

CANCER IN ONTARIO: OVERVIEW

A Statistical Report



Cancer Care Ontario

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Disclaimer

Many of the tables and charts in this report contain information derived from the Ontario Cancer Registry. While Cancer Care Ontario makes every effort to ensure the completeness, accuracy and currency of this information at the time of writing this report, this information does change over time as does our interpretation of it.



FOREWORD

I am pleased to provide a foreword to this important first Cancer in Ontario report, a very comprehensive piece of descriptive epidemiology from the Surveillance group within Cancer Care Ontario.

Unlike other diseases in Ontario, we have relatively complete capture of everyone who has cancer. This registration occurs with great care and protection of privacy. Knowing who gets what kind of cancer by age group, what survival looks like, whether mortality is rising or falling, and whether there are more people living with cancer, all assist us in planning, funding, and evaluating our cancer services. Ultimately these data reflect our progress against this disease.

What this work shows us is that many things are hidden in averages. While it is generally true, for example, that men have higher cancer incidence rates than women, a detailed look shows that women have slightly higher rates than men in the 15–50-year-old band. We also see that cancer incidence and survival differ for children, adolescents and young adults, and older adults.

One of the most encouraging things about this report is the important reductions in mortality, although the reduction in men has been more significant than women largely because, in the current era, rates in men started from a higher burden of disease and began falling faster as men began to quit smoking earlier.

Another important feature is the growth in the prevalence of cancer, resulting partly from improved survival. This presents the challenge of appropriate follow-up faced by organized cancer systems, as these patients have unique social and medical support needs over the course of their lifespan.

The real celebration here is that we are seeing improved survival across all age groups. Among the most dramatically improved is prostate cancer, which results at least partly from the bias of identifying slow-growing disease earlier. This leads to genuine controversies as to the benefits of very early detection of what may be slow-growing cancers, raising questions about over-diagnosis and the medicalization of life in patients who may otherwise have lived full lives and died of other causes. Prostate cancer remains, however, a common cause of premature death. We must monitor carefully its rising incidence and target our initiatives in research, prevention, and early detection to distinguish indolent from more aggressive tumours.

Our ability to characterize different patterns of disease, in different cancers, across different cohorts, in terms of incidence, mortality, survival and prevalence, allows Ontarians to have much richer, more articulated and careful planning for cancer control. Surveillance is a key foundational competence on which we will continue to combat this illness in a stepwise fashion. This first report illustrates a mixed picture: we are making good progress for several common cancers, and we need to redouble efforts for those with persistent poor survival.

Terrence Sullivan, PhD
President & CEO
Cancer Care Ontario

HIGHLIGHTS AND IMPLICATIONS

Cancer in Ontario: Overview is the first in a series of Cancer Care Ontario publications designed to provide information on patterns and trends for cancer and risk factors in the Province. This first report provides an overview of the burden of cancer. Future reports will focus on specific topics.

- The number of new cases of cancer in Ontario has been increasing, mostly because of population growth and aging.
- Cancer mortality rates have been declining, and survival improving, for most of the common cancers and in most age groups.
- Prevalence – the number of Ontarians living with a diagnosis of cancer – is increasing, as a result of both increasing numbers of new cases and better survival. People living with a diagnosis of cancer have ongoing needs, which differ over time since diagnosis.
- Over half of new cancers and cancer deaths are attributable to lung, colon and rectum, breast or prostate cancer.
 - » Tobacco use is the primary cause of lung cancer. Incidence patterns differ across sex and age groups and reflect historical smoking trends. Incidence decreased in all male age groups and continued to rise in older women.
 - » Incidence and mortality rates of colon and rectum cancers have been declining; screening has the potential to improve survival and further reduce mortality.
 - » Breast cancer incidence rates have been stable and mortality rates declining; further mortality improvements could result from higher participation in screening.
 - » While reasons for the long-term rise in prostate cancer incidence are not fully understood, the introduction of prostate-specific antigen (PSA) testing has led to additional abrupt rises. The mortality rate has declined steeply.
- Although only 2.3% of cancers occur before age 30, improved survival at these ages means that more young people face major effects on their health and the course of their lives as a result of their cancer.
 - » Thyroid cancer particularly affects young women, in whom incidence has been rising rapidly.

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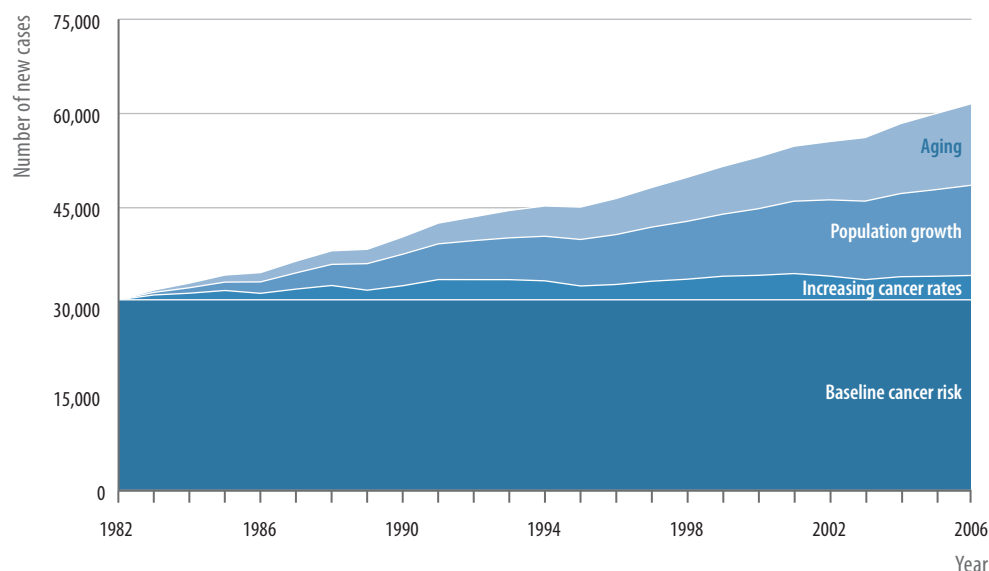
INCIDENCE AND MORTALITY

The number of new cancer cases diagnosed annually in Ontario doubled, from 30,337 in 1982 to 61,178 in 2006 (Figure 1). Population growth, population aging and rising cancer incidence rates all contributed to the increase in the number of new cases.¹

Ontario's population grew from 8.9 million in 1982 to 12.7 million in 2006, accounting for 46% of the increase in cancers.² In 1982, 4% of Ontario's population was aged 65 and older; by 2006, this percentage had increased to 13%. The higher proportion of older people in Ontario accounts for 42% of the increased cases because older people are more likely to develop cancer. Age-specific cancer rates rose slightly in Ontario. This increase in incidence rates contributed 12% to the increase in cases, much smaller than the increase attributed to population aging and population growth.

FIGURE 1

Growth in new cases of cancer, Ontario, 1982–2006



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

Ontario's population is projected to continue growing, reaching 16.9 million in 2031, with nearly 25% of Ontarians aged 65 and over.³ While the number of new cancers will continue to increase due to population growth and aging, effective prevention can slow the rate of increase.

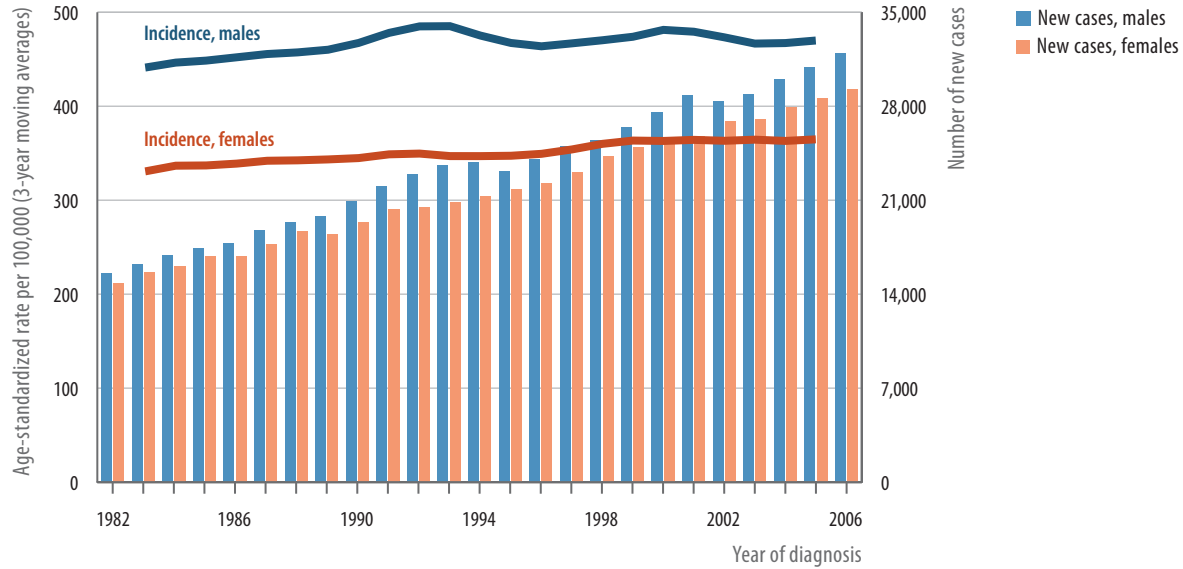
The incidence rate for all cancers in males rose from 433.0 per 100,000 in 1982 to 486.9 in 1992, at an average annual increase of 0.9% (Figure 2). Although the number of new cases continued to rise, incidence rates stabilized, reaching a rate of 471.8 per 100,000 in 2006. Among females, the incidence rate of all cancers combined increased steadily over the 25-year period at 0.4% per year, from 323.7 per 100,000 in 1982 to 365.0 in 2006. (See Glossary for description of terms such as “incidence rate”.)

Trends in incidence rates for all cancers result from the combined impact of differing trends for specific types of cancer, described on pages 18–23.

FIGURE 2

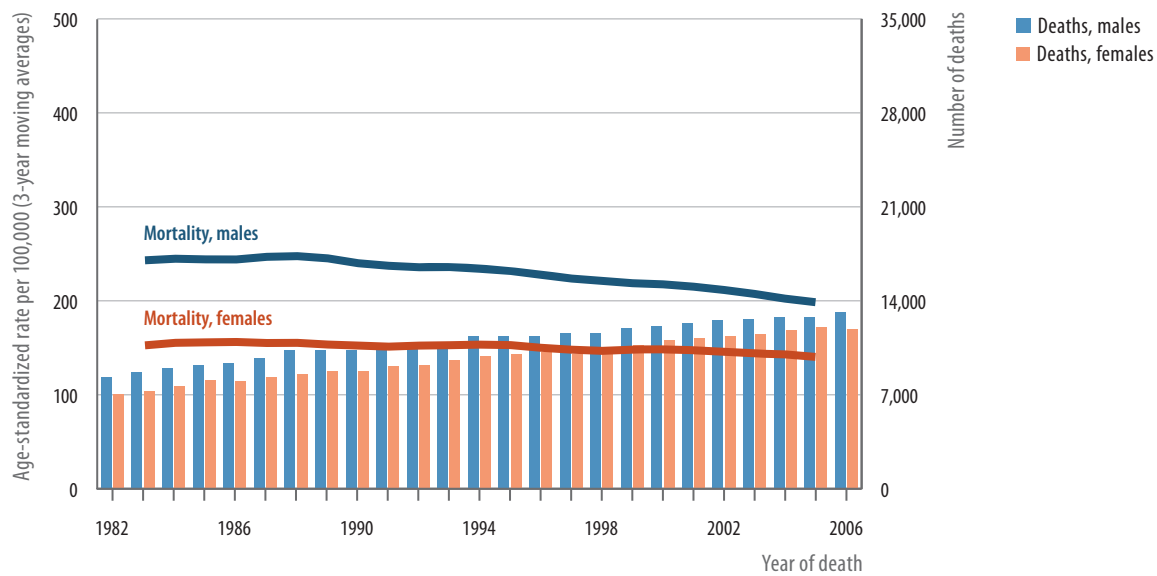
Trends in numbers and rates for all cancers, Ontario, 1982–2006

Number of new cases and incidence rates



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

Number of deaths and mortality rates



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

Cancer mortality in males has been declining since the late 1980s, at 1.1% per year from 1988 to 2001 and at 2.0% per year from 2001 to 2006, from 253.5 per 100,000 in 1988 to 196.1 in 2006 (Figure 2). Female cancer mortality declined slightly, by 0.3% per year from 1982 to 2001 and then 1.4% per year, falling from 151.8 deaths per 100,000 in 1982 to 136.3 in 2006.

Trends in mortality rates for all cancers reflect trends in incidence rates for specific types of cancer, as well as improved treatment and earlier diagnosis for many types of cancer (see pages 18–23).

Despite these substantial declines in mortality rates, the number of deaths grew as a result of the increasing number of new cases.

Most common cancers and cancer deaths

In 2006, 61,178 new cases of cancer and 24,969 deaths from cancer occurred in Ontario (Figures 3 and 4). (Note: These totals exclude basal cell and squamous cell skin cancers, which are not registered in Ontario.)

MOST COMMON CANCERS

Fifty-two percent of new cases were in males (31,954 new cases) and 48% in females (29,224 new cases). In each sex, three body sites accounted for over half of all cancers. Prostate cancer represented 30% of new cancers diagnosed in males, with an estimated 9,617 cases (Figure 3). Lung cancer (4,212 new cases) was the second most common cancer in males, followed by colorectal cancer (4,096 new cases), each accounting for 13% of all male cancers.

The most common cancer diagnosed in females was breast cancer with 7,942 new cases in 2006, accounting for 27% of all female cancers. Lung cancer ranked second in females, with 3,601 new cases (12%), ahead of the 3,398 new cases (12%) of colorectal cancer.

In 2006, non-Hodgkin lymphoma (NHL) was the fourth most common cancer in males (1,390 new cases) and sixth in females (1,202 new cases). Thyroid cancer continues to be more common in females, ranking fourth in females and only fifteenth in males.

