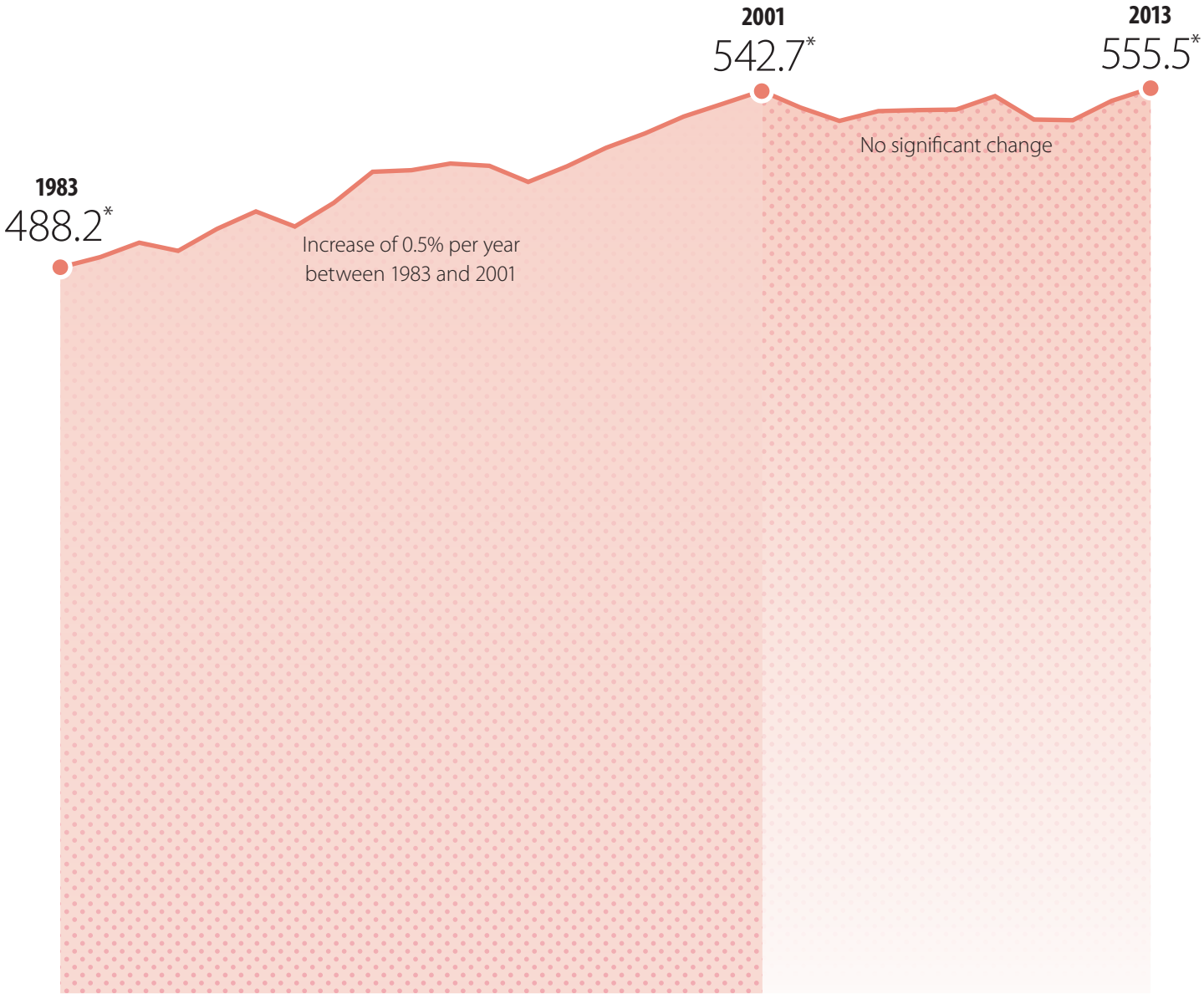
Chapter 4

Cancer incidence rates and trends

Cancer incidence measures the number of new cases of cancer diagnosed within a specific time period. This chapter presents cancer incidence rates and trends over time.

Age-standardized incidence rates

"The cancer incidence rate in Ontario has been stable since 2001, following two decades of increase."



* per 100,000 persons

Cancer incidence measures the number of new cases of cancer diagnosed within a specific time period. This chapter presents non-projected incidence rates and trends. The cancer incidence statistics in this chapter are based on counts deemed complete as of the latest available year.

In 2013, there were 77,088 new cases of cancer diagnosed in Ontario, resulting in an age-standardized incidence rate (ASIR) of 555.5 per 100,000 (Table 4.2). This was a slight decrease compared to 2012, when 77,941 cases were diagnosed for an ASIR of 578.1 per 100,000.

The most commonly diagnosed cancers were breast (10,269 or 13.3% of all new cases), lung (9,757 or 12.7%) and colorectal (8,759 or 11.4%).

Distribution of new cases for selected cancers, 2013

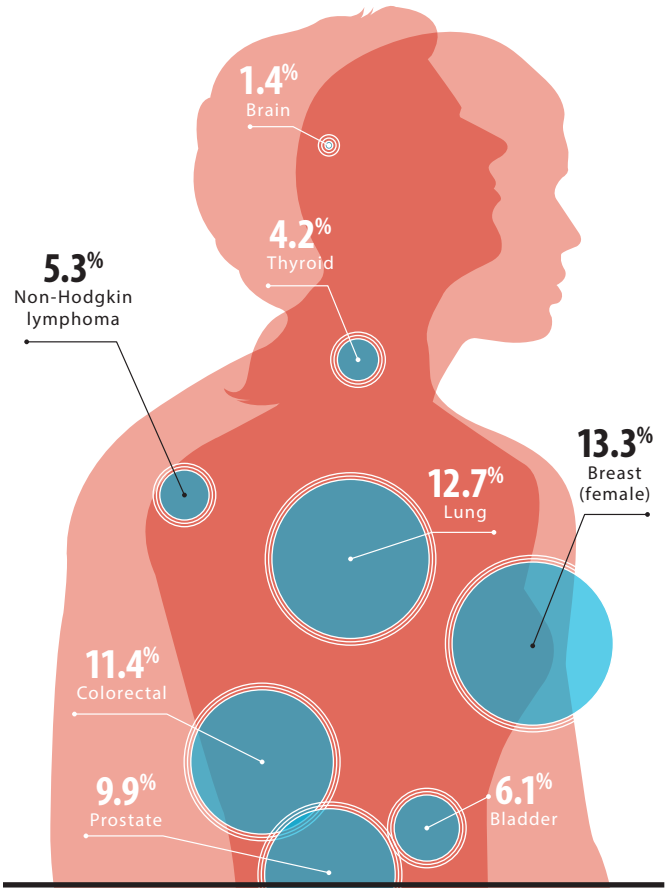


Table 4.1 Cumulative probability of developing cancer by age group and sex, Ontario, 2010–2013

