
2000	103.9	28.6
2001	102.5	26.4
2002	102.9	23.4
2003	93.1	27.2

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 3. Lung Cancer

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	88.8	70.7	35.6	31.8
1987	77	80.2	33.7	27.3
1988	90	86	36.7	28.4
1989	89.7	70.7	37	28.4
1990	85.4	75.9	37.9	29.2
1991	96.2	68.1	43	32.7
1992	86.2	95.7	47.2	35.7
1993	87.5	72.8	44.8	38.9
1994	86.6	78.1	39.3	34.5
1995	76.8	65.3	44.4	29.7
1996	77.8	59.8	46.1	33.3
1997	72.8	62.1	35.1	24.6
1998	82.4	69.3	58.5	38.5
1999	77	78.6	41.6	37
2000	80.5	52.8	46.9	37.9
2001	62.6	54.9	42.2	32.3
2002	73.1	62.5	48	35.7
2003	61.6	58.4	39.8	33

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 4. Female Reproductive Cancers

	Uterus		Ovaries		Cervix	
Year	ASIR	ASMR	ASIR	ASMR	ASIR	ASMR
1986	19.8	2.8	9.1	5.3	10.6	^
1987	23.8	4.7	13.2	6.6	11.8	4
1988	19.6	4	14.1	6.4	8.3	2.5
1989	19.6	3.5	9.3	7.4	9.4	6.2
1990	28.8	1.7	14.9	7.7	13.6	2.8
1991	22.2	^	11.7	6.4	12	2.9
1992	21.1	^	11.1	8.7	7.6	1.9
1993	20.8	^	15.7	5.8	10.5	3.8
1994	30.4	2.6	14.1	8.7	12.5	2.1
1995	22.3	^	13.3	8.4	9.6	2.6
1996	23.6	2.4	12	9.8	10.8	1.9
1997	22.2	1.8	13.4	7.8	11.2	2.6
1998	21	^	16.8	9.5	12	2.8
1999	23.4	^	12	5.6	11.3	2.3
2000	22.6	2.6	13.6	11.5	7.1	2.7
2001	21.8	2.1	11.2	7.1	9.1	1.7
2002	27.1	2	13.1	7.9	6.5	2.4
2003	17.7	3.1	19.6	6.4	11	^

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006
^ Insufficient data to calculate rates

Table 5. Cancers of the Oral Cavity

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	12.4	6.6	7.1	^
1987	14.1	5.3	3.2	2.8
1988	13.7	6.1	5.5	^
1989	16.7	4.6	5.6	^
1990	15	5.9	7	1.9
1991	15	7.9	3.9	1.8
1992	14.3	8.1	6.3	2.8
1993	15.3	5.5	3.3	^
1994	13.3	5.5	2.9	^
1995	16.8	7.5	5.4	^
1996	14.5	4	5.3	1.6
1997	11.6	4	5.5	1.4
1998	12.1	5	5.3	^
1999	12.5	7.6	6.7	2.2
2000	10.6	4.7	3.7	1.5
2001	9.1	7.1	4.5	1.4
2002	11.4	5.5	4.7	^
2003	9.2	4	4.3	1.8

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006
^ Insufficient data to calculate rates

Table 6. Cancer of the Pancreas

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	11.7	9.7	11	8
1987	11	11.7	7.5	7.3
1988	8.1	11.2	9	7
1989	10.2	6.4	7	7.8
1990	11.5	10.2	4.7	6.1
1991	8.1	9.7	12.8	9.3
1992	11.6	11.6	6.5	7.6
1993	11.8	11.4	8.3	6.9
1994	12.1	15.9	6.3	7.9
1995	7.4	8.8	7.3	8.5
1996	12.3	10.3	7	4.8
1997	10.3	9	8.8	11.7
1998	6.5	7.4	7.1	4.7
1999	10.6	9.7	9.3	10.5
2000	13.3	13.1	9.6	7.4
2001	9.1	10.7	7.5	7.4
2002	8.3	10	6.4	7.7
2003	7.9	7.8	6.5	5.3

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 7. Cancer of the Stomach

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	13.6	11.8	8.3	6.2
1987	16.5	15.7	7.2	5.4
1988	14.6	8.6	6.7	5.7
1989	15.2	10.8	8.5	7.3
1990	15.4	8.8	8	3.9
1991	13.8	10.1	5	4.7
1992	16.1	13.5	7.4	4.1
1993	17	7.4	3.1	5
1994	13.5	8.1	7.3	3
1995	18.3	11.6	3.1	4.9
1996	14.5	10.4	6.2	3
1997	12	11.1	3.8	3.8
1998	11.7	5.4	3.6	1.3
1999	12.2	9.9	6	5.8
2000	13.2	9.8	5.9	3.6
2001	9	6	3.4	3.4
2002	9.5	6.9	4.6	2.4
2003	9.8	7.9	3.7	2.2

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 8: Colorectal Cancer

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	70.2	36.9	37	16.6
1987	61.7	28.4	35.4	16.3
1988	64	33.3	39.9	14.7
1989	63.1	32.7	42.8	18
1990	64.2	26.6	36.1	13.3
1991	57.4	29.6	40.2	16.5
1992	68	22.6	44.1	18.5
1993	67.2	30.5	40.8	16.2
1994	63.5	24.7	47.8	14.1
1995	54.9	27.2	48.5	16.9
1996	66.5	24.2	38.8	16.1
1997	59.3	26.6	39.8	17.3
1998	61.1	25.3	42.2	16.7
1999	65.9	29.8	46.4	14.6
2000	63.3	21.6	39.5	15.8
2001	60.5	25	40.8	17.4
2002	66.2	26.3	37.6	15.2
2003	59.3	25.5	35.7	13