MOST COMMON CANCER DEATHS

Fifty-three percent of Ontarian cancer deaths occurred in males (13,124 deaths) and 47% in females (11,845 deaths) during 2006. Lung cancer was the leading cause of cancer death in both sexes, with 3,548 (27%) of cancer deaths in males and 2,822 (24%) in females (Figure 4). Breast cancer accounted for 16% of deaths in females, and colon and rectum cancer for 12%. Pancreatic and ovarian cancer each accounted for 5% of female cancer deaths. Among males, colorectal cancer accounted for 12% of deaths, followed by prostate cancer (11%) and pancreatic cancer (5%).

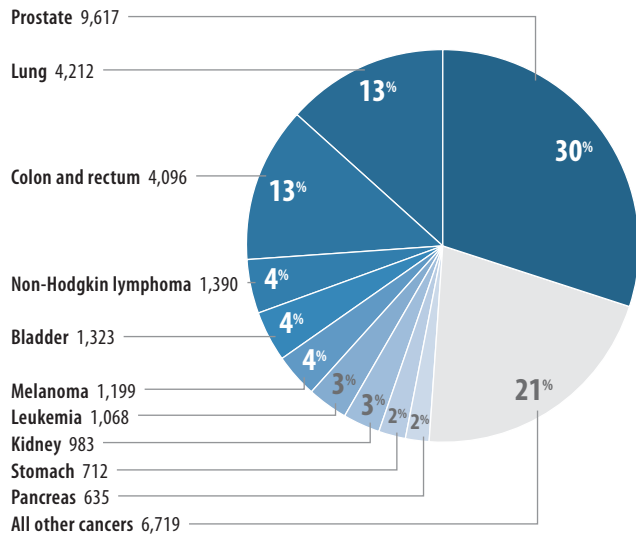
The most common cancers in Ontario are cancers of the prostate, breast, colon and rectum, and lung.

Lung cancer is the leading cause of cancer death in Ontario.

FIGURE 3

Most common cancer diagnoses, Ontario, 2006

Males | N=31,954



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

Females | N=29,224

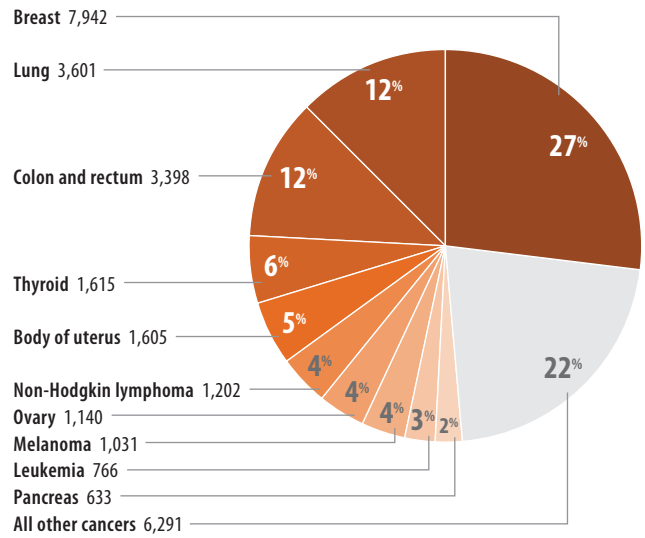
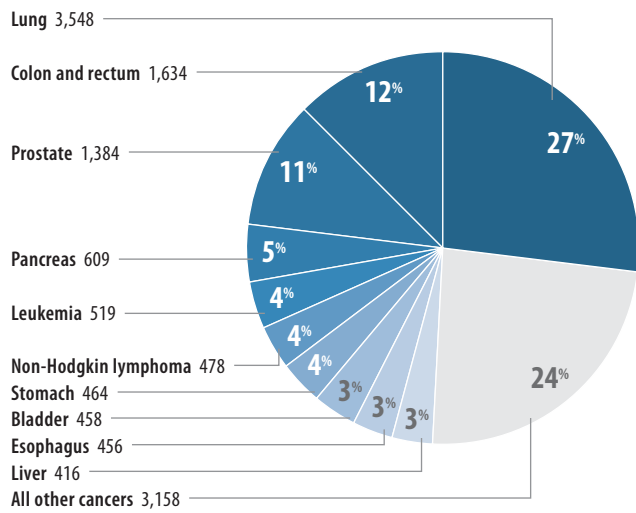


FIGURE 4

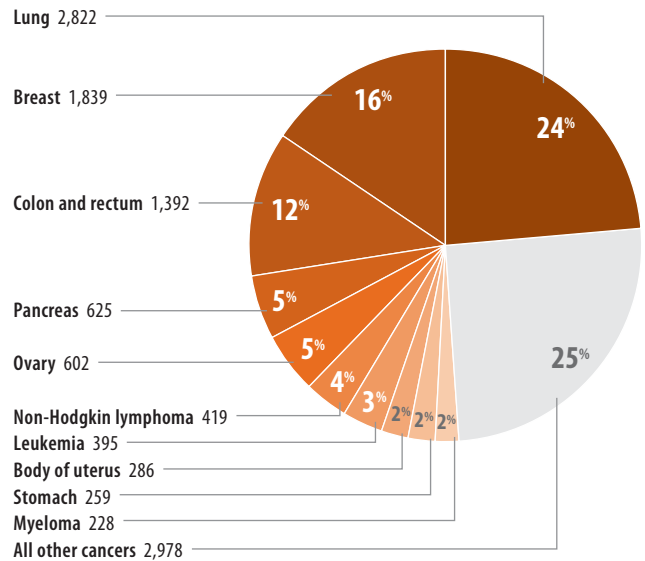
Most common cancer deaths, Ontario, 2006

Males | N=13,124



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

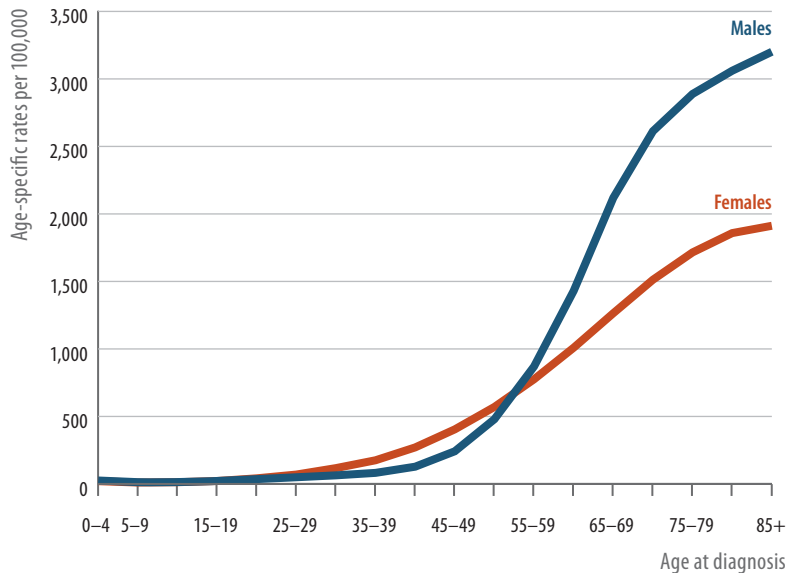
Females | N=11,845



New cases and deaths by age

FIGURE 5

Incidence rates for all cancers, by age, Ontario, 2002–2006



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

AGE-SPECIFIC INCIDENCE RATES

Cancer incidence rates increase with age in both sexes (Figure 5). A crossover soon after age 50, from higher incidence in females to higher rates in males, reflects higher male rates for some cancers common at older ages – colorectal and lung cancer – and high prostate cancer rates.

Breast cancer is the most common cancer in women over 30 and likely explains the higher rates of cancer in women under 50 compared with men at those ages. Young women also have higher rates for some important cancers – thyroid cancer and melanoma – and slightly higher lung cancer rates than young men.

CANCER BY AGE GROUP

Childhood cancers (diagnosed at ages 0–14) accounted for less than 1% of newly diagnosed cases in Ontario in 2006, cancers in adolescents and young adults (aged 15–29) for less than 2% and cancers in adults aged 30–49 for 12% (Figure 6). Most cancers were diagnosed at ages 50–64 (30%) and 65–79 (39%), and 16% were diagnosed among those aged 80 and older.

Deaths due to cancer in Ontarians younger than 50 accounted for just under 6% of all cancer deaths in 2006, while 41% occurred at ages 65–79 and 31% at age 80 and older.

MOST COMMON CANCERS BY AGE GROUP

The most common childhood cancers were leukemia and central nervous system cancers, accounting for half the cancers at ages 0–14 (Figure 7). Lymphomas and neuroblastomas were also among the more common childhood cancers.

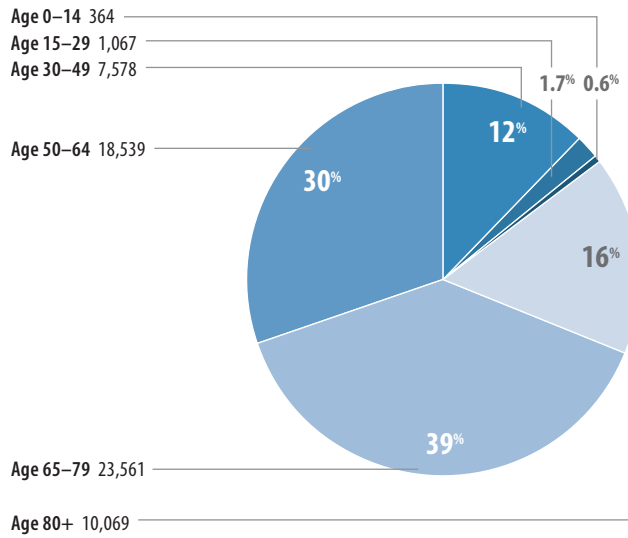
Cancers in adolescents and young adults (aged 15–29) represent a transition between the non-epithelial types common among childhood cancers and the epithelial types common in older adult cancers.

The most common cancer in this age group was thyroid cancer (17%), an epithelial cancer, followed by non-epithelial types: Hodgkin lymphoma, testicular cancer, melanoma (skin and other sites) and NHL. Epithelial cancers are those that arise in cells lining the inside or outside of the body's organs. Non-epithelial cancers arise in other types of cells, such as melanocytes, stem cells and lymphatic tissue.

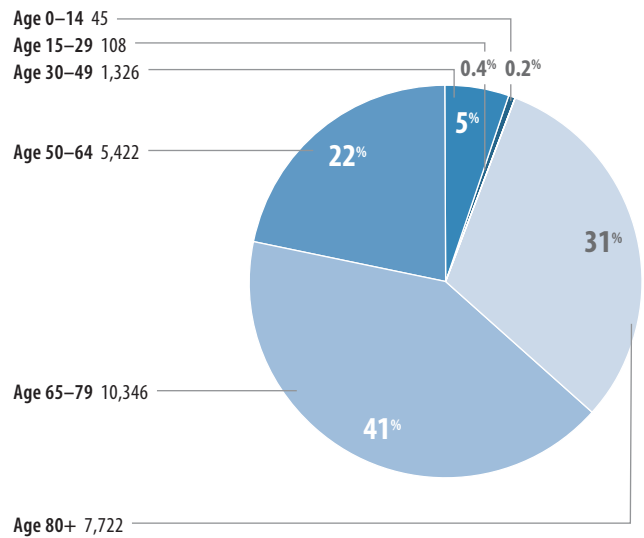
FIGURE 6

Cancer by age group, Ontario, 2006

New cases | N=61,178



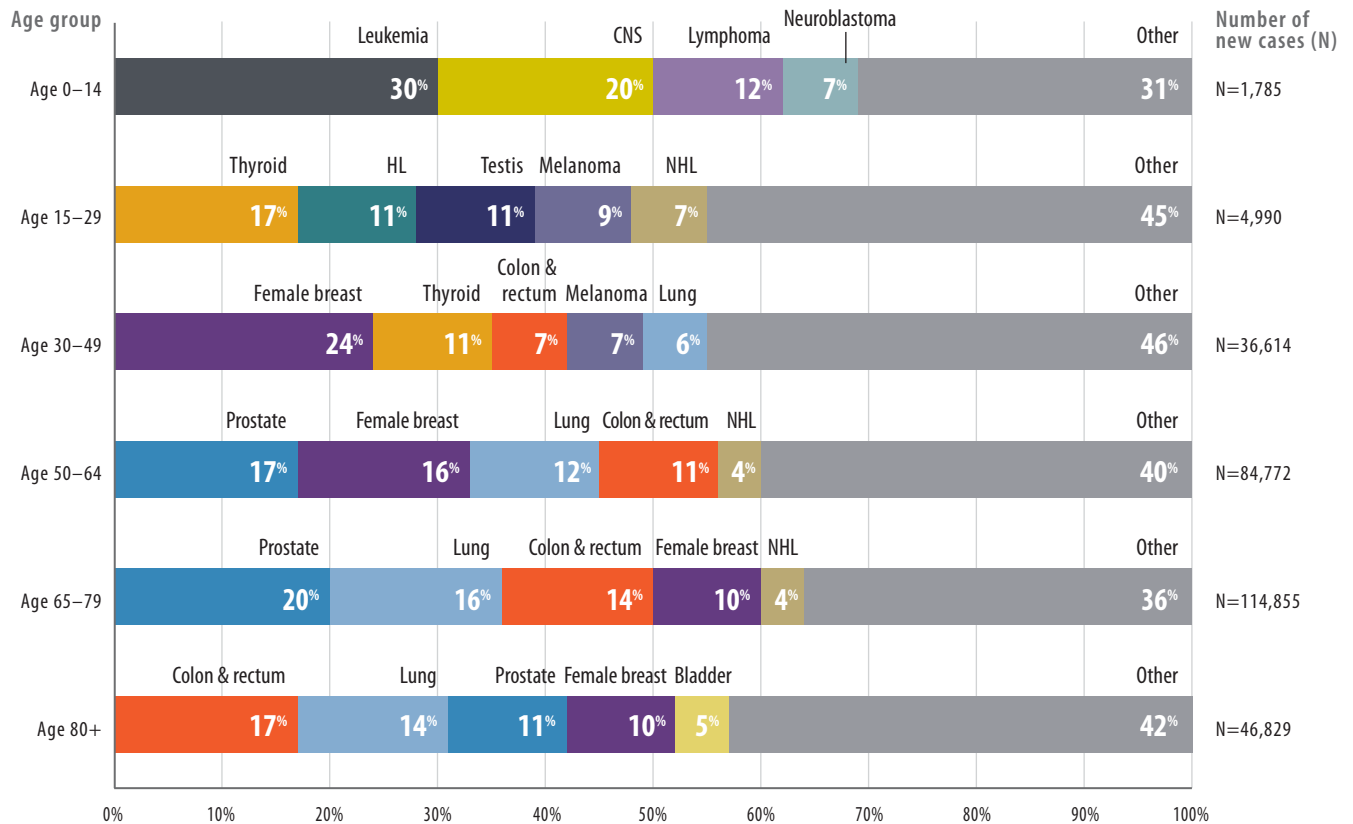
Deaths due to cancer | N=24,969



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

FIGURE 7

Most common cancer diagnoses within age groups, Ontario, 2002-2006



Notes: Cancer definitions may differ for 0-14 and 15-29 compared to older ages.