Age group (years)	Both sexes	Males	Females
0–4	0.1%	0.1%	0.1%
5–9	0.2%	0.2%	0.2%
10–14	0.3%	0.3%	0.3%
15–19	0.4%	0.4%	0.4%
20–24	0.6%	0.6%	0.6%
25–29	0.9%	0.8%	0.9%
30–34	1.3%	1.1%	1.5%
35–39	2.0%	1.6%	2.5%
40–44	3.1%	2.3%	3.9%
45–49	4.7%	3.4%	5.9%
50–54	7.0%	5.5%	8.5%
55–59	10.4%	8.9%	11.9%
60–64	15.1%	14.1%	16.1%
65–69	20.9%	20.8%	21.1%
70–74	27.4%	28.1%	26.7%
75–79	33.6%	35.1%	32.2%
80–84	39.0%	41.0%	37.3%
85+	46.7%	48.4%	45.2%

Analysis by: Surveillance, Analytics and Informatics, CCO
Data sources: Ontario Cancer Registry (January 2017), CCO; Statistics Canada. Table 102-0564 - Leading causes of death, total population, by sex, Canada, provinces and territories (age standardization using 2011 population), annual, CANSIM (database); Statistics Canada. Table 051-0001 - Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted), CANSIM (database).

Probability of developing cancer

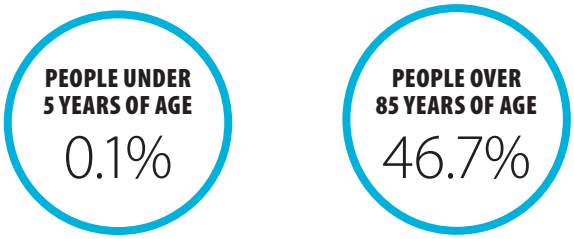
The probability of developing cancer refers to the average chance of being diagnosed with cancer over the course of a lifetime.

The probability of developing a specific type of cancer depends on many factors, including the population's characteristics (e.g., demographics), the prevalence of risk factors (e.g., smoking, obesity) and current life expectancy. Furthermore, these probabilities reflect the average risks for the overall population and do not take into account personal risk factors. In other words, an individual's risk may be higher or lower than the numbers reported here.

The probability of developing cancer for the 2009–2012 time period was 1 in 2.1 (47.5%). The probability was slightly higher for males at 1 in 2.0 than females at 1 in 2.2.[1]

For the period 2010–2013, the probability of developing cancer in Ontario increased with age, going from 0.1% for those under the age of five to 46.7% once a person reaches age 85 (Table 4.1). The probabilities were generally equal between males and females until the age of 25. After age 25, the probabilities were higher for females until the age of 69. The higher probabilities for females are probably the result of higher female rates of cancers common in this age group, such as thyroid and breast cancers. After age 69, the probability of developing cancer was higher for males.

For the period 2010–2013, the probability of developing cancer in Ontario increased with age



Incidence by sex and cancer type

In 2013, the ASIR for all cancers combined was significantly higher in males (605.1 per 100,000) than in females (523.3 per 100,000) (Table 4.2). The most commonly diagnosed cancers for males were prostate (7,647 or 19.9% of all new male cases), lung (4,954 or 12.9%) and colorectal (4,772 or 12.4%). In females, the leading cancer types were breast (10,269 or 26.6% of all new female cases), lung (4,803 or 12.4%) and colorectal (3,987 or 10.3%).

Table 4.2 **Cancer incidence counts and rates by cancer type and sex, Ontario, 2013**

	Both sexes				
Cancer type	New cases	% of new cases	Crude rate	ASIR[†]	ASIR 95% CI
All cancers	**77,088**	**100.0%**	**568.9**	**555.5**	**551.6–559.4**
Bladder	4,737	6.1%	35.0	33.8	32.9–34.8
Brain	1,079	1.4%	8.0	7.9	7.4–8.3
Breast (female)	10,269	13.3%	148.9	141.5	138.8–144.3
Cervix	523	0.7%	7.6	7.5	6.9–8.2
Colorectal	8,759	11.4%	64.6	62.9	61.5–64.2
Esophagus	800	1.0%	5.9	5.7	5.4–6.2
Hodgkin lymphoma	386	0.5%	2.8	2.8	2.6–3.1
Kidney	2,241	2.9%	16.5	16.2	15.5–16.9
Larynx	422	0.5%	3.1	3.0	2.7–3.3
Leukemia	2,414	3.1%	17.8	17.4	16.7–18.1
Liver	1,243	1.6%	9.2	8.9	8.5–9.5
Lung	9,757	12.7%	72.0	69.8	68.4–71.2
Melanoma	3,409	4.4%	25.2	24.7	23.8–25.5
Myeloma	1,235	1.6%	9.1	8.8	8.4–9.3
Non-Hodgkin lymphoma	4,088	5.3%	30.2	29.5	28.6–30.4
Oral cavity & pharynx	1,939	2.5%	14.3	14.0	13.4–14.7
Ovary	1,192	1.5%	17.3	16.3	15.4–17.3
Pancreas	1,878	2.4%	13.9	13.5	12.9–14.1
Prostate	7,647	9.9%	114.9	118.4	115.8–121.1
Stomach	1,497	1.9%	11.0	10.7	10.2–11.3
Testis	407	0.5%	6.1	6.1	5.5–6.7
Thyroid	3,219	4.2%	23.8	23.8	23.0–24.6
Uterus	2,409	3.1%	34.9	33.2	31.9–34.5

Table 4.2 *(Cont'd)* **Cancer incidence counts and rates by cancer type and sex, Ontario, 2013**

