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At-a-glance

Cancer trends in Canada, 1984 to 2015

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Abstract

Examining incidence trends of all cancers combined in order to understand cancer trends can be misleading, as patterns can vary across individual cancer types. This paper highlights findings on trends over time from *Canadian Cancer Statistics 2019*, as measured by the annual percent change (APC) of age-standardized incidence rates. Among the results were a recent increase in thyroid cancer in males (APC: 6.4%, 1997–2015), as well as decreases in prostate cancer (APC: −9.1%, 2011–2015) and cervical cancer (APC: −3.3%, 2010–2015).

Keywords: *neoplasms, data analysis, trend, cancer*

Highlights

- The incidence of some cancers is changing rapidly in Canada.
- Recent trends show increasing rates of thyroid cancer in males, drawing attention to the potential impact of overdiagnosis.
- Prostate cancer incidence is decreasing rapidly, likely reflecting recent changes in screening guidelines.

Introduction

Chronic disease trends are often seen as stable or changing at low rates in populations. For example, the incidence rate of diabetes in Canada went from 6.7 per 1000 population in 2003/04 to 6.3 per 1000 in 2013/14.[1] Up to 2011, before the incidence rates of prostate cancer started to decline rapidly, this claim of relative stability could also be made for all cancers, if they were presented as an overall group. *Canadian Cancer Statistics 2019* (CCS 2019) reports that from 1984 to 2015, cancer incidence rates in Canada increased 0.1% per year on average.[2] However, this collective picture is misleading, as trends can differ greatly depending on the cancer type and the time period.[2]

Monitoring incidence of individual cancers over time can help identify emerging trends, highlight where progress has been made, and suggest where more work and resources are needed. The purpose of this report is to feature findings from the CCS 2019 report relating to time trends in the incidence of cancers in Canada, with a particular focus on patterns of change for individual cancer types.

TABLE 1
Annual percentage change (APC) in age-standardized incidence rates by cancer site and sex, Canada (excluding Quebec), 1984 to 2015

Cancer type	Males				Females			
	Year		APC	*p*-value	Year		APC	*p*-value
	From	To			From	To		
Oral	1984	2004	−2.5	< .001	1984	2003	−1.0	< .001
	2004	2011	2.1	.003	2003	2015	0.7	.028
	2011	2015	−0.1	.94				
Esophagus	1984	2006	0.3	.020	1984	2015	−0.4	< .001
	2006	2010	4.3	.068				
	2010	2015	−2.4	.015				
Stomach	1984	2002	−2.5	< .001	1984	1999	−3.0	< .001
	2002	2015	−1.1	< .001	1999	2015	−0.8	< .001
Colorectal	1984	1996	−0.7	< .001	1984	1996	−1.5	< .001
	1996	2000	0.9	.33	1996	2000	1.2	.23
	2000	2011	−0.5	.001	2000	2011	−0.5	< .001
	2011	2015	−2.2	< .001	2011	2015	−1.9	.002
Liver	1984	2011	3.8	< .001	1984	2015	2.7	< .001
	2011	2015	0.2	.88				
Pancreas	1984	2000	−1.5	< .001	1984	2015	0.1	.58
	2000	2015	0.8	.009				
Larynx	1984	2015	−2.6	< .001	1984	1991	0.7	.64
					1991	2015	−3.0	< .001

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TABLE 1 (continued)
Annual percentage change (APC) in age-standardized incidence rates by cancer site and sex, Canada (excluding Quebec), 1984 to 2015