See Appendix I for cancer definitions.

CNS = Central nervous system, HL = Hodgkin lymphoma, NHL = Non-Hodgkin lymphoma.

Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

Breast cancer was the most common cancer diagnosed at ages 30–49, representing nearly a quarter of the cancers in this age group. Thyroid cancer (11%) and melanoma of skin (7%) continue to be common cancers in this age group, while colorectal and lung cancer represented 7% and 6%, respectively.

Prostate, breast, lung and colorectal cancer were the most common cancers in Ontarians aged 50–64, 65–79 and 80+. Prostate cancer predominated in the 50–64 and 65–79 age groups. Colorectal cancer accounted for a higher proportion of cancers at age 80 and older than in other age groups.

The vast majority of cancers and cancer deaths occur in Ontarians aged 50 and older.

Childhood cancers, and many cancers in adolescents and young adults, are of different types than most adult cancers.

National and international variation in incidence

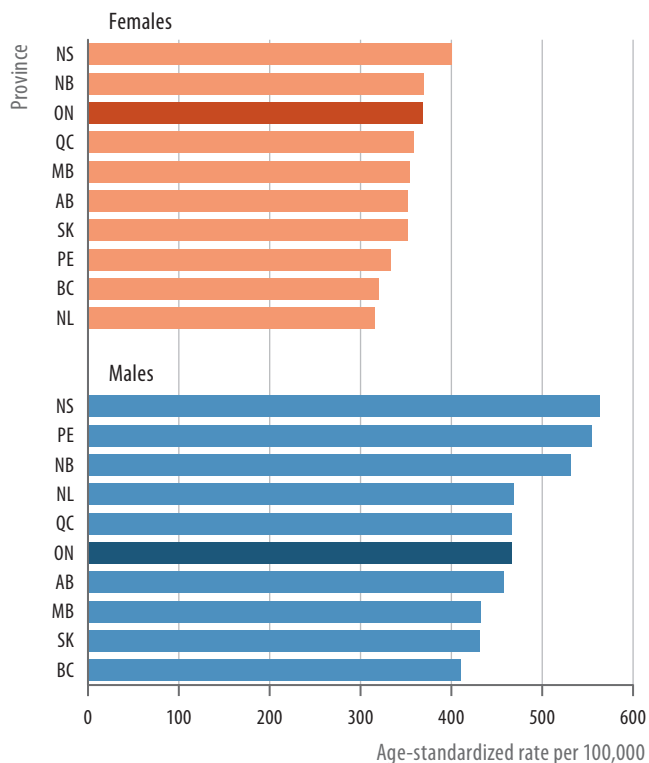
Across Canada, the age-standardized incidence rate (see Glossary) for all cancers was highest in the Maritime Provinces, intermediate in Ontario and lowest in British Columbia (Figure 8). Regional differences in prostate-specific antigen (PSA) testing and smoking rates may explain some of the variation in prostate and lung cancer incidence, respectively.⁴ Rates for some cancers in Quebec and Newfoundland and Labrador may be higher than reported because of under-registration.⁴

Internationally, Ontario's cancer incidence is similar to that of other developed parts of the world while less developed regions tend to have lower rates (Figure 9). Differences in risk factors, screening and cancer registration likely explain international variation. Female lung cancer, for instance, is higher where female smoking has historically been higher – Canada, the US, Australia and China – than in the other jurisdictions shown.

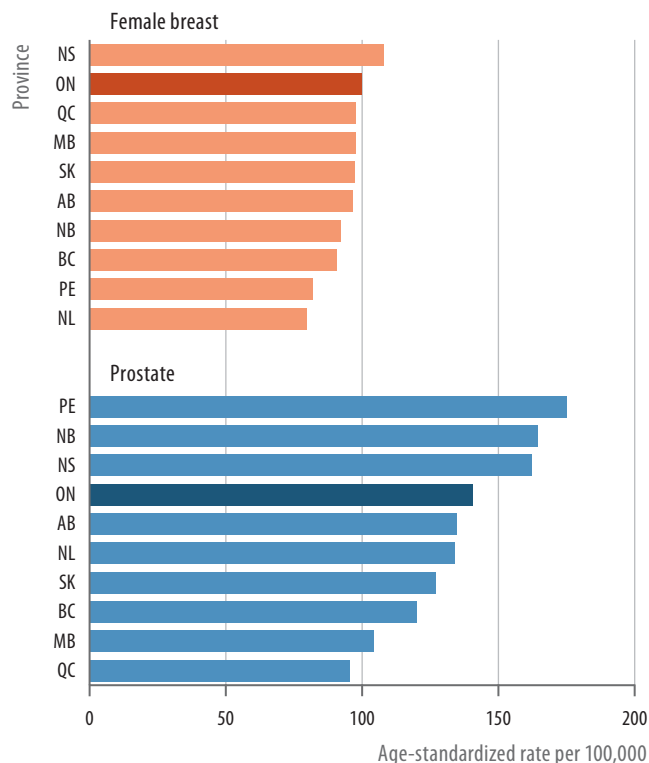
FIGURE 8

Cancer incidence rates by province, 2006

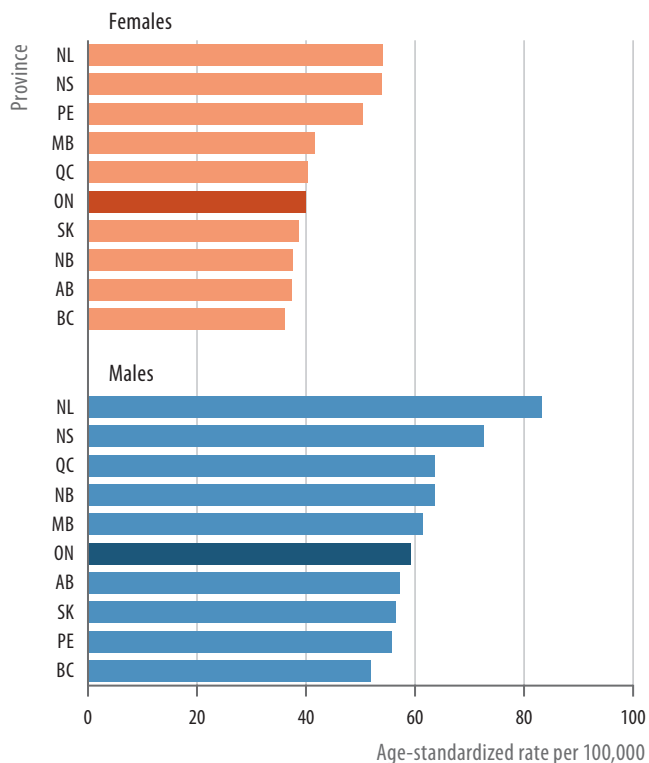
All cancers



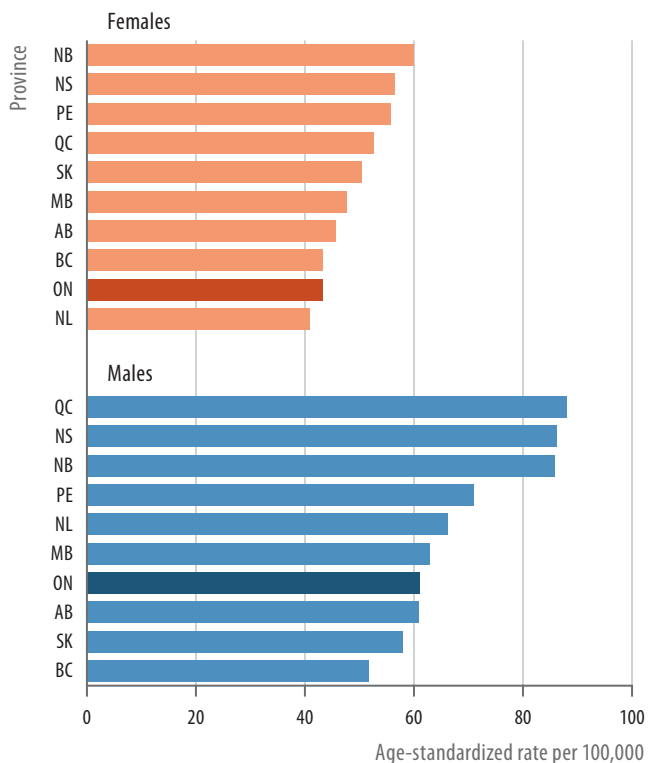
Prostate and female breast cancer



Colon and rectum cancer



Lung cancer



Notes: Rates are age-standardized to the 1991 Canadian population.

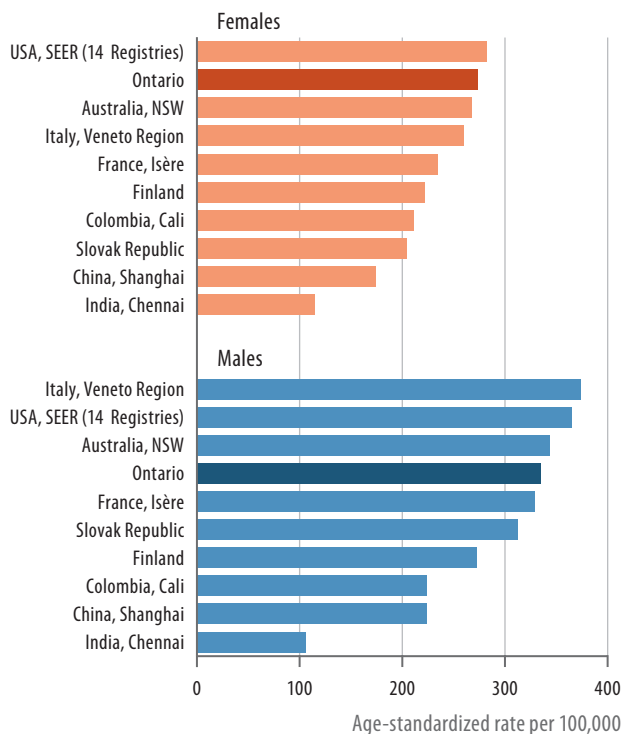
The rate scales differ among the figures, reflecting differing incidence rates.

Source: CANSIM, Statistics Canada, 2009

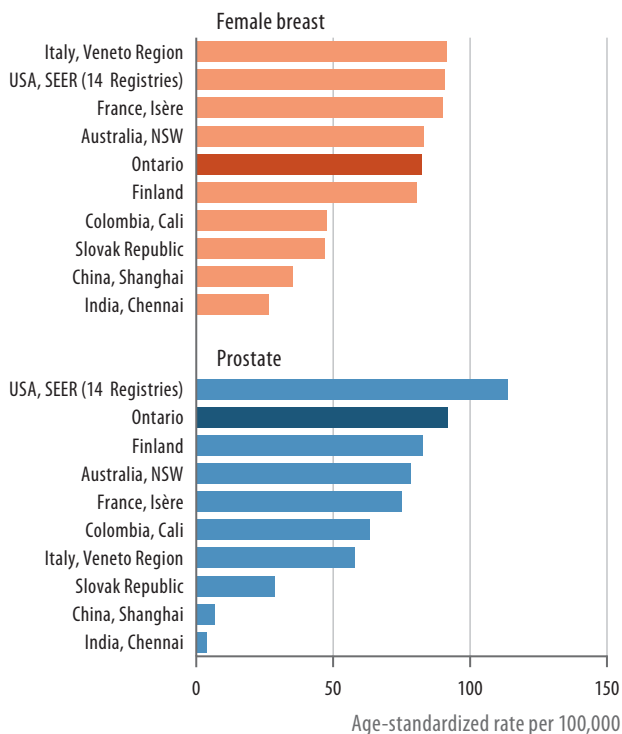
FIGURE 9

Cancer incidence rates for selected international regions, 1998–2002

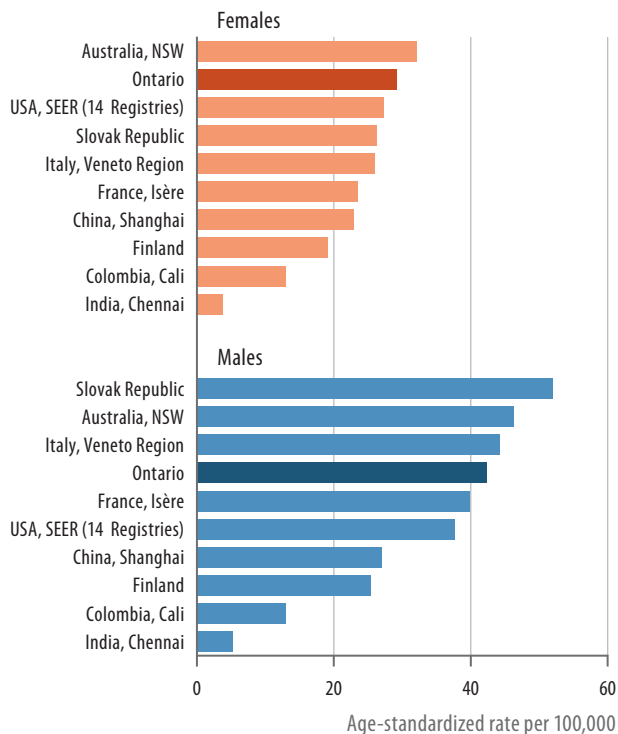
All cancers



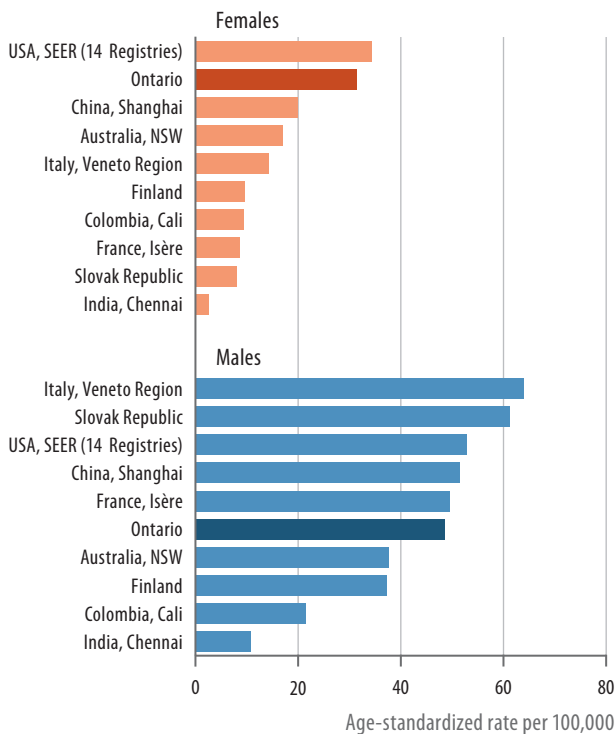
Prostate and female breast cancer



Colon and rectum cancer*



Lung cancer†



Notes: Rates are age-standardized to the World Standard Population.