Males					
Cancer type	New cases	% of new cases	Crude rate	ASIR[†]	ASIR 95% CI
All cancers	**38,453**	**100.0%**	**577.7**	**605.1**	**599.0–611.2**
Bladder	3,627	9.4%	54.5	58.3	56.4–60.3
Brain	609	1.6%	9.1	9.3	8.6–10.1
Colorectal	4,772	12.4%	71.7	75.8	73.7–78.0
Esophagus	592	1.5%	8.9	9.3	8.5–10.0
Hodgkin lymphoma	206	0.5%	3.1	3.1	2.7–3.6
Kidney	1,428	3.7%	21.5	22.1	21.0–23.3
Larynx	356	0.9%	5.3	5.6	5.0–6.2
Leukemia	1,408	3.7%	21.2	22.3	21.2–23.5
Liver	845	2.2%	12.7	13.2	12.3–14.1
Lung	4,954	12.9%	74.4	78.6	76.4–80.9
Melanoma	1,858	4.8%	27.9	29.4	28.0–30.7
Myeloma	731	1.9%	11.0	11.7	10.9–12.6
Non-Hodgkin lymphoma	2,223	5.8%	33.4	35.1	33.7–36.6
Oral cavity & pharynx	1,337	3.5%	20.1	20.6	19.5–21.7
Pancreas	957	2.5%	14.4	15.1	14.2–16.1
Prostate	7,647	19.9%	114.9	118.4	115.8–121.1
Stomach	914	2.4%	13.7	14.5	13.6–15.5
Testis	407	1.1%	6.1	6.1	5.5–6.7
Thyroid	737	1.9%	11.1	11.2	10.4–12.0

Table 4.2 *(Cont'd)* **Cancer incidence counts and rates by cancer type and sex, Ontario, 2013**

Females					
Cancer type	New cases	% of new cases	Crude rate	ASIR[†]	ASIR 95% CI
All cancers	**38,635**	**100.0%**	**560.3**	**523.3**	**518.1–528.6**
Bladder	1,110	2.9%	16.1	14.4	13.6–15.3
Brain	470	1.2%	6.8	6.6	6.0–7.2
Breast	10,269	26.6%	148.9	141.5	138.8–144.3
Cervix	523	1.4%	7.6	7.5	6.9–8.2
Colorectal	3,987	10.3%	57.8	52.3	50.7–54
Esophagus	208	0.5%	3.0	2.7	2.4–3.1
Hodgkin lymphoma	180	0.5%	2.6	2.6	2.2–3.0
Kidney	813	2.1%	11.8	11.0	10.3–11.8
Larynx	66	0.2%	1.0	0.9	0.7–1.1
Leukemia	1,006	2.6%	14.6	13.5	12.7–14.4
Liver	398	1.0%	5.8	5.2	4.7–5.7
Lung	4,803	12.4%	69.7	63.6	61.8–65.4
Melanoma	1,551	4.0%	22.5	21.3	20.2–22.4
Myeloma	504	1.3%	7.3	6.6	6.1–7.2
Non-Hodgkin lymphoma	1,865	4.8%	27.0	24.9	23.7–26.0
Oral cavity & pharynx	602	1.6%	8.7	8.2	7.6–8.9
Ovary	1,192	3.1%	17.3	16.3	15.4–17.3
Pancreas	921	2.4%	13.4	11.9	11.2–12.7
Stomach	583	1.5%	8.5	7.6	7.0–8.3
Thyroid	2,482	6.4%	36.0	35.9	34.5–37.3
Uterus	2,409	6.2%	34.9	33.2	31.9–34.5

ASIR=Age-standardized incidence rate
CI=Confidence interval
[†]Rates standardized to the 2011 Canadian population
Note: Rates are per 100,000.
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2016), CCO

The incidence rate was higher in males than females for almost all cancers. The one exception was thyroid cancer, for which the ASIR for females was 35.9 per 100,000 compared to just 11.2 per 100,000 in males. A number of possible reasons for the higher incidence of thyroid cancer in females have been proposed. For example, females have an increased likelihood of diagnostic investigation because they are more likely to have thyroid disease,[2] as well as a greater tendency to seek medical attention and participate more actively in medical visits.[3–5] Biological differences in the hormone levels of males and females (such as thyroid stimulated hormone and sex steroids) may also be a reason for the higher rate among females.[6–8]

While the incidence of less aggressive types such as papillary thyroid cancer has been observed to be higher for females than males in a number of jurisdictions, the rate of more aggressive types (such as anaplastic and medullary thyroid cancers) are generally similar between the sexes.[2, 9] The result of this is similar thyroid mortality rates between the sexes (see *Chapter 5: Cancer mortality rates and trends).*

Thyroid cancer was the only cancer type that was more commonly diagnosed in females than males in 2013.

Incidence rates were higher in males for all other cancer types. The greatest disparity in incidence between male and female incidence was in bladder, esophageal and oral cavity & pharynx cancers. Specifically:

- For bladder cancer, the male rate was more than four times that of the female rate. One of the risk factors for bladder cancer is a history of smoking, with smokers two to three times more likely to develop bladder cancer than non-smokers.[10, 11] Because a history of tobacco use is more common in males, this may be one of the reasons bladder cancer incidence is so much higher among males.[12]
- For esophageal cancer, the male rate was more than three times that of the female rate. Like bladder cancer, smoking is a key risk factor for esophageal cancer and may also contribute to the disparity between males and females for this cancer type. Alcohol use and obesity—also more common in males—are other risk factors for esophageal cancer.[13]
- For oral cavity & pharynx cancer, the male rate was more than twice that of the female rate. Tobacco and alcohol use are also important risk factors for oral cavity & pharynx cancer.[14]

Incidence by age

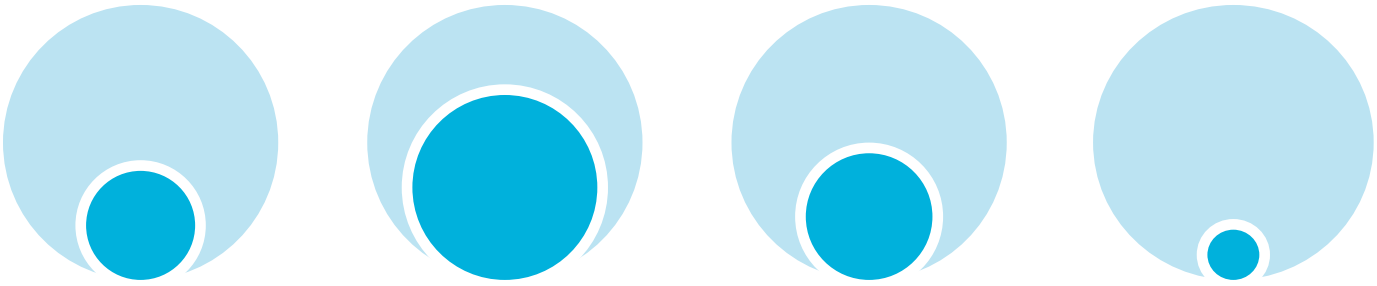
In 2013, more than half of all newly diagnosed cancer cases were in people ages 60 to 79 (Table 4.3). The distribution of incident cases by age group was as follows:

- 19.1% of all new cases occurred in people 80 years of age or older, with prostate and female breast the leading cancers;
- 50.8% of all new cases occurred in people 60 to 79 years of age, with prostate and female breast the leading cancers;
- 25.1% of all new cases occurred in people 40 to 59 years of age, with prostate and female breast the leading cancers; and
- 5.0% of all new cases occurred in people under the age of 40, with female breast and thyroid the leading cancers.

