Changing trends in melanoma incidence and mortality

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Abstract

Objectives

This article analyzes trends in melanoma incidence and mortality rates. Information on sun exposure supplements these statistics.

Data sources

Melanoma incidence data were obtained from the National Cancer Incidence Reporting System and from the Canadian Cancer Registry. Cancer mortality data were extracted from the Canadian Vital Statistics Data Base. Information on sun exposure is from the 1996 Sun Exposure Survey.

Analytical techniques

Incidence and mortality rates were age-standardized to the 1991 Canadian population to account for changes in the age structure of the population over time. The average annual percentage changes in age-specific rates were calculated for selected time periods.

Main results

After years of steady increases, melanoma incidence and mortality rates have levelled off as a result of declining rates in younger age groups, and for melanoma of the trunk among men and of the leg among women. Incidence rates for men are now higher than those for women; mortality rates for men are twice as high as for women.

Key words

skin neoplasms, cohort effect, sunburn, sunscreen, health surveys, clothing

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Throughout the 1970s and early 1980s, melanoma incidence and mortality rates were rising among Canadians.[1] This trend was also observed among other White populations around the world.[2] The upsurge has been attributed to increasing exposure to ultraviolet light, and was expected to continue because of the predicted depletion of the ozone layer.[3,4] More frequent, intermittent exposure to intense sunlight, as a result of greater participation in outdoor activities and winter travel, has been implicated as well.[5] (See *What is melanoma?*)

Rising incidence rates have also been ascribed to earlier detection of thinner lesions and the ability to diagnose melanomas that are essentially benign. Earlier detection can lead to improved survival and lower mortality rates. Since the mid-1980s, melanoma incidence and mortality rates in Canada have tended to level off.[6]

This article examines the factors underlying these changes by analyzing trends by sex, age group and site of melanoma from 1969 to the mid-1990s (see *Methods* and *Definitions).* Data from the 1996 Sun Exposure Survey supplement these statistics.

Methods

Data sources

Incidence data for invasive melanoma of the skin were obtained from the National Cancer Incidence Reporting System for 1969 to 1991 and from the Canadian Cancer Registry for 1992 and 1993. Each year, provincial and territorial cancer registries report information on all cases of cancer diagnosed among their residents to the Health Statistics Division at Statistics Canada,[7] which maintains these data bases.

Mortality data for 1969 to 1996 were extracted from the Canadian Vital Statistics Data Base maintained at Statistics Canada, which compiles information provided by the vital statistics registrars in each province and territory.[8]

Data on sun exposure are from the 1996 Sun Exposure Survey,[9] conducted by Statistics Canada in September and October that year. This survey, sponsored by the Institute of Health Promotion Research at the University of British Columbia, was funded by a number of national and provincial organizations and government departments. The target population was all Canadians aged 15 and older, excluding residents of the Northwest Territories and the Yukon, and residents of institutions. Of 5,847 households selected by a modified random-digit dialling procedure, 4,023 respondents comprised the final sample, for an overall response rate of 69%. Data were collected by computer-assisted telephone interviews; proxy responses were not allowed.

Respondents were asked: "During June to August, in your leisure hours, how much time each day (on average) were you in the sun?" Those who averaged at least 30 minutes a day in the sun were asked: "When you were in the sun for 30 minutes or more, how frequently did you: ...Seek shade? …Avoid the sun between 11 a.m. and 4 p.m.? …Cover your head? ….Wear clothing to protect your skin from the sun? (long sleeve shirt, long pants, t-shirt)? …Wear sunglasses? …Use sunscreen on your face? ….Use sunscreen on your body?" The response options were *always, often, sometimes, rarely, never.* This analysis groups together those who answered *always* and *often*.

Respondents were asked several questions about sunburns. Responses to the following were combined into one index for total sunburns: "A sunburn is defined as any reddening of the skin received either from the sun or artificial methods of tanning. During June to August, how many times have you had the following types of sunburns: …A blistering burn that required medical attention? …A blistering burn that did not require medical attention? …Redness or sensitivity with peeling? …Redness or sensitivity, with no peeling?" For this analysis, respondents were grouped as having had 0, 1 to 2, or 3 or more sunburns.

Those who reported at least one sunburn were asked about their most recent sunburn: "Which part of your body was most seriously sunburned?" The response options were *face, scalp or neck, back or shoulders, arms, legs, chest or stomach.* In this analysis, responses for *face, scalp or neck* were combined as "head." Responses for *back or shoulders* and *chest or stomach* were combined into "trunk."

Analytical techniques

Incidence and mortality rates were age-standardized to the 1991 Canadian population to account for changes in the age structure of the population over time. Population estimates were adjusted for net census undercoverage from 1971 onwards. International comparisons were based on the World Standard Population.