The rate scales differ among the figures, reflecting differing incidence rates.

*Colon and rectum excludes intestinal tract, not otherwise specified (C26.0) which accounts for only 1.3% of colon and rectum cases in Ontario in 1998–2002.

†Lung cancer includes trachea (C33.9).

Source: Cancer Incidence in Five Continents, Vol. IX, International Agency for Research on Cancer, 2007

PREVALENCE

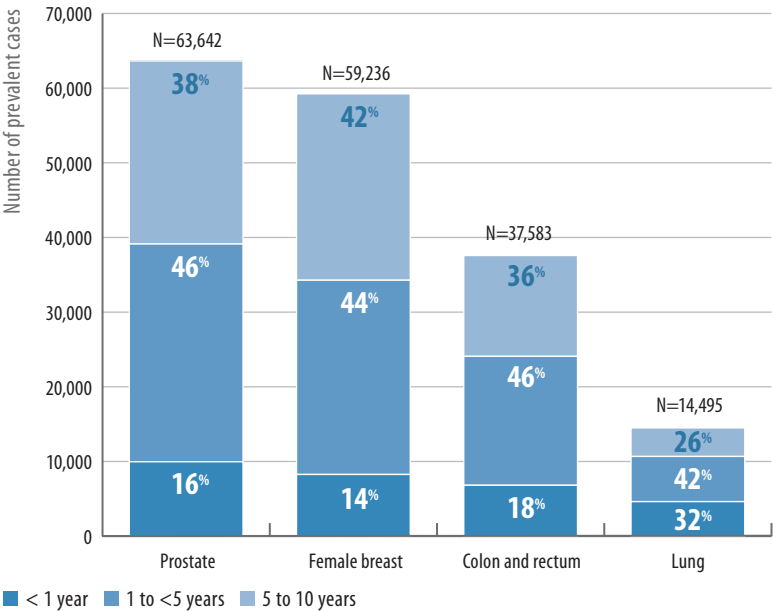


TABLE 1 Ten-year prevalence, most common cancers, Ontario, January 1, 2007

	Both sexes		Male		Female	
	Count	%*	Count	%*	Count	%*
All cancers	302,451	2.4	149,492	2.4	152,959	2.4
Prostate	63,642	0.5	63,642	1.0	–	–
Female breast	59,236	0.5	–	–	59,236	0.9
Colon and rectum	37,583	0.3	19,934	0.3	17,649	0.3
Lung	14,495	0.1	7,067	0.1	7,428	0.1

*Percent of the 2006 Ontario population.
Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

FIGURE 10 Prevalence for the most common cancers, by time since diagnosis, Ontario, January 1, 2007



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

Prevalence is the number of people living with a past diagnosis of cancer. It is a measure of the burden of cancer for individuals, families and health services. It is determined by the number of people diagnosed, and by survival. Both of these have been increasing in Ontario, resulting in more people living with cancer.

As of January 1, 2007, 2.4% of Ontarians (302,451) had received a diagnosis of cancer in the previous ten years (Table 1).

Prostate and breast cancer had the highest prevalence because of their high incidence and good survival. Together they accounted for 41% of ten-year prevalent cancers in Ontario, with over 63,000 cases of prostate cancer and over 59,000 of breast cancer.

Colorectal cancer was next, accounting for 12% of cases. The prevalence of lung cancer is much lower than that of colorectal cancer due to poorer survival.

Ten-year prevalence estimates represent a mixture of cases – from the newly diagnosed through to the long-term survivors. Health care needs vary across this ten-year period and include active treatment, follow-up for recurrences, treatment for recurrences, and end-of-life or palliative care.

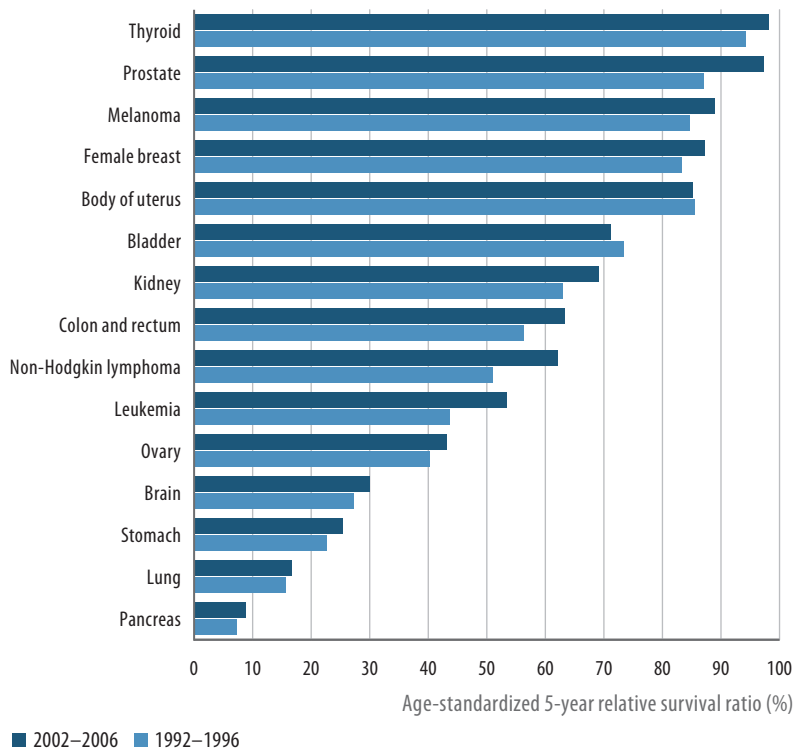
Figure 10 shows prevalence at different times since diagnosis. These times approximately represent different phases of the cancer journey, from post-diagnosis events and primary treatment (<1 year) through to long-term survivorship (5 to 10 years). Prevalence was highest for all of the most common cancers at one to five years after diagnosis.



SURVIVAL

FIGURE 11

Five-year relative survival for 15 common cancers, Ontario, 1992–1996 vs 2002–2006



Note: Based on individuals diagnosed at 15–99.

Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

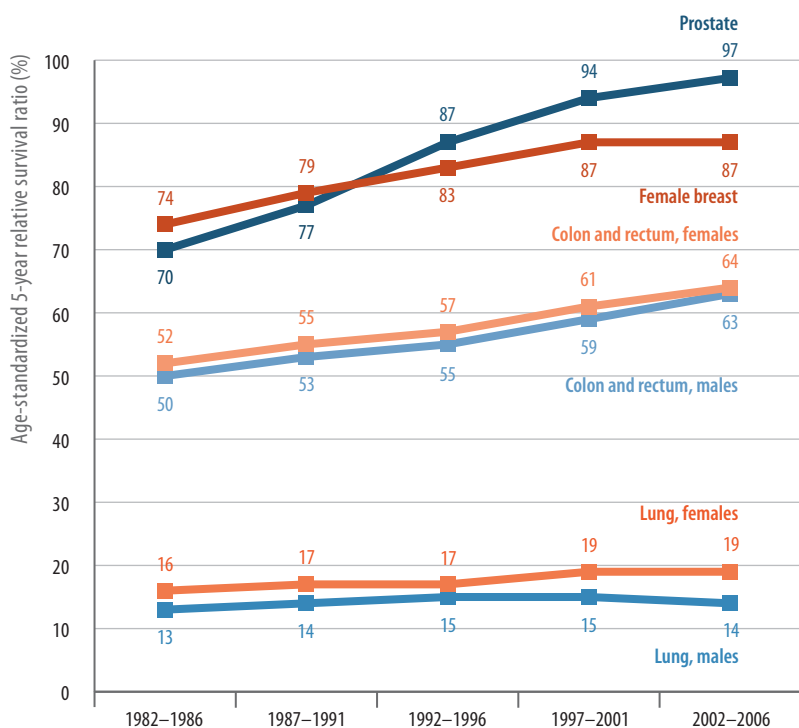
Relative survival is a measure of the impact of cancer on life expectancy. It is the ratio of the observed survival for a group of persons diagnosed with cancer to the survival expected for people in the entire population. Survival varies considerably according to cancer type, at 90% or higher for thyroid and prostate cancer to less than 20% for lung and pancreatic cancer (Figure 11). Most cancers showed improved survival from 1992–1996 to 2002–2006, with the greatest increases for leukemia and non-Hodgkin lymphoma. Survival improvements are usually related to improved treatment and earlier detection. Reasons for the decline in bladder cancer survival are unclear and may include increasing prevalence of comorbidities or changes in treatment patterns.⁵

In the 25-year period since the early 1980s, prostate cancer survival improved markedly to 97% (Figure 12). This is probably because the PSA test, introduced in the late 1980s, finds some cancers very early. Early detection of slow-growing cancers can mean that some men are living as long as they would have if their prostate cancer had remained undetected. Breast and colorectal cancer survival improved, while lung cancer survival remained low.

Cancer relative survival varies by age, but has improved since the early 1980s across all age groups (Figure 13). The largest gains occurred for ages 50–64, and the smallest for ages 15–29. Relative survival is, however, highest for ages 15–29, followed by children and by adults aged 30–49, while older adults have the worst survival. Age-group survival differences are partly due to age-related differences in cancer types. For example, over half the cancers in adolescents and young adults are thyroid cancer, Hodgkin lymphoma, testis cancer and melanoma, all of which have good survival.

FIGURE 12

Five-year relative survival for the most common cancers, Ontario, 1982–1986 to 2002–2006

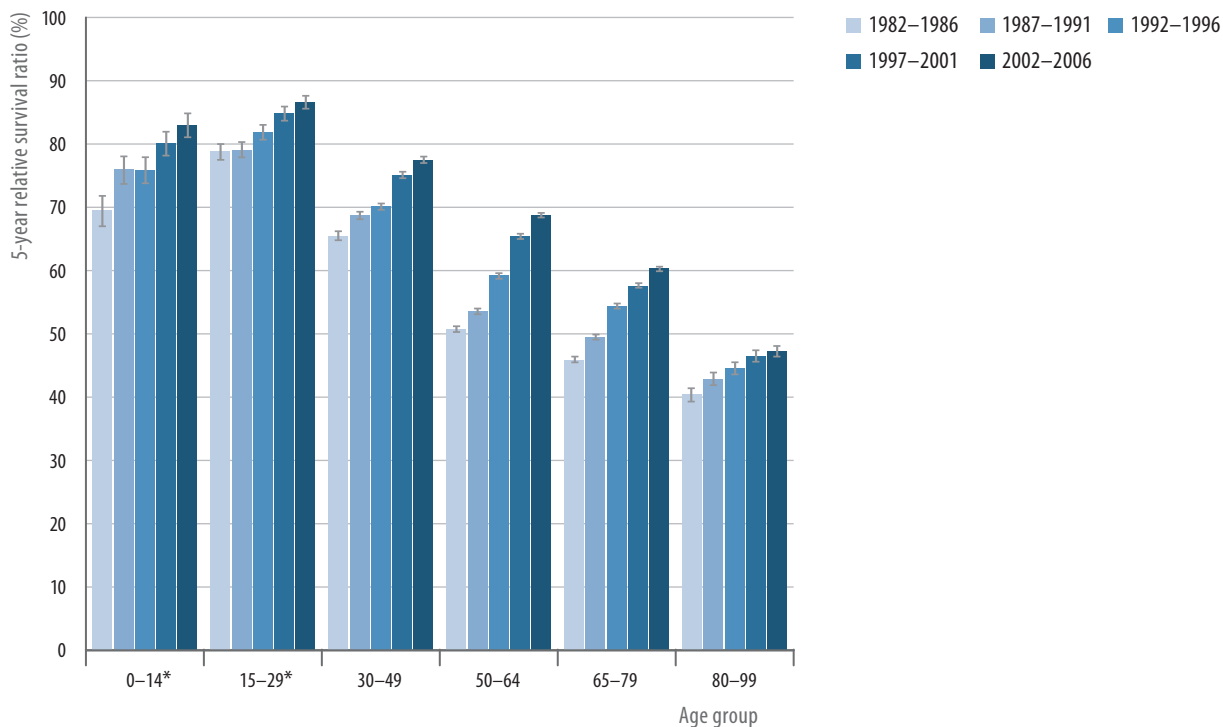


Note: Based on individuals diagnosed at ages 15–99.

Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

FIGURE 13

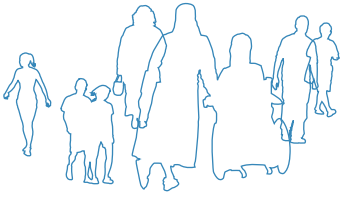
Five-year relative survival for all cancers, by age group, Ontario, 1982–1986 to 2002–2006



Note: *Observed survival proportions.

I = 95% confidence intervals.

Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)



INCIDENCE AND MORTALITY TRENDS, MOST COMMON CANCERS

TABLE 2

Annual percent change (APC) in age-standardized incidence and mortality rates, most common cancers, Ontario, 1982–2006

Cancer*	Incidence				Mortality			
	Males		Females		Males		Females	
	Period	APC [†]	Period	APC [†]	Period	APC [†]	Period	APC [†]
All cancers	1982–1992	0.9 ↑	1982–2006	0.4 ↑	1982–1988	0.4	1982–2001	-0.3 ↓
	1992–2006	-0.1			1988–2001	-1.1 ↓	2001–2006	-1.4 ↓
Prostate	1982–1989	2.7			1982–1994	1.6 ↑		
	1989–1992	11.4			1994–2006	-3.2 ↓		
	1992–2006	1.0 ↑						
Female breast			1982–1992	1.9 ↑			1982–1986	1.6
			1992–2006	-0.2			1986–1994	-1.2 ↓
							1994–2006	-2.6 ↓
Lung	1982–1990	-0.5	1982–1985	7.1 ↑	1982–1989	-0.3	1982–1985	7.3 ↑
	1990–2006	-2.2 ↓	1985–1998	2.0 ↑	1989–2006	-2.2 ↓	1985–1999	1.9 ↑
			1998–2006	0.3			1999–2006	0.1
Colon and rectum	1982–2006	-0.3 ↓	1982–1996	-1.3 ↓	1982–2006	-1.4 ↓	1982–2006	-1.9 ↓
			1996–1999	2.4				
			1999–2006	-1.4 ↓				
Colon	1982–2006	-0.5 ↓	1982–2006	-0.8 ↓	1982–1986	2.1	1982–2006	-1.8 ↓
					1986–2006	-1.5 ↓		
Rectum	1982–1997	-0.5 ↓	1982–1997	-1.4 ↓	1982–1999	-3.1 ↓	1982–1996	-3.5 ↓
	1997–2000	3.7	1997–2000	5.6	1999–2006	1.2	1996–2006	-0.6
	2000–2006	-0.8	2000–2006	-2.0 ↓				
Non-Hodgkin lymphoma	1982–1995	2.3 ↑	1982–1998	2.2 ↑	1982–2001	1.7 ↑	1982–1997	2.2 ↑
	1995–2006	0.7 ↑	1998–2006	0.3	2001–2006	-4.4 ↓	1997–2006	-1.9 ↓
Melanoma	1982–1988	5.8 ↑	1982–1987	4.0	1982–2006	1.2 ↑	1982–2006	0.2
	1988–1992	-2.0	1987–1992	-3.2				
	1992–2006	2.3 ↑	1992–2006	2.0 ↑				
Bladder [‡]	1989–2006	-1.1 ↓	1989–2006	-0.9 ↓	1982–2006	-0.9 ↓	1982–1997	-1.5 ↓
							1997–2006	2.1
Leukemia	1982–2006	-0.1	1982–2006	-0.3	1982–2006	-0.8 ↓	1982–2006	-1.3 ↓
Thyroid	1982–2006	5.6 ↑	1982–1998	5.2 ↑	1982–2006	0.9	1982–2006	-1.4 ↓
			1998–2002	14.5 ↑				
			2002–2006	6.0 ↑				
Body of uterus			1982–1989	-2.5 ↓			1982–1991	-2.5 ↓
			1989–2006	0.3 ↑			1991–2006	0.6
Kidney	1982–1988	4.6 ↑	1982–1986	10.2 ↑	1982–2006	-0.2	1982–2006	-0.6 ↓
	1988–2006	0.4	1986–1994	-0.1				
			1994–2006	1.5 ↑				
Pancreas	1982–2006	-1.3 ↓	1982–2006	-0.3 ↓	1982–2006	-1.4 ↓	1982–2006	-0.3 ↓
Ovary [§]			1982–2006	0.5 ↑			1982–2006	-0.5 ↓
Stomach	1982–2006	-1.9 ↓	1982–1993	-3.3 ↓	1982–2006	-3.0 ↓	1982–2006	-2.8 ↓
			1993–2006	-1.2 ↓				
Brain	1982–2006	-0.4 ↓	1982–2006	-0.4 ↓	1982–2006	-1.1 ↓	1982–2006	-1.2 ↓

Notes: * The 15 most common cancers are shown.

[†] ↑/↓ indicates significant increase/decrease in annual percent change.

Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

[‡] Bladder cancer trend begins at 1989 due to classification changes.

[§] Ovary excludes borderline malignancies.

Table 2 and Figures 14 through 17 show incidence and mortality rate trends over time for common cancers.

PROSTATE CANCER

Prostate cancer incidence rates increased while mortality rates declined from the early 1990s. The decline in mortality is likely due to improved treatment and early detection.

- Prostate cancer incidence rose at 1.0% per year from 1992, reaching a rate of 141.9 per 100,000 in 2006 (Table 2). On visual inspection, incidence peaked twice, in 1993 and 2001 (Figure 14).
 - » The first incidence peak is likely due to the introduction of PSA testing in 1988. An abrupt rise and fall in incidence is common when a new method of early diagnosis is introduced; incidence rises sharply as existing tumours are diagnosed earlier, and then returns to its former pattern.
 - » The slight 2001 peak may be the result of increased PSA testing following publicity around the federal Minister of Health's prostate cancer diagnosis in early 2001.
- Prostate cancer mortality rose from 1982 to 1994 at 1.6% per year, then fell annually by 3.2% (Table 2). Mortality was at its lowest in 2006, at 21.3 per 100,000 (Figure 16).

The effectiveness of screening healthy men for prostate cancer remains uncertain. A recent US trial has shown no reduction in mortality.⁶ European trials have found that PSA screening reduced mortality but also resulted in a high risk of overdiagnosis (diagnosis of slow-growing tumours that would not have presented clinical symptoms during the patients' lifetime), with its resulting overtreatment and lowered quality of life.^{7, 8}

FEMALE BREAST

Breast cancer incidence rates stabilized from the early 1990s and mortality rates declined from the late 1980s.

- Breast cancer incidence rates increased at 1.9% per year over the 1980s and then stabilized in 1992, reaching 99.3 per 100,000 in 2006 (Table 2, Figure 14). Mortality declined at 1.2% per year from 1986 and then at 2.6% per year from 1994, reaching a rate of 21.4 per 100,000 in 2006 (Table 2, Figure 16). Rising incidence in the 1980s may reflect increased mammography screening. Stable rates from the 1990s likely reflect several factors, some of which operate in opposing directions: a decrease in the use of hormone replacement therapy after 2002, which would tend to decrease breast cancer incidence; only minimal increases in screening mammography, which would slow the transient rate of increase that usually results from screening uptake; and the increasing tendency for women to delay childbirth to a later age, which increases the risk of breast cancer.^{9, 10}
 - » Screening mammography among women aged 50 to 69 (the recommended population screening age range) was estimated at 63.7% in 2005–2006 in Ontario, a slight increase from 61.2% in 2003–2004 and 61.4% in 2001–2002.¹¹
- The fall in breast cancer mortality beginning in the late 1980s is likely due to improved treatment and increased participation in breast screening.¹²

COLON AND RECTUM CANCER

Colorectal cancer incidence and mortality rates declined for both sexes.

- In females, the trend in colorectal cancer incidence is complex: rates fell by 1.3% per year through 1996, rose (non-significantly) in 1996–1999, and fell again from 1999 (1.4% annually); this reflects the rectal cancer trend (Table 2, Figure 14). Colon cancer incidence rates declined steadily (0.8% per year).
- In males, colorectal cancer incidence rates declined steadily from the early 1980s at 0.3% per year, although visually the trend line suggests a slight rise from the late 1990s and then a fall reflecting the rectal cancer trend. Colon cancer incidence rates declined throughout the period (0.5% per year).
- Large bowel investigations (colonoscopy, sigmoidoscopy, etc.) increased abruptly in Ontario from 1996, corresponding to the beginning of the apparent increase in colorectal cancer incidence rates.^{13, 14}
- Declines in incidence may be due to changes in risk and protective factors (e.g., smoking, diet, physical activity, hormone replacement therapy).^{15, 16}
- Mortality from colorectal cancer fell from the early 1980s in both sexes, at 1.4% per year in males and 1.9% per year in females (Table 2, Figure 16). These strong declines probably reflect a combination of changes in risk/protective factors, earlier diagnosis due to more screening and improvements in treatment.¹⁷

LUNG CANCER

The long-term decline in lung cancer incidence rates in males and the recent stabilization in females reflects differences in smoking trends between the sexes.

- Lung cancer incidence and mortality rates in males declined at 2.2% per year since 1990 (incidence) and 1989 (mortality) (Table 2, Figures 14 and 16). Incidence declined from 89.9 per 100,000 in 1982 to 62.5 in 2006 and mortality from 75.6 per 100,000 to 52.9 during the same time period.
- Among females, lung cancer incidence and mortality rates increased over the 1980s and 1990s until levelling off in the late 1990s. Incidence rose from 26.3 per 100,000 in 1982 to 43.5 in 1998 and then stabilized, reaching 44.0 per 100,000 in 2006. Mortality increased from 20.5 per 100,000 in 1982 to 33.1 in 1999 and reached 33.7 in 2006.
- Tobacco use is the primary cause of lung cancer, accounting for an estimated 86% of cases.¹⁸ Tobacco consumption began to decline in the mid 1950s for males and twenty years later for females.^{19, 20}
- Other causes of lung cancer include exposure to radon, asbestos, environmental tobacco smoke, air pollution, and a variety of substances found in the workplace.²¹

OTHER CANCERS

Non-Hodgkin lymphoma mortality rates declined from 2001 in males (4.4% per year) and from 1997 in females (1.9% per year) following a rise in the 1980s and 1990s (Table 2, Figure 17). The rise in the 1980s and 1990s reflects increases in incidence rates that occurred during this time.

The incidence rates of **melanoma of the skin** rose from 1992 by about 2% per year in both sexes (Table 2, Figure 15). The increase likely reflects more exposure to ultraviolet radiation from both sun and other sources.²² Increases in mortality rates in males (1.2% per year) were largely driven by incidence trends.

Bladder cancer occurs predominately in males. Incidence rates in both sexes fell from 1989. Declines in smoking and exposures to some occupational chemicals (e.g., aromatic amines) may have played a role in the incidence decline.²³

Leukemia mortality rates declined in both sexes between 1982 and 2006. These declines reflect relatively stable incidence rates over this time period, combined with advances in chemotherapy, which have been especially beneficial to young patients.²⁴

Thyroid cancer is the most rapidly rising cancer in Ontario, with an especially sharp increase in females between 1998 and 2002. The rise is likely due in large part to increased diagnostic investigations such as ultrasonography and fine-needle aspiration, which may have allowed for detection of subclinical tumours.^{25, 26} The contribution of changes in exposure to established (e.g., ionizing radiation) or emerging risk factors is unknown.

Kidney cancer incidence rates in females increased by 70% from 1982 to 2006, rising sharply from 1982 to 1986 and steadily from 1994. A less steep rise in males was confined to earlier years. Increased use of high-tech imaging that detects early tumours may partially explain the rise.²⁷⁻²⁹ More recent rises among females may be related to the increasing prevalence of obesity, hypertension and earlier rises in smoking.^{19, 20, 30-33}

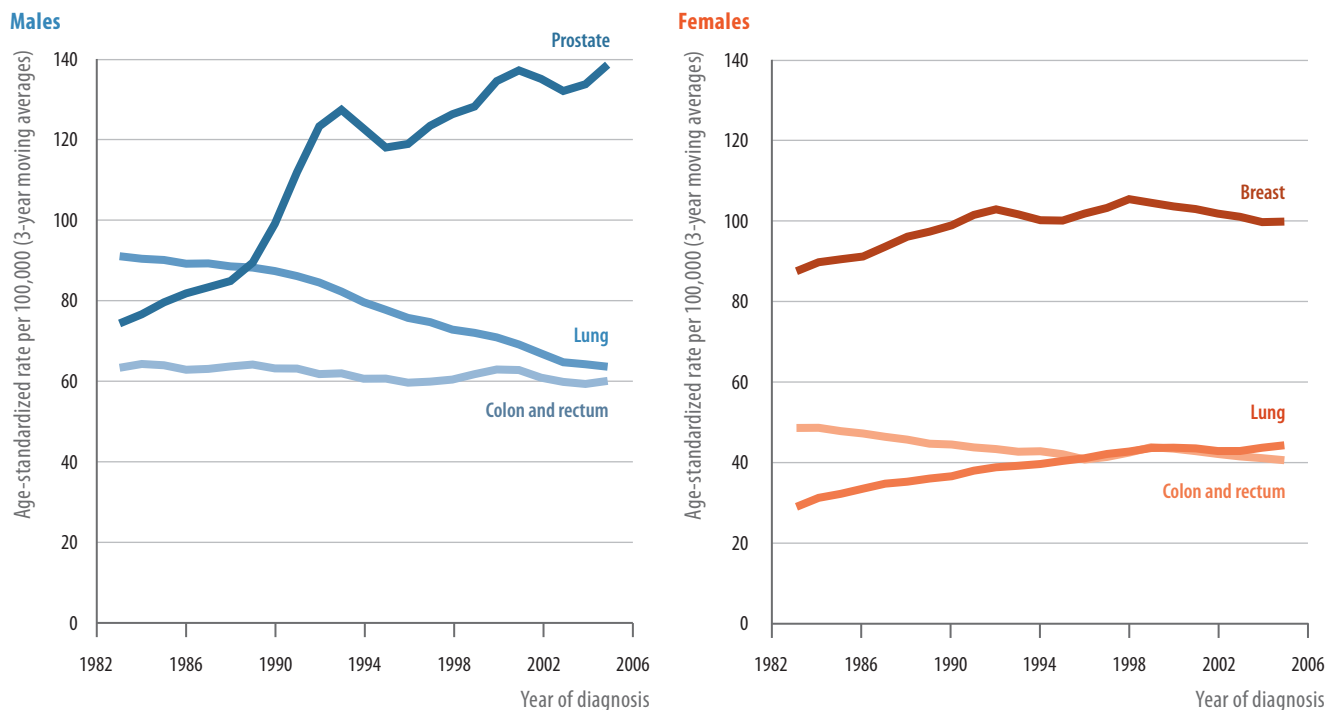
Pancreatic cancer incidence and mortality rates fell after 1982 in both sexes, more markedly in males. The decline may be partly explained by declines in smoking.³⁴⁻³⁶

Stomach cancer incidence and mortality rates have been falling since 1982 in both sexes, similar to trends in most other parts of the world.³⁷ Reasons for the widespread declines include better diet (including more fresh fruits and vegetables and fewer salted foods, both enabled by greater availability of refrigeration), falling smoking rates and control of *H. pylori* infection.^{15, 38}

Brain cancer mortality rates declined at approximately 1% annually in both sexes. This reflects a gradual decline in incidence rates also observed in the US.^{17, 39} Little is known about the causes of this heterogeneous group of cancers.