People ages 60 to 79 were the most likely to be diagnosed with the most common cancers accounting for 45.5% of all new cases of breast cancer, 67.5% of new cases of prostate cancer, 50.8% of new cases of lung cancer and 60.6% of new cases of colorectal cancer.

Nearly half of all new cases of thyroid cancer occurred among people ages 40 to 59 and 20.8% of new cervical cancer cases occurred in females ages 40 to 59. The under-40 age group accounted for the majority of new cases of Hodgkin lymphoma and testicular cancer, accounting for 55.4% and 68.8%, respectively.

Distribution of newly diagnosed cancer cases by age group



80 YEARS OF AGE OR OLDER
19.1%

60–79 YEARS OF AGE
50.8%

40–59 YEARS OF AGE
25.1%

UNDER THE AGE OF 40
5.0%

Table 4.3 Incidence counts and age-specific rates by cancer type and age group, Ontario, 2013

Cancer type	Age group (years)					
	0–39			40–59		
	Count	Age-specific rate	95% CI	Count	Age-specific rate	95% CI
All cancers*	**3,888**	**57.7**	**55.9–59.6**	**19,311**	**486.6**	**479.7–493.5**
Bladder	49	0.7	0.5–1.0	657	16.6	15.3–17.9
Brain*	222	3.3	2.9–3.6	343	8.6	7.8–9.6
Breast (female)	425	12.7	11.5–14.0	2,846	192.2	186.2–198.4
Cervix	130	3.9	3.2–4.6	255	12.7	11.2–14.4
Colorectal*	193	2.9	2.5–3.3	1,817	45.8	43.7–47.9
Esophagus	7	0.1	0.0–0.2	197	5.0	4.3–5.7
Hodgkin lymphoma	214	3.2	2.8–3.6	94	2.4	1.9–2.9
Kidney	85	1.3	1.0–1.6	674	17.0	15.7–18.3
Larynx	**	**	**	99	2.5	2.0–3.0
Leukemia*	287	4.3	3.8–4.8	464	11.7	10.7–12.8
Liver	23	0.3	0.2–0.5	283	7.1	6.3–8.0
Lung	48	0.7	0.5–0.9	1,522	38.3	36.4–40.3
Melanoma*	297	4.4	3.9–4.9	985	24.8	23.3–36.4
Myeloma	7	0.1	0.0–0.2	226	5.7	5.0–6.5
Non-Hodgkin lymphoma*	354	3.8	3.3–4.3	953	24.0	22.5–35.6
Oral cavity & pharynx	71	1.1	0.8–1.3	694	17.5	16.2–18.8
Ovary	75	2.2	1.8–2.8	294	19.7	17.8–21.7
Pancreas	24	0.4	0.2–0.5	323	8.1	7.3–9.1
Prostate	**	**	**	1,445	73.4	68.7–77.3
Stomach*	17	0.3	0.1–0.4	311	7.8	7.0–8.8
Testis	280	8.3	7.3–9.3	115	5.8	4.8–7.0
Thyroid	767	11.4	10.6–12.2	1,582	39.9	37.9–41.9
Uterus	60	1.8	1.4–2.3	809	40.4	37.7–43.3

Table 4.3 *(Cont'd)* **Incidence counts and age-specific rates by cancer type and age group, Ontario, 2013**

Cancer type	Age group (years)					
	60–79			80+		
	Count	Age-specific rate	95% CI	Count	Age-specific rate	95% CI
All cancers*	**39,121**	**1,706.60**	**1,689.7–1,723.6**	**14,748**	**2,656.7**	**2,614.0–2,699.9**
Bladder	2,758	120.3	115.8–124.8	1,367	246.2	233.4–259.7
Brain*	405	17.7	16.0–19.5	109	19.6	16.1–23.7
Breast (female)	4,676	388.3	377.3–399.6	1,322	285.0	364.5–406.3
Cervix	109	9.1	7.4–10.9	29	8.4	5.7–12.1
Colorectal*	4,449	194.0	188.3–199.8	2,300	414.3	397.6–431.6
Esophagus	433	18.9	17.1–20.7	163	29.4	25.0–34.2
Hodgkin lymphoma	63	2.7	2.1–3.5	15	2.7	1.5–4.5
Kidney	1,096	47.9	45.0–50.7	305	54.9	48.9–61.5
Larynx	251	10.9	9.6–12.4	70	12.6	9.8–15.9
Leukemia*	1,104	48.1	45.2–51.1	599	100.7	92.5–109.4
Liver	679	29.6	27.4–31.9	258	46.5	41.0–52.5
Lung	5,913	257.8	251.3–264.5	2,274	409.6	393.0–426.8
Melanoma*	1,467	64.0	60.7–67.3	660	118.9	110.0–128.3
Myeloma	670	29.2	27.0–31.5	332	59.8	53.5–66.6
Non-Hodgkin lymphoma*	1,991	86.8	83.0–90.7	890	160.3	150.0–171.2
Oral cavity & pharynx	928	40.5	37.9–43.2	246	44.3	38.9–50.2
Ovary	547	45.4	41.7–49.4	176	51.3	44.0–59.4
Pancreas	1,039	45.3	42.6–48.1	492	88.6	81.0–96.8
Prostate	5,164	474.1	461.2–487.2	1,037	489.8	460.4–520.5
Stomach*	779	34.0	31.6–36.4	390	70.3	63.5–77.6
Testis	10	0.9	0.4–1.7	**	**	**
Thyroid	797	34.8	32.4–37.2	73	13.2	10.3–16.5
Uterus	1,293	107.4	101.6–113.4	247	71.9	63.2–81.5

CI=Confidence interval
*Significant increasing trend in age-specific rate with increasing age
**Suppressed due to small cell count (n<6)
Notes: 1. Rates are per 100,000.
2. Excludes cases of unknown age.
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2016), CCO

Cancer incidence increased significantly with age—from a rate of 57.7 per 100,000 in those diagnosed at age 39 or younger to 2,656.7 per 100,000 in those diagnosed at age 80 or older. Incidence rates for:

- cancers of the brain, colorectum and stomach, as well as leukemia, melanoma and non-Hodgkin lymphoma, all increased significantly with age;
- cancers of the bladder, esophagus, kidney, larynx, liver, lung, oral cavity & pharynx, ovary, pancreas and prostate, as well as myeloma, increased non-significantly with age;
- testicular cancer decreased non-significantly with age;
- breast and uterine cancer peaked in those ages 60 to 79;
- cervical and thyroid cancer peaked in those ages 40 to 59; and
- Hodgkin lymphoma peaked in those ages 39 or younger, declined among people ages 40 to 59 and then increased slightly in those 60 and older.