Cancer type	Males				Females			
	Year		APC	*p*-value	Year		APC	*p*-value
	From	To			From	To		
Lung and bronchus	1984	1990	−0.6	.087	1984	1993	2.9	< .001
	1990	2003	−2.2	< .001	1993	2011	0.9	< .001
	2003	2011	−0.9	.002				
	2011	2015	−3.3	< .001	2011	2015	−1.3	.043
Melanoma	1984	2015	2.2	< .001	1984	1994	0.1	.79
					1994	2015	2.0	< .001
Breast	1984	2015	0.5	.015	1984	1991	2.1	< .001
					1991	2015	−0.2	.010
Cervix					1984	2006	−2.1	< .001
			N/A		2006	2010	1.5	.41
					2010	2015	−3.3	< .001
Uterus					1984	1990	−1.5	.063
					1990	2006	0.5	.013
			N/A		2006	2011	3.7	.002
					2011	2015	0.1	.92
Ovary					1984	1994	−1.7	< .001
			N/A		1994	2015	−0.4	.001
Prostate	1984	1993	6.3	< .001				
	1993	1997	−3.0	.38				
	1997	2001	4.1	.23		N/A		
	2001	2011	−1.6	.006				
	2011	2015	−9.1	< .001				
Testis	1984	2015	1.3	< .001		N/A		
Bladder	1984	2009	−1.0	< .001	1984	2009	−0.9	< .001
	2010	2015	−1.5	.052	2010	2015	−1.3	.18
Kidney and renal pelvis	1984	1989	4.0	.005	1984	2015	1.0	< .001
	1989	2003	0.1	.64				
	2003	2011	2.8	< .001				
	2011	2015	−0.3	.76				
Brain/CNS	1984	2009	−0.2	.081	1984	2011	−0.3	.002
	2009	2015	−1.9	.012	2011	2015	−3.2	.059
Thyroid	1984	1997	2.8	.002	1984	1998	3.8	< .001
	1997	2015	6.4	< .001	1998	2002	11.9	< .001
					2002	2011	6.5	< .001
					2011	2015	0.1	.94
Hodgkin lymphoma	1984	2015	−0.4	< .001	1984	2015	0.0	.74
Non-Hodgkin lymphoma	1984	2015	1.3	< .001	1984	1993	2.2	< .001
					1993	2015	0.9	< .001
Multiple myeloma	1984	2007	0.3	.077	1984	2015	0.6	< .001
	2007	2015	2.6	< .001				
Leukemia	1984	1994	−0.9	.067	1984	2003	−0.2	.18
	1994	2015	0.7	< .001	2003	2007	3.7	.071
					2007	2015	−0.6	.14

Data source: Canadian Cancer Statistics Advisory Committee. Canadian cancer statistics 2019. Toronto (ON): Canadian Cancer Society; 2019.
Abbreviations: APC, annual percent change; CNS, central nervous system; N/A, not applicable.

Methods

Results are drawn from the incidence chapter of the CCS 2019 report,[2] covering the period from 1984 to 2015. Quebec was not included because data were available up to 2010 only. The Canadian Cancer Registry (CCR)[3] was the source of data for 1992 to 2015, and the National Cancer Incidence Reporting System (NCIRS) was utilized prior to 1992.