FIGURE 14

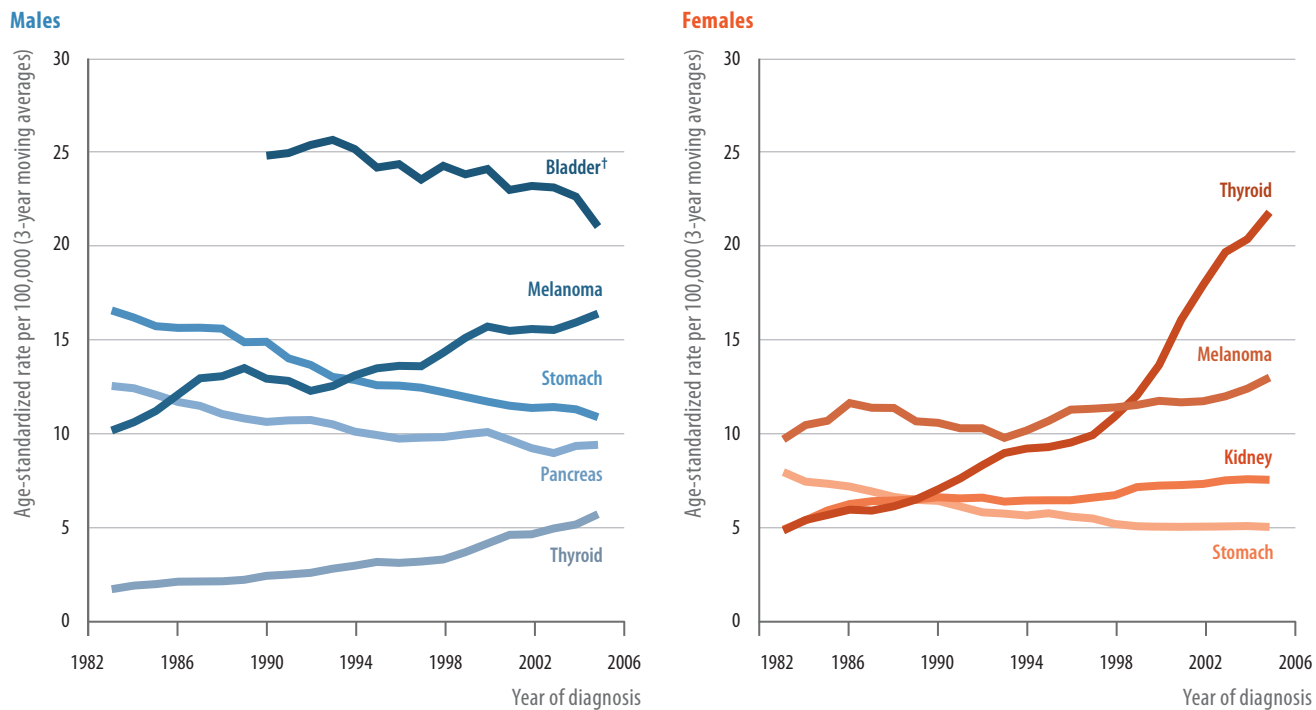
Incidence trends for the most common cancers, Ontario, 1982–2006



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

FIGURE 15

Incidence trends for the most rapidly changing cancers*, Ontario, 1982–2006

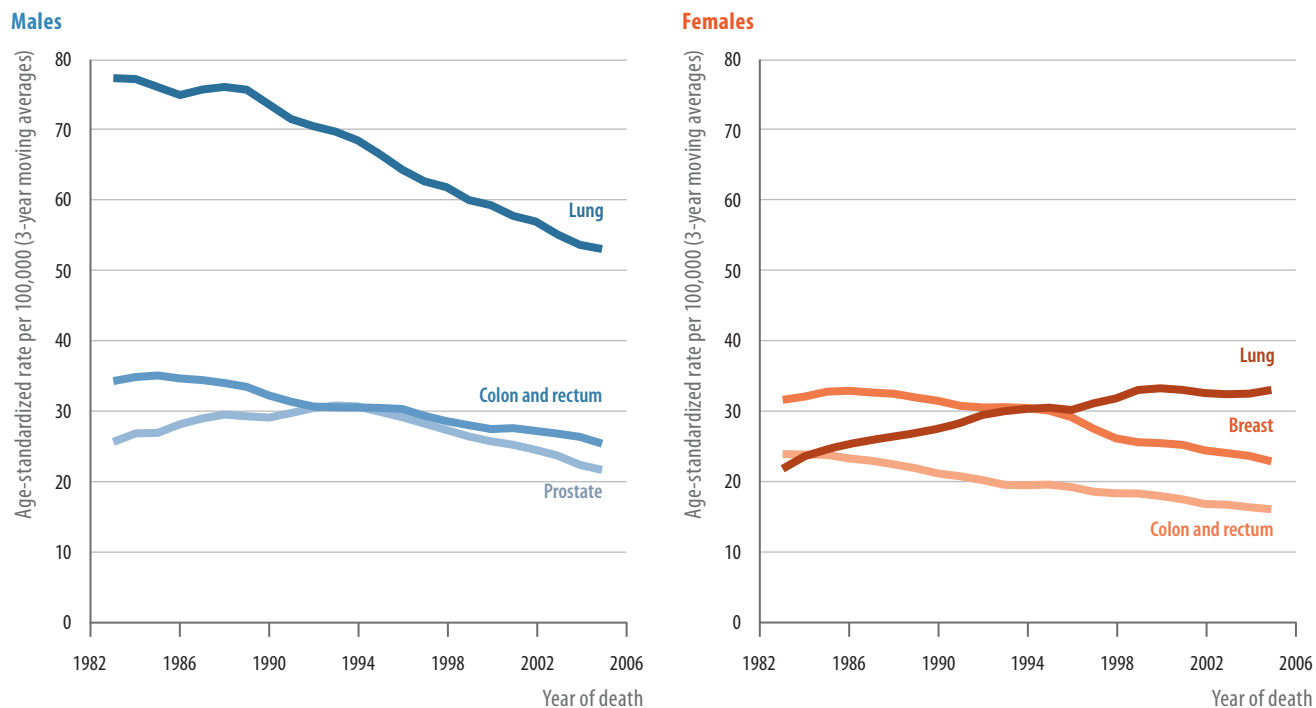


Note: *Cancers with a statistically significant change in incidence rate of at least 1% per year.

†Bladder cancer trend begins at 1989 due to classification changes.

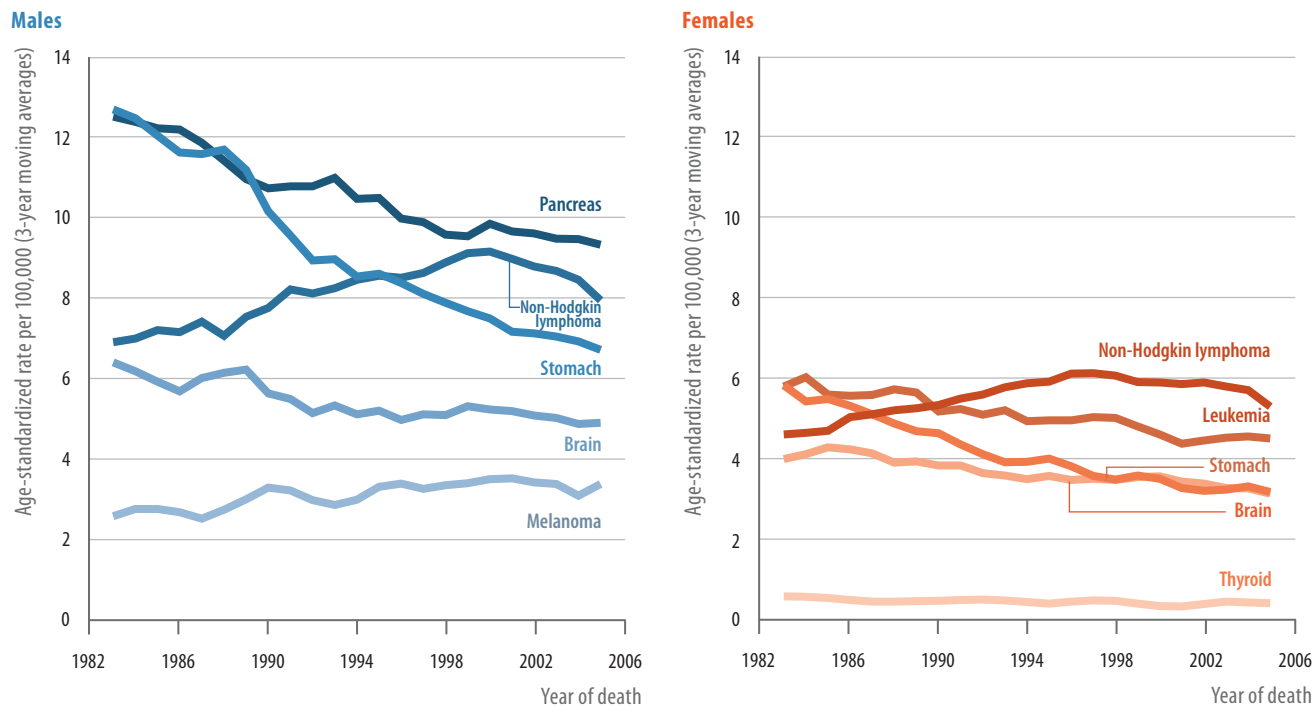
Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

FIGURE 16 Mortality trends for the most common cancers, Ontario, 1982–2006



Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

FIGURE 17 Mortality trends for the most rapidly changing cancers*, Ontario, 1982–2006



Note: *Cancers with a statistically significant change in mortality rate of at least 1% per year.
Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)



INCIDENCE AND MORTALITY TRENDS BY AGE GROUP

TABLE 3

Annual percent change (APC) in age-standardized incidence rates, most common cancers, by age group, Ontario, 1982–2006

Age group	Cancer*	Males				Females			
		New cases 2002–2006	Rate† 2002–2006	Trend, 1982–2006		New cases 2002–2006	Rate† 2002–2006	Trend, 1982–2006	
				Period	APC‡			Period	APC‡
0–14	All cancers	983	17.3	1982–2006	0.2	802	14.6	1982–2006	0.3
	Leukemia	305	5.4	1982–2006	-0.0	231	4.3	1982–2006	0.3
	Central nervous system (CNS)	198	3.4	1982–2006	0.6	156	2.8	1982–2006	0.4
	Lymphoma	134	2.2	1982–2006	0.3	77	1.3	1982–2006	0.5
	Neuroblastoma	74	1.4	1982–2006	-0.1	58	1.1	1982–2006	-0.4
15–29	All cancers	2,262	37.1	1987–2006	0.3	2,728	46.6	1982–2006	1.2 ↑
	Thyroid	128	2.2	1982–2006	3.8 ↑	701	12.1	1982–2006	5.3 ↑
	Hodgkin lymphoma	293	4.6	1982–2006	-0.3	280	4.6	1988–2006	-1.6 ↓
	Testis [§]	529	9.0	1982–2006	1.3 ↑				
	Melanoma	173	2.9	1982–2006	0.0	294	5.0	1982–2006	-0.1
30–49	All cancers	12,723	118.3	1988–2006	-0.3 ↓	23,891	225.1	1996–2006	1.3 ↑
	Female breast					8,776	80.0	1985–2006	-0.0
	Thyroid	680	6.7	1982–2006	5.8 ↑	3,373	34.1	2002–2006	5.9 ↑
	Colon and rectum	1,287	11.6	1982–2006	0.0	1,174	10.5	1990–2006	0.2
	Melanoma	1,020	9.8	1993–2006	-0.0	1,364	13.4	1993–2006	1.2 ↑
	Lung	950	8.2	1982–2006	-3.0 ↓	1,072	9.3	1982–2006	-1.1 ↓
50–64	All cancers	44,417	908.2	1982–2006	0.7 ↑	40,355	776.4	2002–2006	-1.1
	Prostate	14,461	300.3	1993–2006	4.9 ↑				
	Female breast					13,905	264.5	1999–2006	-1.3
	Lung	5,500	114.1	1987–2006	-3.3 ↓	4,599	90.8	1992–2006	-0.9 ↓
	Colon and rectum	5,540	112.9	1982–2006	-0.0	3,697	72.3	1982–2006	-0.8 ↓
65–79	All cancers	67,666	2469.9	1992–2006	-0.2	47,189	1456.4	1988–2006	0.3 ↑
	Prostate	22,587	830.4	1992–2006	0.3				
	Lung	10,563	383.9	1992–2006	-2.0 ↓	8,076	249.0	1988–2006	2.0 ↑
	Colon and rectum	9,118	331.7	1982–2006	-0.1	7,002	213.1	1982–2006	-0.7 ↓
	Female breast					11,002	345.1	1992–2006	-0.6 ↓
	Non-Hodgkin lymphoma	2,541	92.6	1982–2006	1.8 ↑	2,156	66.1	1998–2006	0.7
80+	All cancers	22,131	3121.0	1991–2006	-1.3 ↓	24,698	1881.4	1982–2006	0.1
	Colon and rectum	3,250	457.6	1982–2006	-1.1 ↓	4,713	358.1	2000–2006	-2.7 ↓
	Lung	3,490	488.5	1982–2006	-0.6 ↓	3,183	244.3	2001–2006	0.9
	Prostate	5,371	754.5	1995–2006	-2.6 ↓				
	Female breast					4,507	343.9	1982–2006	-0.4 ↓
	Bladder	1,616	228.4	1989–2006	-0.7	806	61.1	1989–2006	-0.2

Notes: * The five most common cancers in each age group are shown (except for age group 0–14 due to small numbers).