Incidence trends by cancer type

From 1983 to 2001, the cancer incidence rate for all cancers combined increased by 0.5% per year and then remained stable until 2013 (Table 4.4). Among males, the incidence rate increased by 0.4% per year from 1983 to 2001 followed by a decrease of 0.7% per year from 2001 to 2013. While the cancer incidence rate among males has been decreasing in recent years, the incidence rate among females has increased by 0.4% per year since 1983.

Table 4.4 **Annual percent change in age-standardized incidence rates by cancer type and sex, Ontario, 1983–2013**

Cancer type	Both Sexes			Males			Females		
	Period	APC (%)		Period	APC (%)		Period	APC (%)	
All cancers	**1983–2001**	**0.5**	↑	**1983–2001**	**0.4**	↑	**1983–2013**	**0.4**	↑
	2001–2013	**–0.1**		**2001–2013**	**–0.7**	↓			
Bladder†	1989–2013	–1.0	↓	1989–2013	–1.0	↓	1989–2003	–0.6	
							2003–2013	–2.5	↓
Brain	1983–2013	–0.3	↓	1983–2013	–0.3	↓	1983–2013	–0.4	↓
Breast (female)							1983–1992	2.0	↑
							1992–2013	–0.2	↓
Cervix							1983–2005	–2.1	↓
							2005–2013	–0.3	
Colorectal	1983–1997	–0.9	↓	1983–2008	–0.3	↓	1983–1996	–1.4	↓
	1997–2000	2.1		2008–2013	–2.1	↓	1996–1999	2.3	
	2000–2013	–1.2	↓				1999–2013	–1.1	↓
Esophagus	1983–2013	0.3	↑	1983–2013	0.6	↑	1983–2013	–0.6	↓
Hodgkin lymphoma	1983–2013	–0.5	↓	1983–2013	–0.7	↓	1983–2013	–0.2	
Kidney	1983–1989	4.9	↑	1983–1989	4.6	↑	1983–2013	1.3	↑
	1989–1995	–1.0		1989–2000	–0.2				
	1995–2013	1.6	↑	2000–2013	2.1	↑			
Larynx	1983–2013	–2.3	↓	1983–2013	–2.4	↓	1983–2013	–2.4	

Table 4.4 *(Cont'd)* **Annual percent change in age-standardized incidence rates by cancer type and sex, Ontario, 1983–2013**

Cancer type	Both Sexes			Males			Females		
	Period	APC (%)		Period	APC (%)		Period	APC (%)	
Leukemia	1983–2013	0.2	↑	1983–2013	0.2		1983–2013	0.2	
Liver	1983–2007	4.1	↑	1983–2013	4.5	↑	1983–2007	3.4	↑
	2007–2013	6.9	↑				2007–2013	10.4	↑
Lung	1983–1990	0.6		1983–2008	–1.8	↓	1983–1995	2.4	↑
	1990–2008	–0.8	↓	2008–2013	0.0		1995–2013	0.7	↑
	2008–2013	0.9							
Melanoma	1983–1987	6.1	↑	1983–2013	2.1	↑	1983–1994	–0.1	
	1987–1992	–1.7					1994–2013	2.2	↑
	1992–2013	2.2	↑						
Myeloma	1983–2004	0.5	↑	1983–2004	0.6	↑	1983–2013	0.3	↑
	2004–2008	–2.6		2004–2007	–4.9				
	2008–2013	5.0	↑	2007–2013	5.5	↑			
Non-Hodgkin lymphoma	1983–1998	2.0	↑	1983–2009	1.4	↑	1983–1998	2.1	↑
	1998–2009	0.6	↑	2009–2013	4.2	↑	1998–2009	0.3	
	2009–2013	5.1	↑				2009–2013	4.9	↑
Oral cavity & pharynx	1983–2003	–1.6	↓	1983–2003	–2.1	↓	1983–2004	–0.9	↓
	2003–2013	1.6	↑	2003–2013	1.8	↑	2004–2013	1.1	↑
Ovary							1983–2002	0.4	↑
							2002–2013	–1.2	↓
Pancreas	1983–2006	–0.7	↓	1983–2004	–1.3	↓	1983–2006	–0.3	↓
	2006–2013	2.8	↑	2004–2013	2.4	↑	2006–2013	2.4	↑
Prostate				1983–1993	5.4	↑			
				1993–2007	1.2	↑			
				2007–2013	–6.0	↓			
Stomach	1983–2007	–1.9	↓	1983–2008	–1.9	↓	1983–1999	–2.6	↓
	2007–2013	1.4		2008–2013	1.2		1999–2013	0.1	
Testis				1983–2013	1.2	↑			
Thyroid	1983–1998	4.8	↑	1983–2013	6.5	↑	1983–1998	4.9	↑
	1998–2002	13.3	↑				1998–2002	15.0	↑
	2002–2013	6.3	↑				2002–2013	6.0	↑
Uterus							1983–1989	–2.7	↓
							1989–2005	0.6	↑
							2005–2013	3.5	↑

APC=Annual percent change
†Bladder cancer trend begins at 1989 due to classification changes and excludes carcinomas *in situ*
Notes: 1. Statistically significant changes in trend and their direction are indicated by corresponding arrows.
2. IARC/IACR multiple primary rules used when presenting trends over time.
3. Rates are standardized to the 2011 Canadian population.
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2016), CCO

Changes in trend were observed among the four most commonly diagnosed cancers:

BREAST

The ASIR for breast cancer increased by 2.0% per year during the 1980s and early 1990s. This increase in the incidence rate was likely due to a rise in both opportunistic and then programmatic mammography screening through the Ontario Breast Screening Program (OBSP) that began in 1990.[15]

Since 1992, the ASIR for breast cancer in females in Ontario has been steadily decreasing at 0.2% per year. An abrupt rise and fall in the incidence rate is common when a new method of early diagnosis is introduced; this may explain the decline in the breast cancer incidence rate in the 1990s. In addition, the use of hormone replacement therapy (HRT) began to decline in the 2000s.[16, 17] As HRT is associated with an increased risk of breast cancer among post-menopausal females, this may also have contributed to the decline in the breast cancer incidence rate after 2000.