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 9. Kidney Cancer

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	11.6	7.1	6.2	3.7
1987	14	5.7	10.6	3.5
1988	14.1	8.6	7.3	5.3
1989	11.7	4.5	6.1	^
1990	15.7	4.7	6.7	3.8
1991	13.3	5.3	6.6	2.1
1992	13.6	5.3	6.8	3.8
1993	13.4	6	8.6	1.7
1994	14.2	6.2	5.9	1.9
1995	13.8	5.6	7.6	3.2
1996	9	5.7	6	3.7
1997	15	5.9	6	3.4
1998	11.4	5.9	10.9	2.9
1999	15.3	5.2	6.9	2.3
2000	18.4	3.2	8.9	3
2001	17.1	6	9.7	3
2002	19.8	5.3	7.8	3.2
2003	22.1	9.3	8.5	2.1

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006
^ Insufficient data to calculate rates

Table 10. Cancer of the Bladder

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	38	^	8	2.5
1987	30.7	11.3	9.2	3.3
1988	39.3	12.2	7.9	3.3
1989	36.2	9.4	5.1	2.4
1990	13.2	8.3	4.6	1.7
1991	21	8.1	6.4	^
1992	17.9	7.7	5.1	1.6
1993	25.2	7	6.4	^
1994	22.5	8.5	4.2	1.8
1995	20.8	9.2	5.1	1.8
1996	20.3	5.7	7.8	2.6
1997	27.9	4.2	4.6	2.1
1998	26.1	6.9	6.2	2.3
1999	26.7	8.4	8.4	2.6
2000	23.3	9.2	6.5	2
2001	22.8	5.5	4.8	2.9
2002	20.3	7.8	6.6	3.4
2003	24.1	7.5	6.5	2.3

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006
^ Insufficient data to calculate rates

Table 11. Endocrine Glands (Thyroid)*

Year	Males and Females
	ASIR
1986	1.8
1987	2.3
1988	2.4
1989	2.9
1990	2.4
1991	3.1
1992	2
1993	3.2
1994	3.2
1995	3.1
1996	3.8
1997	3.2
1998	4.5
1999	4.6
2000	5.5
2001	7.1
2002	8.6
2003	7.2

*Incidence rates are combined and Mortality rates for both sexes are suppressed due to small numbers
Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 12: Leukaemia

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	20.3	13.3	9	5.3
1987	22.4	9.9	11.5	4.5
1988	17.2	12.8	13	5.8
1989	18.7	10.4	10.6	5.4
1990	17.7	9.7	11.9	3.1
1991	18.3	10.3	10.4	5.8
1992	10.3	6.8	9.9	5.2
1993	16.3	8.3	6.5	5.7
1994	11.1	8.9	8.4	4
1995	13.7	10.1	8.6	3
1996	17.4	7.9	13.1	6.2
1997	17.7	8.3	9	5
1998	8.8	9.2	12.2	2.6
1999	12.9	8.3	9.8	5.7
2000	15.5	8.3	7.8	3.8
2001	8.5	6.9	8.9	4.4
2002	17.5	7.6	11.1	4.6
2003	17.3	8.6	13.3	7.9

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006

Table 13: Hodgkin's Disease*

	Males	Females
Year	ASIR	ASIR
1986	2.6	5.1
1987	2.4	2.9
1988	^	4.1
1989	3.2	^
1990	2.7	3.8
1991	4	2.7
1992	4.6	^
1993	4.4	2.7
1994	4.2	^
1995	2.5	2.6
1996	3.2	4.2
1997	^	^
1998	4.4	^
1999	2.6	3.4
2000	4.1	^
2001	4.4	2.9
2002	^	2.7
2003	4.8	2.1

*Mortality rates for both sexes are suppressed due to small numbers
Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006
^ Insufficient data to calculate rates

Table 14. Non-Hodgkin's Disease

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	14	6.8	8.9	2.9
1987	17	7.4	13	5.4
1988	14.6	5.2	9.6	4.3
1989	20.2	5	16	5.4
1990	19.5	7.6	19.6	5.2
1991	19.1	6.4	13.1	4.7
1992	17.7	8.2	14.2	6.1
1993	16.5	8.7	14	6.4
1994	18	10	12.2	9
1995	19.8	12.5	11	3.4
1996	21.9	6.7	12.6	3.9
1997	24.3	9.4	18.1	7.3
1998	19.5	7.3	14.3	6.5
1999	24.7	13	16.6	6
2000	24.3	10.4	16.3	5.2
2001	22.4	9.3	14.5	6.7
2002	18.3	10.7	23	6.6
2003	25.2	6	15.4	8.2

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006
^ Insufficient data to calculate rates

Table 15. Melanoma

	Males		Females	
Year	ASIR	ASMR	ASIR	ASMR
1986	10	2.6	13.9	2.1
1987	12.2	3.1	8.5	3.1
1988	17.3	4.6	10.9	2
1989	15	5.3	14.8	^
1990	13.4	3.9	13.6	^
1991	12.3	3.2	13.1	1.9
1992	18.5	3.1	11.8	2.3
1993	16.5	3.1	14.4	^
1994	19	3.6	8.3	2
1995	17	2.6	12.1	2.9
1996	12.7	5.5	14.6	^
1997	15.3	4.9	13.7	^
1998	17.9	3.6	14.6	2.5
1999	13.9	3.6	15	1.3
2000	12.5	3.8	11.9	2.7
2001	13.8	2.3	12	2.8
2002	12.1	3.5	6.6	1.7
2003	15.4	2.1	10.7	1.4

`

Rates are per 100,000 and age-adjusted to the 1991 Canadian standard.
Source: SEERStat 2006
^ Insufficient data to calculate rates