† Average annual age-standardized incidence rate per 100,000.

‡ Trends were analyzed for 1982–2006. If the slope of the trend was not constant over this entire time period, APC describes the increase or decrease for the most recent time period.

↑/↓ indicates significant increase/decrease in annual percent change in the most recent trend within period 1982–2006.

§ Testicular germ cell cancer (see Appendix I).

|| Bladder cancer trend begins at 1989 due to classification changes.

Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

Tables 3 and 4 and Figure 18 show incidence and mortality rate trends over time for the most common cancers in several age ranges: childhood, adolescents and young adults, and adults in four age groups.

CHILDHOOD CANCERS

Cancer incidence rates in children (aged 0–14) remained stable over the period 1982–2006 in both sexes, for all cancers combined and for the most common cancers (Table 3, Figure 18). Incidence and mortality rates are slightly higher in boys than girls, both overall and for each of the most common types of cancer.

Cancer mortality rates declined dramatically by about 60% over the 25-year period (Table 4, Figure 18). The drop in mortality is due to significant improvements in treatment. One result of this good news is that growing numbers of children face the possibility of late effects from their treatment (e.g., second cancers, reduced fertility, neurocognitive disorders, psychosocial issues).⁴⁰

TABLE 4

Annual percent change (APC) in age-standardized mortality rates, most common cancers, by age group, Ontario, 1982–2006

Age group	Cancer*	Males				Females			
		Deaths	Rate [†]	Trend, 1982–2006		Deaths	Rate [†]	Trend, 1982–2006	
		2002–2006	2002–2006	Period	APC [‡]	2002–2006	2002–2006	Period	APC [‡]
0–14	All cancers	155	2.7	1982–2006	-2.4 ↓	113	2.1	1982–2006	-3.1 ↓
15–29	All cancers	302	4.9	1982–2006	-2.1 ↓	243	4.1	1982–2006	-1.2 ↓
30–49	All cancers	3,150	28.4	1986–2006	-2.0 ↓	4,002	36.2	1982–2006	-2.1 ↓
	Female breast					1,155	10.4	1987–2006	-3.6 ↓
	Thyroid [§]	13	0.1			10	0.1		
	Colon and rectum	367	3.2	1982–2006	-2.0 ↓	310	2.8	1982–2006	-2.2 ↓
	Melanoma	170	1.6	1982–2006	-1.7 ↓	114	1.1	1982–2006	-2.1 ↓
50–64	Lung	575	4.9	1982–2006	-3.5 ↓	591	5.0	1982–2006	-1.9 ↓
	All cancers	13,570	279.4	1989–2006	-2.3 ↓	12,426	243.5	1987–2006	-1.4 ↓
	Prostate	472	10.1	1988–2006	-3.3 ↓				
	Female breast					2,657	51.2	1988–2006	-2.7 ↓
	Lung	4,020	83.5	1988–2006	-3.7 ↓	3,071	61.0	1992–2006	-1.0 ↓
65–79	Colon and rectum	1,687	34.8	1982–2006	-1.8 ↓	1,108	21.8	1982–2006	-2.7 ↓
	Non-Hodgkin lymphoma	628	12.6	2001–2006	-6.6 ↓	408	8.0	1982–2006	-0.0
	All cancers	29,318	1058.9	1995–2006	-1.6 ↓	23,210	704.1	1994–2006	-0.6 ↓
	Prostate	2,751	98.0	1994–2006	-4.6 ↓				
	Lung	8,918	323.0	1994–2006	-2.3 ↓	6,296	192.4	1993–2006	1.2 ↑
80+	Colon and rectum	3,796	137.2	1982–2006	-1.4 ↓	2,592	77.8	1982–2006	-1.9 ↓
	Female breast					3,050	93.4	1993–2006	-2.7 ↓
	Non-Hodgkin lymphoma	1,110	40.1	2000–2006	-3.0	944	28.4	1997–2006	-1.7
	All cancers	17,379	2495.3	1994–2006	-0.6 ↓	18,558	1404.2	1982–2006	0.5 ↑
	Colon and rectum	2,357	338.8	1982–2006	-1.2 ↓	3,035	228.2	1982–2006	-1.3 ↓
	Lung	3,640	513.8	1982–2006	-0.6 ↓	3,041	232.4	2001–2006	1.1
	Prostate	3,533	516.6	1993–2006	-1.7 ↓				
	Female breast					2,643	199.1	1982–2006	-0.0
	Bladder	862	126.1	1982–2006	-0.6	523	39.3	1982–2006	-0.0

Notes: * The five most common cancers in each age group are shown (except for age groups 0–14 and 15–29 due to small numbers).

[†] Average annual age-standardized mortality rate per 100,000.

[‡] Trends were analyzed for 1982–2006. If the slope of the trend was not constant over this entire time period, APC describes the increase or decrease for the most recent time period.

[§] ↑/↓ indicates significant increase/decrease in annual percent change in the most recent trend within period 1982–2006.

[¶] APC could not be estimated because of low numbers.

Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

CANCERS IN ADOLESCENTS AND YOUNG ADULTS

Incidence rates for adolescents and young adults aged 15–29 were higher in females than males (46.6 vs. 37.1 per 100,000 in 2002–2006) (Table 3). Rates increased at 1.2% per year in females and were stable in males. Mortality rates were similar in both sexes and decreased steadily from 1982 (Table 4).

- **Thyroid cancer** was the most common cancer in this age group; incidence was over five times higher in females than males in 2002–2006. Incidence rates increased in both sexes between 1982 and 2006, reflecting increased detection (see page 21).
- **Hodgkin lymphoma** ranked second in incidence for both sexes combined; incidence rates declined in females from 1988. **NHL** was less common; incidence rates rose in females and declined non-significantly from 1997 in males, probably reflecting the introduction of effective antiviral drugs for HIV (human immunodeficiency virus) infection in the mid 1990s.⁴¹
- Among males, **testicular cancer** was the most common malignancy. Incidence rates rose 1.3% per year from 1982 to 2006. Reasons for the increase are unclear; risk factors, apart from undescended testicle, are poorly understood.

CANCERS IN ADULTS AGED 30 AND OLDER

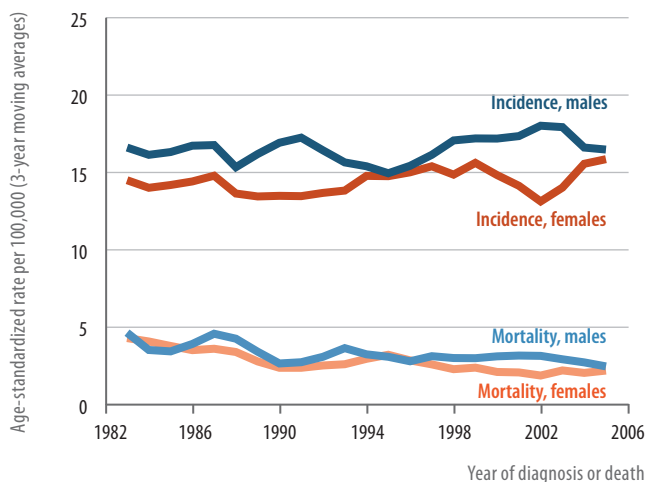
Incidence and mortality rates were higher in males than females aged 50 and over for the most common cancers. Incidence was higher in females than males for all the most common cancers in age group 30–49 except colorectal cancer. (Tables 3 and 4).

- **Breast cancer** incidence rates were stable from 1985 for age group 30–49, and declined from 1992 for women aged 65–79 and from 1982 for women aged 80 and over. Mortality rates declined from the late 1980s and early 1990s for women aged 30 to 79 and were stable for women 80 and older.
- **Lung cancer** incidence and mortality rates have been declining for women aged 30 to 64, but increased in women aged 65–79. Male lung cancer incidence and mortality rates declined across all age groups.
- **Colorectal cancer** incidence rates were stable for males through age 79, and fell for men 80 and older. Incidence rates fell for women aged 50 to 79, and from 2000 for women aged 80 and over. Mortality rates declined in all age groups for both sexes.
- **Prostate cancer** was the most common cancer in males aged 50–79. Incidence rates increased in men aged 50–64 from 1993, stabilized from 1992 in men aged 65–79, and fell from 1995 in men 80 and older. Mortality rates declined for all three age groups.
- **NHL** was the fifth most common cancer for age groups 50–64 and 65–79. Incidence rates increased in females aged 50–64 and males 65–79 between 1982 and 2006. Mortality rates decreased significantly for males aged 50–64.
- **Thyroid cancer** incidence rates increased for both sexes in the age group 30–49.
- **Melanoma** incidence rates increased for females aged 30–49 from 1993; mortality declined for both sexes.

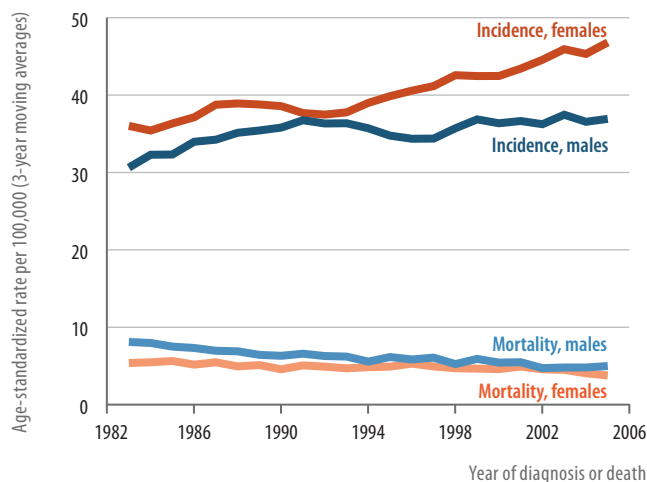
FIGURE 18

Incidence and mortality trends for all cancers, by age group, Ontario, 1982–2006

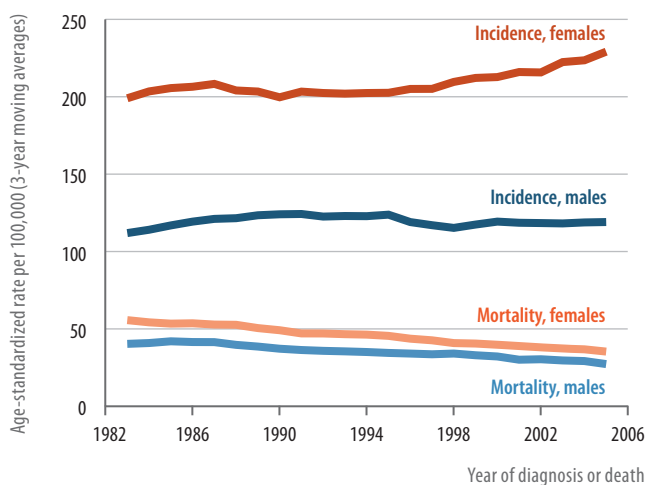
Age 0–14



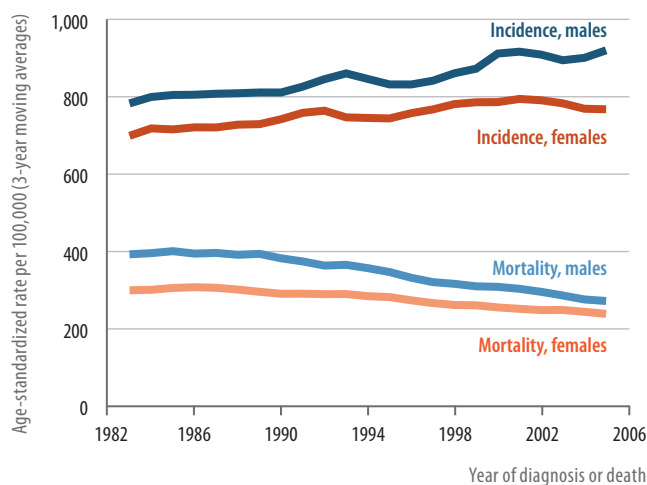
Age 15–29



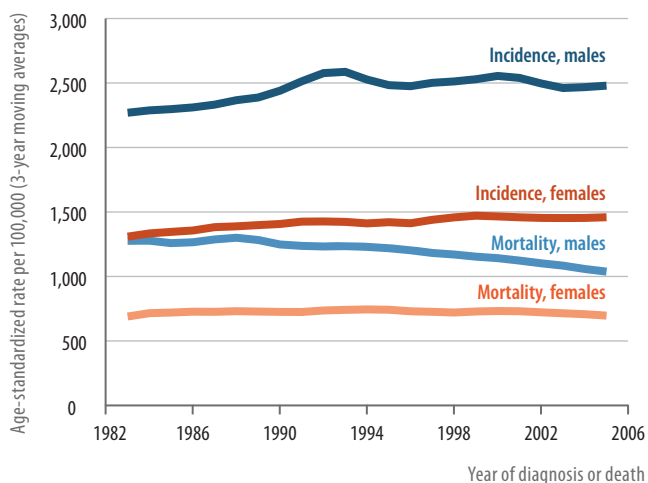
Age 30–49



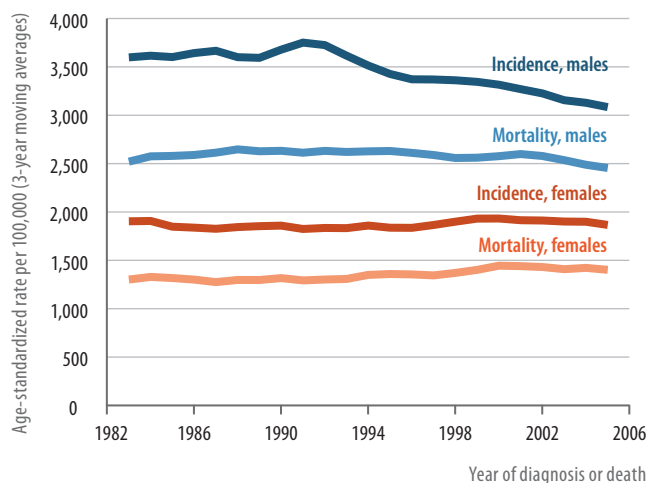
Age 50–64



Age 65–79



Age 80+



Note: The rate scales differ among the age groups, reflecting different incidence rates.
Source: Cancer Care Ontario (Ontario Cancer Registry, 2009)