COLORECTAL

The colorectal cancer rate among males declined gradually from 1983 to 2008 by 0.3% per year and then more steeply by 2.1% per year from 2008 to 2013. Individually, incidence rates for both colon and rectal cancers also declined during this period (data not shown).[1]

Among females the rate fell by 1.4% per year from 1983 to 1996, was stable from 1996 to 1999, and then decreased again after 1999 at a rate of 1.1% per year. These fluctuations reflect an increase in rectal cancer from 1996 to 1999, and a steady decrease in colon cancer from 1983 to 2013 in females (data not shown).[1]

LUNG

In males, the ASIR for lung cancer decreased by 1.8% per year from 1983 to 2008, and then stabilized. The incidence rate among females has been increasing since the 1980s—although the upward trend has slowed since 1995.

The long-term decline in the lung cancer incidence rate in males and the slowing increase in the incidence rate in females over the last two decades reflects differences in historical smoking rates between the sexes.[12] While tobacco use is the primary cause of lung cancer, other causes include exposure to radon, asbestos, environmental tobacco smoke and air pollution.

PROSTATE

The ASIR for prostate cancer rose by 5.4% per year from 1983 to 1993. The increase in the later years of this period is probably due to the introduction of prostate-specific antigen (PSA) testing in 1988. From 1993 to 2007, the ASIR increased more slowly at 1.2% per year and then fell by 6.0% per year from 2007 to 2013. An abrupt rise and fall in the incidence rate is common when a new method of early diagnosis is introduced. The decrease after 2007 is also probably a reflection of recommendations from the U.S. Preventive Services Task Force against using prostate-specific antigen (PSA) testing for the routine screening of healthy males.[18]

Notable changes in trend were also observed for the following cancers:

LIVER

Incidence rates for liver cancer increased steeply from 1983 to 2013. Among males, the ASIR increased at a rate of 4.5% per year from 1983 onward. The increasing trend in the incidence rate of liver cancer was even more pronounced among females, with the ASIR increasing by 3.4% per year from 1983 to 2007 and then by 10.4% per year from 2007 onward.

A rising incidence rate of liver cancer may be the result of increasing immigration from countries where certain risk factors (e.g., hepatitis B and C infections, exposure to aflatoxins) are more common.[19] A higher prevalence of hepatitis C infection caused by needle sharing as well as the increasing prevalence of obesity and diabetes may also have contributed to the incidence rate.[20]

MYELOMA

The ASIR for myeloma increased by 5.0% per year from 2008 to 2013. This increase was driven mainly by the increased ASIR in males, which went up by 5.5% per year from 2007 to 2013. The rate for females increased by 0.3% per year from 1983 to 2013. Increasing trends in other jurisdictions suggest the rise in myeloma rates may be due to improvements in diagnostics and better case ascertainment.[21]

THYROID

The ASIR for thyroid cancer increased significantly throughout the time period. The greatest increase occurred among females from 1998 to 2002, growing by 15.0% per year during this period. The incidence rate continued to increase from 2002 to 2013 but at a slower pace of 6.0% per year. Among males, the ASIR increased by 6.5% per year from 1983 onward.

This rising incidence rate has been attributed to improved diagnostic technology, including the use of ultrasound and fine-needle aspiration, which may have allowed for the detection of subclinical tumours.[22–25]

Changes in incidence rates from 1983 to 2013 for other cancer types are provided in Table 4.4.

Thirty-year trend in incidence

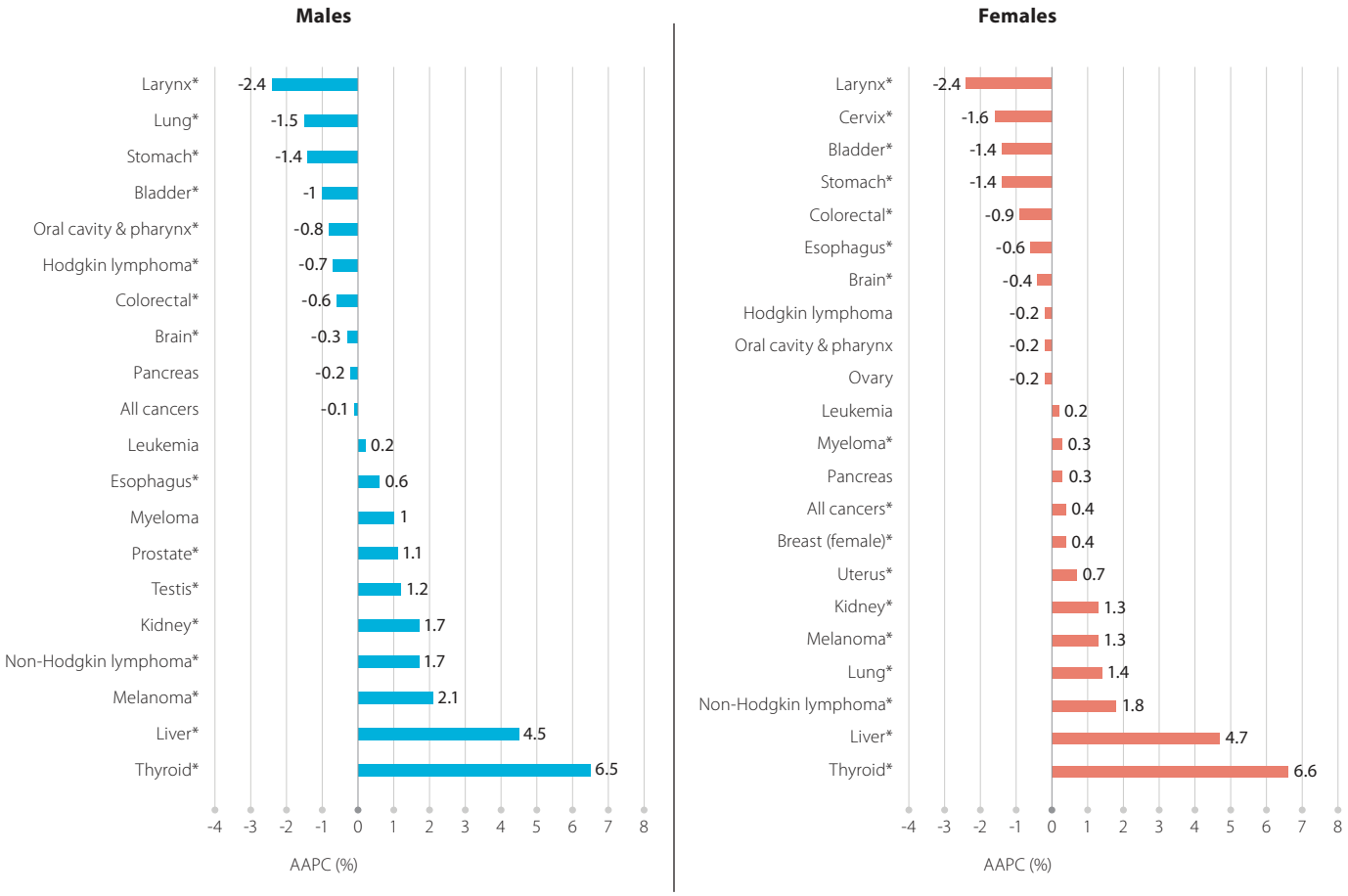
Over the last thirty years (1983 to 2013) the average annual percent change (AAPC) in ASIR for males (Figure 4.1):