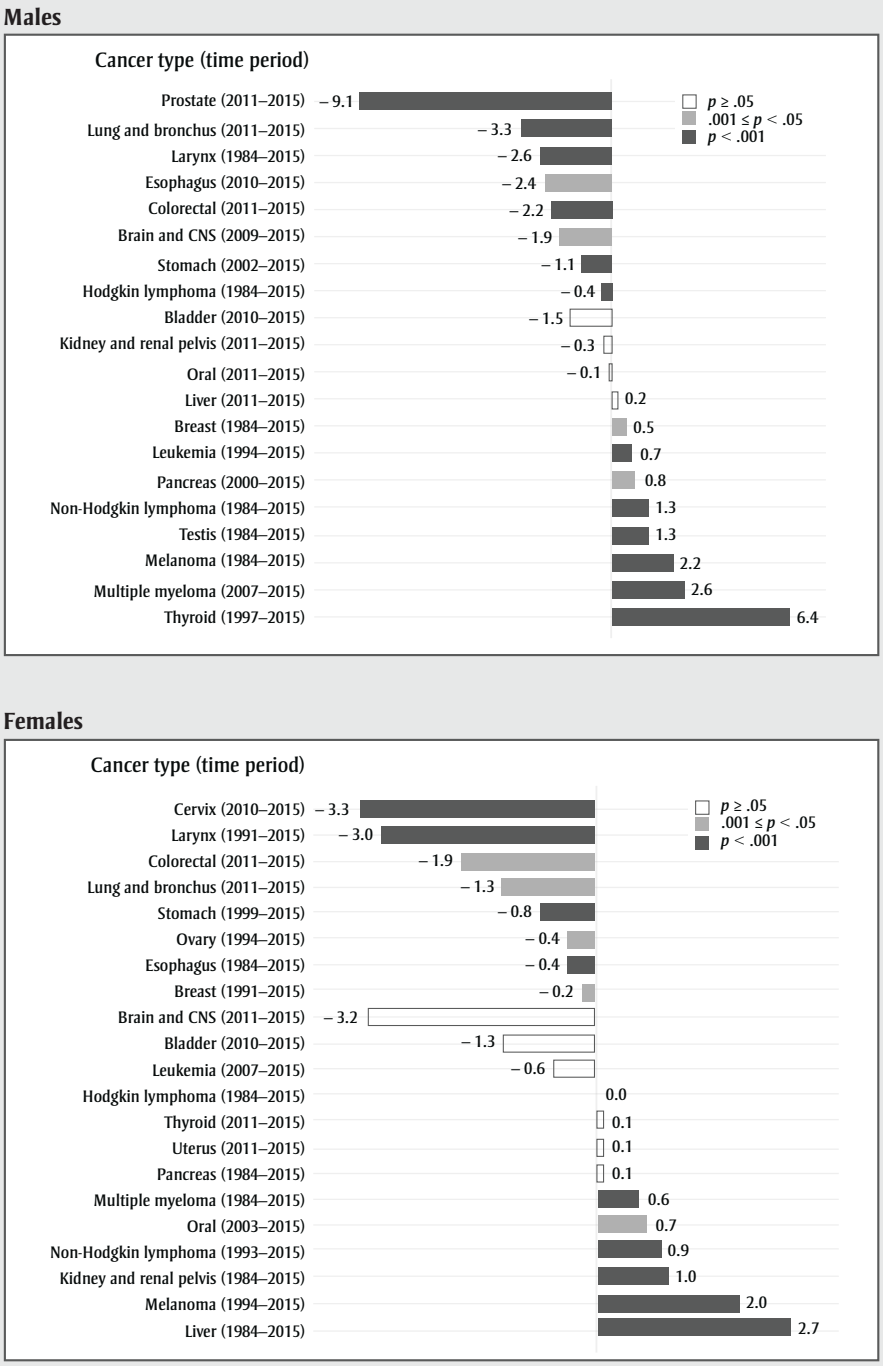
All analyses were performed by the Public Health Agency of Canada. Age-standardized incidence rates (ASIRs) were calculated through direct standardization using the age structure of the 2011 Canadian population by five-year age group. Joinpoint[4] analysis software (version 4.6.0.0) was used to calculate the annual percent change (APC) using the annual ASIRs for each cancer type from 1984 to 2015, and to determine years in which the APC changed significantly. The minimum time span to report a trend was set at five years. Thus, the most recent trend period possible was 2011 to 2015. Otherwise, default Joinpoint parameters were used. In total, 23 types of cancer were investigated.

Results and discussion

Table 1 shows all trends identified by Joinpoint between 1984 and 2015; Figure 1 pulls out the most recent trend. For both sexes in Figure 1, cancers were divided into those that have decreased or increased significantly (p-value < .05 or p-value < .001) in the most recent trend and those that have been stable (p-value ≥ .05). The following text highlights a few of the results.

Thyroid cancer has stabilized in females after many years of increase; however, it is still increasing rapidly in males. The increase may be due to overdiagnosis resulting from increased use of diagnostic technologies such as ultrasound;[5] however, recent studies also show an increase in late-stage papillary tumours, suggesting that the overall increase may not be entirely due to overdiagnosis.[6] The increase in **multiple myeloma** in males and females could be related to the increased prevalence of obesity.[7] It may also be due to improved detection and case ascertainment, as the rate of myeloma is relatively stable in countries with high ascertainment.[8-12] **Melanoma** rates are still increasing in males and females. Exposure to ultraviolet radiation through sunlight,

FIGURE 1
Most recent[a] annual percent change (APC) in age-standardized incidence rates, by cancer site and sex, Canada (excluding Quebec)



Data source: Canadian Cancer Statistics Advisory Committee. Canadian cancer statistics 2019. Toronto (ON): Canadian Cancer Society; 2019.