APPENDIX I

CANCER DEFINITIONS FOR ALL AGES AND AGE GROUPS 30–49, 50–64, 65–79, 80+

Short title	Full title*	ICD-0-3 Site/ Histology Type (Incidence) ^{†,‡}	ICD-10 (Mortality) [‡]
Esophagus	Esophagus	C15	C15
Stomach	Stomach	C16	C16
Colon and rectum	Colon and Rectum	C18–C20, C26.0	C18–C20, C26.0
Colon	Colon excluding rectum	C18, C26.0	C18, C26.0
Rectum	Rectum and Rectosigmoid Junction	C19.9, C20.9	C19–C20
Liver	Liver and Intrahepatic Bile Duct	C22.0–C22.1	C22
Pancreas	Pancreas	C25	C25
Lung	Lung and Bronchus	C34	C34
Melanoma	Melanoma of the Skin	C44 with histology codes 8720–8790	C43
Breast	Breast	C50	C50
Body of uterus	Corpus and Uterus, NOS	C54, C55	C54–C55
Ovary	Ovary	C56.9	C56
Prostate	Prostate	C61.9	C61
Bladder [§]	Urinary Bladder	C67	C67
Kidney	Kidney and Renal Pelvis	C64.9, C65.9	C64–C65
Brain	Brain and Other Nervous System	C70–C72	C70–C72
Thyroid	Thyroid	C73.9	C73
Non-Hodgkin lymphoma	Non-Hodgkin lymphoma	9590–9596, 9670–9671, 9673, 9675, 9678–9680, 9684, 9687, 9689–9691, 9695, 9698–9702, 9705, 9708–9709, 9714–9719, 9727–9729; All sites other than C42.0, C42.1, C42.4 with histology codes 9823, 9827	C82–C85, C96.3
Myeloma	Myeloma	9731–9732, 9734	C90.0, C90.2
Leukemia	Leukemia	9733, 9742, 9800–9801, 9805, 9820, 9826, 9831–9837, 9840, 9860–9861, 9863, 9866–9867, 9870–9876, 9891, 9895–9897, 9910, 9920, 9930–9931, 9940, 9945–9946, 9948, 9963–9964; C42.0, C42.1, C42.4 with histology codes 9823, 9827	C91–C95, C90.1
All cancers		C00–C80 [¶]	C00–C97

* Titles based on SEER Site Recode ICD-0-3 definition.

† ICD-0-3 refers to the Third Edition of the International Classification of Diseases for Oncology (2000).

ICD-0-3 site/histology code definitions were used for all ages, and age groups 30–49, 50–64, 65–79 and 80+. See http://seer.cancer.gov/siterecode/icdo3_d01272003/.

‡ ICD-10 refers to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision.

§ Urinary bladder excludes carcinomas in situ.

|| Histology types 9590–9989 (lymphomas, leukemias, and hematopoietic diseases), 9050–9055 (mesothelioma), and 9140 (Kaposi sarcoma) are excluded from other specific organ sites.

¶ All cancers exclude basal cell and squamous cell skin cancers.

CANCER DEFINITIONS FOR AGE GROUP 0–14

Short title	Full title*	ICD-0-3 Site†	Histology Type (Incidence)
Leukemia	I Leukemias, myeloproliferative diseases, and myelodysplastic diseases	C00–C80	9800–9801, 9805, 9820, 9823, 9826–9827, 9831–9837, 9840, 9860, 9861, 9863, 9866–9867, 9870–9876, 9891, 9895–9897, 9910, 9920, 9930–9931, 9940, 9945–9946, 9948, 9950, 9960–9964, 9975, 9980, 9982–9987, 9989
Central nervous system (CNS)	III CNS and miscellaneous intracranial and intraspinal neoplasms	C00–C80	8270–8281, 8300, 9350–9352, 9360–9362, 9381–9384, 9390–9394, 9400–9413, 9420–9424, 9430, 9440–9442, 9444, 9450–9451, 9460, 9470–9474, 9480, 9492–9493, 9505–9508, 9530–9539, 9582
		C70–C72, C75.1–C75.3	8000–8005, 9380
		C70–C72	9501–9504
Lymphoma	II Lymphomas and reticuloendothelial neoplasms	C00–C80	9590, 9591, 9596, 9650–9655, 9659, 9661–9665, 9667, 9670–9671, 9673, 9675, 9678–9680, 9684, 9687, 9689–9691, 9695, 9698–9702, 9705, 9708–9709, 9714, 9716–9719, 9727–9729, 9731–9734, 9740–9742, 9750, 9754–9758, 9760–9762, 9764–9769, 9970
Neuroblastoma	IV Neuroblastoma and other peripheral nervous cell tumors	C00–C80	8680–8683, 8690–8693, 8700, 9490, 9500, 9520–9523
		C00–C69, C73.9–C76.8, C80.9	9501–9504

* Titles based on International Classification of Childhood Cancer, Third Edition based on ICD-0-3 (ICCC-3) definition.

ICCC-3 site/histology recode definitions were used for age group 0–14. See <http://www.seer.cancer.gov/iccc/iccc3.html>.

† ICD-0-3 refers to the Third Edition of the International Classification of Diseases for Oncology (2000).

CANCER DEFINITIONS FOR AGE GROUP 15–29

Short title	Full title*	ICD-0-3 Site†	Histology Type (Incidence)
Thyroid	8.1 Thyroid carcinoma	C73.9	8010–8589
Hodgkin lymphoma	2.2 Hodgkin lymphoma	C00–C80	9650–9655, 9659, 9661–9665, 9667
Testis	6.1 Germ cell and trophoblastic neoplasms of gonads‡	C62	9060–9065, 9070–9073, 9080–9085, 9100–9102, 9105
Melanoma	7.1 Melanoma	C00–C80	8720–8723, 8726, 8728, 8730, 8740–8746, 8761, 8770–8774, 8780
Non-Hodgkin lymphoma	2.1 Non-Hodgkin lymphoma	C00–C80	9590–9591, 9596, 9670–9671, 9673, 9675, 9678–9680, 9684, 9687, 9689–9691, 9695, 9698–9702, 9705, 9708–9709, 9714, 9716–9719, 9727–9729

* Titles based on SEER AYA Site Recode definition. AYA refers to Adolescent and Young Adults (AYA) site/histology code definitions based on scheme proposed by Barr et al.

AYA site recode histology definitions were used for age group 15–29. See <http://www.seer.cancer.gov/ayarecode/index.html>.

† ICD-0-3 refers to the Third Edition of the International Classification of Diseases for Oncology (2000).

‡ Germ cell and trophoblastic neoplasms of gonads was restricted to males only.

APPENDIX II

Data sources

CANCER CARE ONTARIO (ONTARIO CANCER REGISTRY, 2009)

Ontario Cancer Registry (OCR)

The OCR is operated by Cancer Care Ontario and registers newly-diagnosed cases of invasive neoplasia, except for basal cell and squamous cell skin cancers. Electronic records are linked at the person level and then “resolved” into incident cases of cancer using computerized medical logic. Major data sources are:

1. Cancer-related hospital discharge and day surgery records from the Canadian Institute for Health Information;
2. Cancer-related pathology reports, received mostly electronically from hospital and community laboratories;
3. Consultation and treatment records of patients referred to one of 14 Regional Cancer Centres;
4. Death certificates with cancer identified as the underlying cause of death, received from the Ontario Registrar General.

CANSIM, STATISTICS CANADA, 2009

Canadian Cancer Registry (CCR)

Provincial and territorial cancer registries collect clinical and demographic data on newly diagnosed cancer cases for people residing in the province or territory. These data are reported annually to Statistics Canada and added to the CCR. Numbers and rates are broadly comparable but reflect differing methods of registering and counting cancers among the registries.

Statistics Canada. *Table 103-0553 – New cases and age-standardized rates for ICD-0-3 primary sites of cancer (based on the July 2009 CCR tabulation file), by sex, Canada, provinces and territories, annual, CANSIM (database).*

Available at: http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&CNSM-Fi=CII/CII_1-eng.htm
and browse by survey: Canadian Cancer Registry. Accessed July 23, 2010.

CANCER INCIDENCE IN FIVE CONTINENTS, VOL. IX, INTERNATIONAL AGENCY FOR RESEARCH ON CANCER, 2007

Cancer Incidence in Five Continents is the recognized reference source on the incidence of cancer in populations around the world. The ninth volume presents data for 1998–2002 from populations all over the world for which good quality data are available from regional or national cancer registries.

Curado, M. P., Edwards, B., Shin, H.R., Storm, H., Ferlay, J., Heanue, M. and Boyle, P., eds (2007). *Cancer Incidence in Five Continents, Vol. IX*. IARC Scientific Publications No. 160, Lyon, IARC. Available at: <http://ci5.iarc.fr/CI5i-ix/ci5i-ix.htm>. Accessed July 23, 2010.

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GLOSSARY OF TERMS AND METHODS

Terms are listed in the order in which they are used in the report.

INCIDENCE/MORTALITY

New cases

The number of new cases of cancer diagnosed during a defined period of time in a specified population. This counts the cancers, not the number of people; a person can have more than one cancer.

Growth in new cases

Growth in the number of new cases is attributed to changing rates, population growth, and population aging. Baseline risk is based on the number of new cases in 1982. The number of additional cases for each year 1983–2006 is estimated by assuming that the baseline age structure and population size remained constant.

Deaths

The number of deaths attributed to cancer during a defined period of time in a specified population, regardless of when the diagnosis of cancer was made (during or prior to the period of interest, or at the time of death).

Most common cancers

For all ages combined and each age group (0–14, 15–29, 30–49, 50–64, 65–79, and 80+), the numbers of cases of cancer occurring in the period 2002–2006 for both sexes together were ranked and the most common cancers were selected.

Incidence/mortality rate

The number of new cases/deaths occurring in a specified population during a year (or 2002–2006 period) expressed per 100,000 population at risk. It is calculated as the number of new cases/deaths divided by the population size, then multiplied by 100,000.

Age-specific incidence/mortality rate

The number of new cases/deaths attributed to cancer in a five-year age group (0–4, 5–9...85+) during a year divided by the number of people in that age group during that year, multiplied by 100,000 and then expressed as a rate per 100,000 persons in that year.

Age-standardized incidence/mortality rate

The number of new cases or deaths per 100,000 that would have occurred in the standard population (1991 Canadian population) if the age distribution in the population of interest was the same as that of the standard population and if the actual age-specific rates observed in the population of interest had prevailed.

Age standardizing allows for valid comparison across time or geographic areas by accounting for differences in population age and sex.

In this report the 1991 Canadian population was used as the standard population except for international comparisons (Figure 9), where the World Standard Population was employed. Because the World Standard Population is younger, age-standardized rates using this population are lower than those standardized using the Canadian population.

Average annual increase/decrease

Annual percent change (APC) is a measure to assess the rate of change over time of an incidence or mortality rate, calculated by fitting a linear model to the annual rates after applying a logarithmic transformation. The estimated slope is then transformed back to represent a percentage increase or decrease per year. The method used allows for a series of straight line segments with different slopes to be fit to long-term trend data.

INTERNATIONAL REGIONS

Registries that represent various world regions with registration methods reasonably similar to those used in Canada were selected. These criteria omit Africa and much of South America.

PREVALENCE

Prevalence is the number of Ontarians diagnosed with cancer in the previous ten years who were still alive on January 1, 2007. A person diagnosed with more than one of prostate, breast, colorectal and lung cancer in that ten-year period will be included in the count for each cancer diagnosed. However, if a person is diagnosed with more than one of the same cancer (e.g., a person with two colorectal cancers), only one cancer would be included in the prevalence estimate.

SURVIVAL

Observed survival

Five-year observed survival is the proportion of people with cancer still alive five years after diagnosis.

Relative survival

Five-year relative survival is the proportion of people still alive five years after diagnosis, adjusted for the mortality expected for people of the same age, sex and time period in the general population of Ontario.

The cases diagnosed in the five-year time periods, 1982–1986, 1987–1991, 1992–1996, 1997–2001, were included in the calculation of relative survival using the cohort method. For cases diagnosed in the most recent time period, 2002–2006, relative survival was estimated using the period method.⁴²

Age-standardized relative survival

Age-standardized survival was calculated by first calculating survival for five age groups (15–44, 45–54, 55–64, 65–74, 75–99) for each cancer disease site except prostate (15–54, 55–64, 65–74, 75–84, 85–99). The age-specific survival estimates were then weighted by the site-specific age distribution for cancers diagnosed in Canada, 1992–2001.

For more information:

Supplemental materials available at www.cancercare.on.ca/reports include the numbers on which the information in this report is based.

Ontario Cancer Facts are short, monthly fact sheets intended to increase knowledge about cancer and its risk modifiers in Ontario. Data typically originate from several sources including the Ontario Cancer Registry, Cancer Care Ontario publications, and Canadian, provincial or regional health surveys. Readers may subscribe to receive Ontario Cancer Facts by e-mail.

Please see www.cancercare.on.ca/cancerfacts

Insight on Cancer publications are in-depth reports on specific cancer topics, including colorectal, breast, and cervical cancer; environmental exposures and cancer; and nutrition and cancer prevention.

Please see www.cancercare.on.ca/reports

The **Cancer System Quality Index** is a web-based tool that reports on a variety of evidence-based indicators covering every aspect of cancer control, from cancer prevention to end-of-life care and tracking progress against six dimensions of quality.

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