- decreased most for laryngeal (2.4% per year), lung (1.5%) and stomach (1.4%) cancers;
- increased most for thyroid (6.5%) and liver (4.5%) cancers and melanoma (2.1%); and
- remained stable for pancreatic cancer, leukemia and myeloma.

For females, the AAPC:

- decreased most for laryngeal (2.4% per year), cervical (1.6%), bladder (1.4%) and stomach (1.4%) cancers;
- increased most for thyroid (6.6%) and liver (4.7%) cancers as well as non-Hodgkin lymphoma (1.8%); and
- remained stable for oral cavity & pharynx, ovarian and pancreatic cancers as well as Hodgkin lymphoma and leukemia.

Figure 4.1 **Average annual percent change in age-standardized incidence rates by cancer type and sex, Ontario, 1983–2013**



AAPC=Average annual percent change
*Statistically significant AAPC
Notes: 1. Bladder cancer trend begins at 1989 due to classification changes and excludes carcinomas *in situ*; therefore, AAPC is for the period 1989–2013.
2. IARC/IACR multiple primary rules used when presenting trends over time.
3. Rates standardized to the 2011 Canadian population.
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2016), CCO

Incidence trends by age

Over the past 30 years, cancer incidence rates have been increasing among younger and middle-aged people and decreasing among the elderly.

Among people under the age of 39, the cancer incidence rate increased by 0.5% per year from 1983 to 2001 and then by 1.5% per year from 2001 to 2013 (Figure 4.2). Differential trends were seen in males and females. Among males, the rate increased from 1983 to 1990, remained stable until 2005 and then increased until 2013; for females, the rate was stable from 1983 to 1993 and then increased from 1993 to 2013. This increase in incidence among females is probably due to their increased rates of thyroid cancer, which is the second most common cancer in this age group.

Among people ages 40 to 59, the rate of cancer increased by 0.4% per year from 1983 to 2013. While the trend among females was the same, the male rate decreased by 1.9% per year after 2008.

For those ages 60 to 79, the rate increased by 0.7% per year from 1983 to 2001 and then declined by 0.5% per year from 2001 to 2013. The rate among males was similar, although the increase ceased in 1992 and the rate did not begin to decline until 2007. Females in this age group had no decrease in incidence; their rate increased by 0.6% per year from 1983 to 1999, and then remained stable from 1999 to 2006 before rising again from 2006 to 2013 at a rate of 0.8% per year.

In the oldest age group (those 80 and older), the incidence rate declined slightly by 0.2% per year until 2007, after which it remained stable. While the male rate declined steadily throughout the time period, the female rate has been increasing slowly since 1987 following five years of stability.

Figure 4.2 **Annual percent change in age-standardized incidence rates by age group and sex for all cancers combined, Ontario, 1983–2013**

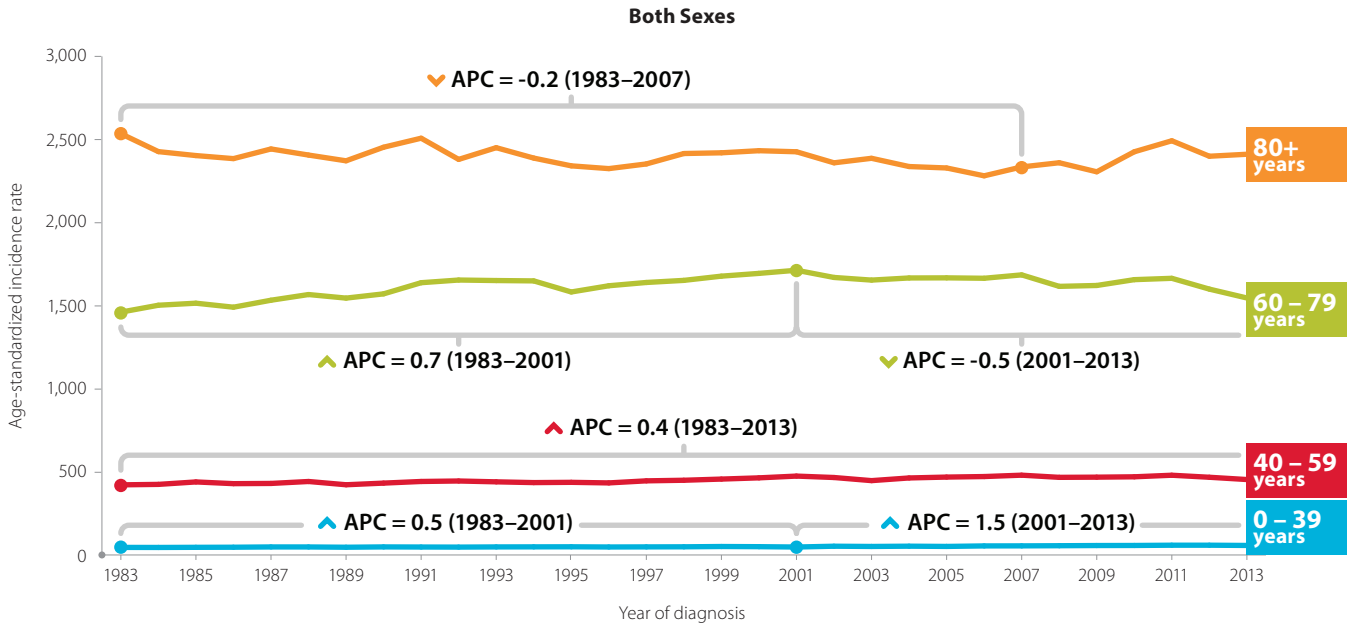


Figure 4.2 *(Cont'd)* **Annual percent change in age-standardized incidence rates by age group and sex for all cancers combined, Ontario, 1983–2013**