Abbreviation: CNS, central nervous system.

[a] The APCs were calculated from 1984 to 2015. If one or more significant change in the trend of rates was detected, the APC reflects the trend from the most recent significant change to 2015. If no significant change was detected, the APC reflects the trend over the entire period.

tanning beds and sun lamps are well-established risk factors for melanoma.[13] Increase in ultraviolet light exposure without corresponding increases in sun safety behaviours likely explains these increasing rates.[14]

Laryngeal cancer is strongly associated with smoking,[15] and the decreasing trend observed in both males and females likely reflects the decreasing trend in smoking rates in Canada.[16,17] The same observations probably explain the recent trend in **lung cancer** ASIR in males and females. The recent decline in **colorectal cancer** ASIR is likely due in part to increased screening that identifies treatable precancerous polyps. Since 2007, the majority of provinces and territories have implemented organized colorectal cancer screening programs.[18] While not evident in this report, increasing rates have been reported in the younger population, likely due in part to the prevalence of obesity.[19] **Esophageal cancer** ASIR is decreasing in both males and females. Risk factors for this cancer include obesity, alcohol consumption and tobacco consumption.[20] Whereas obesity[7] and sales of alcoholic drinks[21] have been increasing in Canada, past decreases in tobacco consumption[22] may account for the decreasing rates. In males, liver cancer ASIR has stabilized, though it is still increasing in females. Increases in the most common type of **liver cancer**, hepatocellular carcinoma (HCC), are generally driven by chronic hepatitis B and C infection, as well as increasing rates of excessive alcohol consumption and diabetes.[23] However, HCC is more prevalent in low-income countries, and the increase in Canada may be partially explained by rising immigration from regions where HCC is common, including parts of Asia and Africa.[24]

Female breast cancer ASIR has decreased slowly since 1991. This pattern is likely due to mammography screening and long-term changes in risk factors.[25] **Cervical cancer** is decreasing, largely due to routine screening with Pap tests. Every province in Canada (except Quebec) has an organized cervical cancer screening program. Current guidelines recommend screening every two to three years starting at age 21 or 25 until age 65 or 70.[26] In the coming years, human papillomavirus vaccination is expected to result in further reductions in cervical cancer incidence.[27] The ASIR of **prostate cancer** over time has mirrored the utilization of prostate-specific

antigen testing (PSA) in Canada.[28] In 2014, the Canadian Task Force on Preventive Health Care advised against PSA screening in men of all ages due to a lack of evidence for benefits and the risk of overdiagnosis and harms of unnecessary treatment.[29] Prostate cancer ASIRs are currently decreasing rapidly.

In 2014, Cancer Care Ontario implemented a new cancer reporting system that brought several enhancements to the identification of cancer cases, including the registration of *in situ* **bladder cancers**, which were not previously reported.[30] The implementation was retrospectively applied to the data from 2010 onward. This change created an apparent increase in incident cases of bladder cancer for the year 2010 and after. Although the decreasing trend for bladder cancer from 2010 to 2015 is comparable to that of 1984 to 2009, this time period is not long enough to be significant. We forced a joinpoint in 2010 to account for the data collection artefact.

Brain and central nervous system (CNS) cancers decreased 3.9% annually in females between 2011 and 2015, although the decrease was not statistically significant (p = .059). The lack of significance is most likely due to the shortness of the trend and the variability in the annual rates. The significant decrease of 1.9% per year in males started in 2009.

Conclusion

Results show that cancer trends in Canada are dynamic and type-specific. The most recent trends show increasing rates of thyroid cancer in males, drawing attention to the potential impact of overdiagnosis on cancer incidence. Conversely, rates of other cancers have recently decreased, most notably prostate and cervical cancers. The decreases for prostate and cervical cancers underscore the potential impact of improving screening guidelines based on the best evidence. Specifically, reductions in overscreening (e.g. prostate cancer) and the implementation of routine screening (e.g. cervical cancer) can both lead to decreased incidence.

Conflicts of interest

The authors have no conflicts of interest to declare.

Authors' contributions and statement

All authors contributed to the design, conceptualization and revision of the work. Drafting, analysis and interpretation of the data were done by the Public Health Agency of Canada.

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