APC=Annual percent change
Notes: 1. Rates are per 100,000 and standardized to the age distribution of the 2011 Canadian population.
2. IARC/IACR multiple primary rules used when presenting trends over time.
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2016), CCO

Incidence by stage

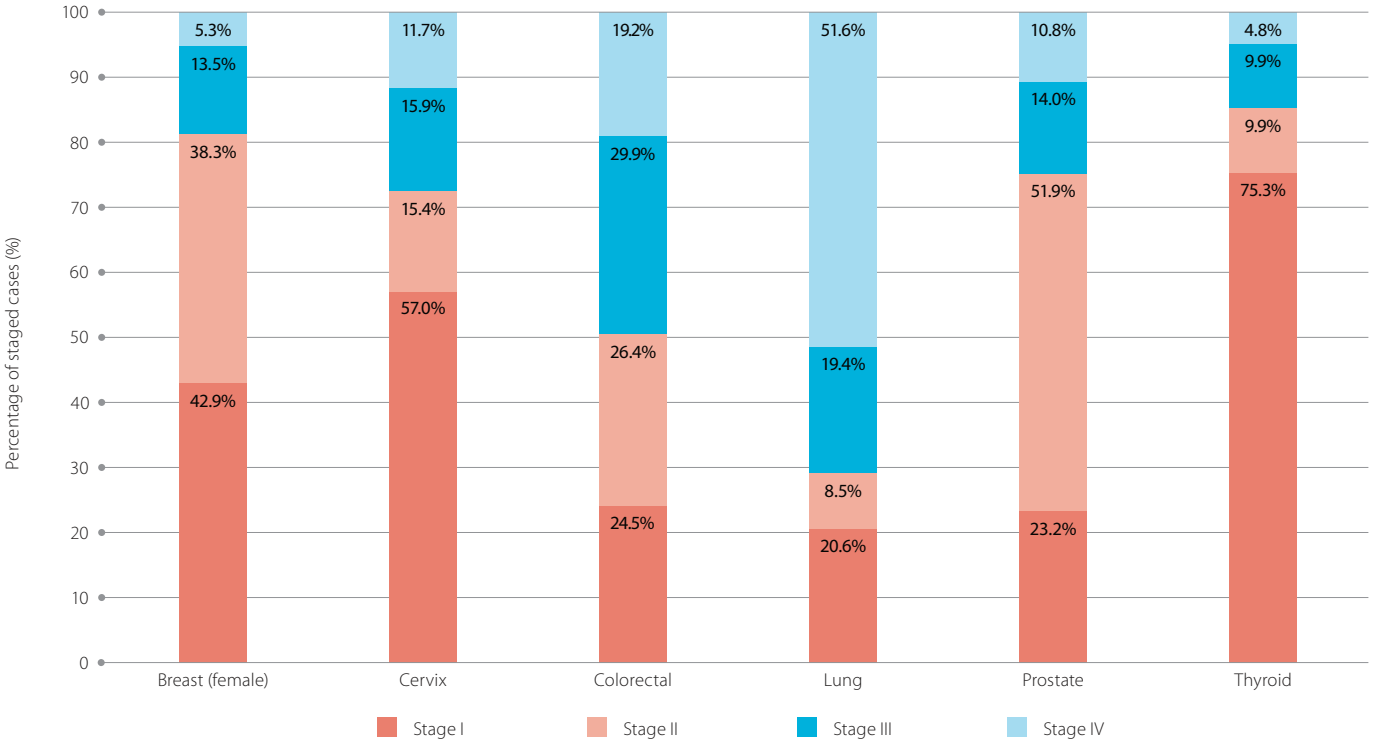
"Stage" is defined as the classification of people with cancer into prognostically similar groups according to the extent of the disease. "Stage at diagnosis" is the extent of the disease at the time of initial diagnosis. Knowing the stage of the disease helps physicians plan appropriate treatment and determine the likely outcome or course of the disease. A cancer diagnosed at an early stage is more likely to be treated successfully. If the cancer has spread, treatment becomes more difficult and a person's chances of survival are generally much lower.

Information about stage at diagnosis is one of the most important prognostic factors for cancer. High-quality stage data at the population level supports healthcare providers, administrators, researchers and decision-makers in planning, evaluating, enhancing quality of care and improving treatment outcomes.

Stage at diagnosis data for Ontario are currently available for six cancers: female breast, prostate, colorectal, lung, cervix and thyroid. The majority of breast, colorectal, prostate, cervical and thyroid cancers were diagnosed at stage I or II. This may partly be the result of the availability of screening for breast, colorectal and cervical cancers, which increases the likelihood of detecting these cancers at early stages. More specifically:

- The majority of staged breast cancer cases were diagnosed at stage I (42.9%) or stage II (38.3%) in 2013 (Figure 4.3)
- Cervical cancer was even more likely to be diagnosed at stage I (57.0%) than breast cancer. Despite the successes of screening programs in decreasing cervical cancer incidence and mortality, 11.7% of cases were still not diagnosed until stage IV. Females who are diagnosed at a later stage are less likely to have been routinely screened.[26]

Figure 4.3 **Incidence distribution by cancer type and stage for selected cancers, Ontario, 2013**



Note: Case counts are as follows: prostate n = 6,735 (excludes unknown stage = 42); breast n = 9,446 (excludes unknown stage = 85); colorectal n = 7,029 (excludes unknown stage = 233); lung n = 8,212 (excludes unknown stage = 101); cervix n = 479 (excludes unknown stage = 10); thyroid n = 2,887 (excludes unknown stage = 97). Cases that were not staged were excluded from this analysis.
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2016), CCO

- The majority of staged colorectal cancer cases were diagnosed at stage II (26.4%) or stage III (30.5%).
- Prostate cancer cases were most likely to be diagnosed at stage II (51.9%) followed by stage I (23.2%).
- Lung cancer cases were the most likely to be diagnosed at stage IV, accounting for 51.6% of all staged lung cancer cases.
- Thyroid cancer was the most likely to be diagnosed at stage I with 75.3% of staged cases diagnosed at this early stage. Only 4.8% of thyroid cases were diagnosed at stage IV.

It should be noted that approximately 10% to 20% of breast, colorectal, lung and prostate cancer cases in the Ontario Cancer Registry are missing any information on stage at diagnosis and are therefore excluded from this analysis. We cannot be sure that the distributions would be the same for these cases.

The majority of breast, colorectal, prostate, cervical and thyroid cancers were diagnosed at stage I or II.

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