Changes in the annual age-standardized cancer incidence and mortality rates for melanoma were examined by calculating the average annual percentage change (AAPC) over various time periods. The AAPC is $(e^{\beta} - 1)100$, where β is the slope from a regression of log rates on year.

Limitations

Cancer incidence data may be under- or over-reported as a result of variations in procedures and data sources used to register cases, and differences in definitions used by registries to determine what is, or is not, an invasive cancer.[10] In general, registration procedures have improved to the point where cancer registration since 1984 is considered to be relatively consistent across Canada, and coverage for Canadian incidence data has been estimated to be 95% or more complete.[7] This overall estimate may vary by province and site.[11] Melanoma is known to be under-registered in Quebec because that registry relies on hospital separation records rather than pathology reports.[12]

Interpretation of data from the Sun Exposure Survey may be affected by the 69% response rate. People with more knowledge of, or interest in, health-promoting behaviour may be over-represented in the sample. Inferences based on these data about the association between sun exposure and melanoma incidence and mortality are limited by the cross-sectional nature of the survey and its focus on recent behaviours.

Incidence and mortality level off

During the 1970s and early 1980s, age-standardized incidence rates of melanoma rose steeply for both sexes, but were slightly higher for women than men (Chart 1). In the mid-1980s, women's incidence rates levelled off, and the rate among men surpassed that for women. Since 1989, men's rates, too, have levelled off. A number of other countries have reported this change in sex ratio.[13]

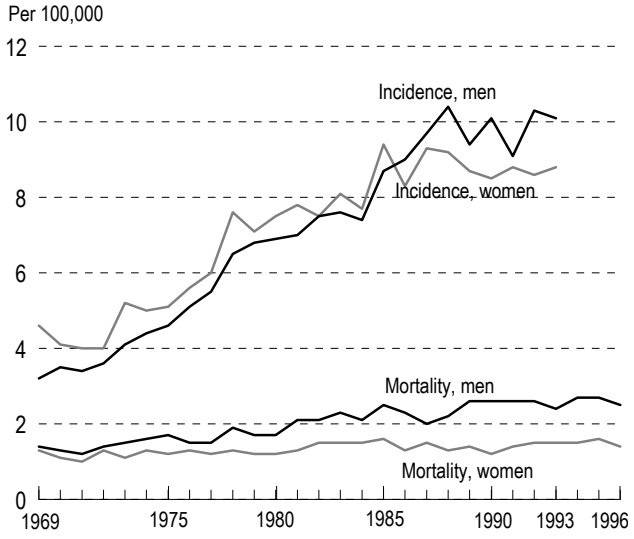
Throughout the past quarter century, age-standardized mortality rates for men exceeded those for women. Moreover, since the early 1980s, mortality rates have risen more rapidly among men, which widened the gap between the sexes.

Incidence declines at younger ages

Between 1969 and 1984, incidence rates increased on average by 2% to 7% per year in each age group among men, and by 3% to 4% among women (Chart 2, Appendix Tables A and B). Mortality increased significantly among men aged 40 and older, and significantly but less rapidly among women aged 60 or more. Significant decreases occurred for 20- to 29-year-olds of both sexes.

A different pattern emerged between 1985 and 1993. For both men and women in most age groups, the large average annual percentage increases in incidence rates were replaced either by declines, or by much smaller increases. Among women,

Chart 1
Age-standardized melanoma incidence (1969 to 1993) and mortality (1969 to 1996) rates, Canada



Data sources: *National Cancer Incidence Reporting System, Canadian Cancer Registry, Canadian Vital Statistics Data Base*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

Definitions

Incidence: The number of new melanoma cases diagnosed during the year.

Mortality: The number of deaths during the year attributed to melanoma based on the underlying cause of death.

Age-specific rate: The number of new melanoma cases or melanoma deaths during the time period in a given group, expressed as a rate per 100,000 population in that age group.

Age-standardized rate: The number of new melanoma cases or melanoma deaths per 100,000 that would have occurred in the standard population (1991 Canadian population) if the actual age-specific rates observed in a given population had prevailed in the standard population. In some tables, annual age-standardized incidence rates (ASIRs) and age-standardized mortality rates (ASMRs) are based on age-specific rates calculated by aggregating counts of new cases or deaths for 1989 to 1993, the most recent five-year period for which incidence data were available.

Melanoma of the skin was identified by code 172 from the International Classification of Diseases, Ninth Revision (ICD-9).[14] The codes used to identify each subsite are:

Head: 172.0, lip; 172.1, eyelid; 172.2, ear; 172.3, other and unspecified parts of the face; and 172.4, scalp and neck
Trunk: 172.5, trunk except scrotum
Arm: 172.6, upper limb including shoulder
Leg: 172.7, lower limb
Other: 172.8, other; 172.9, site unspecified.

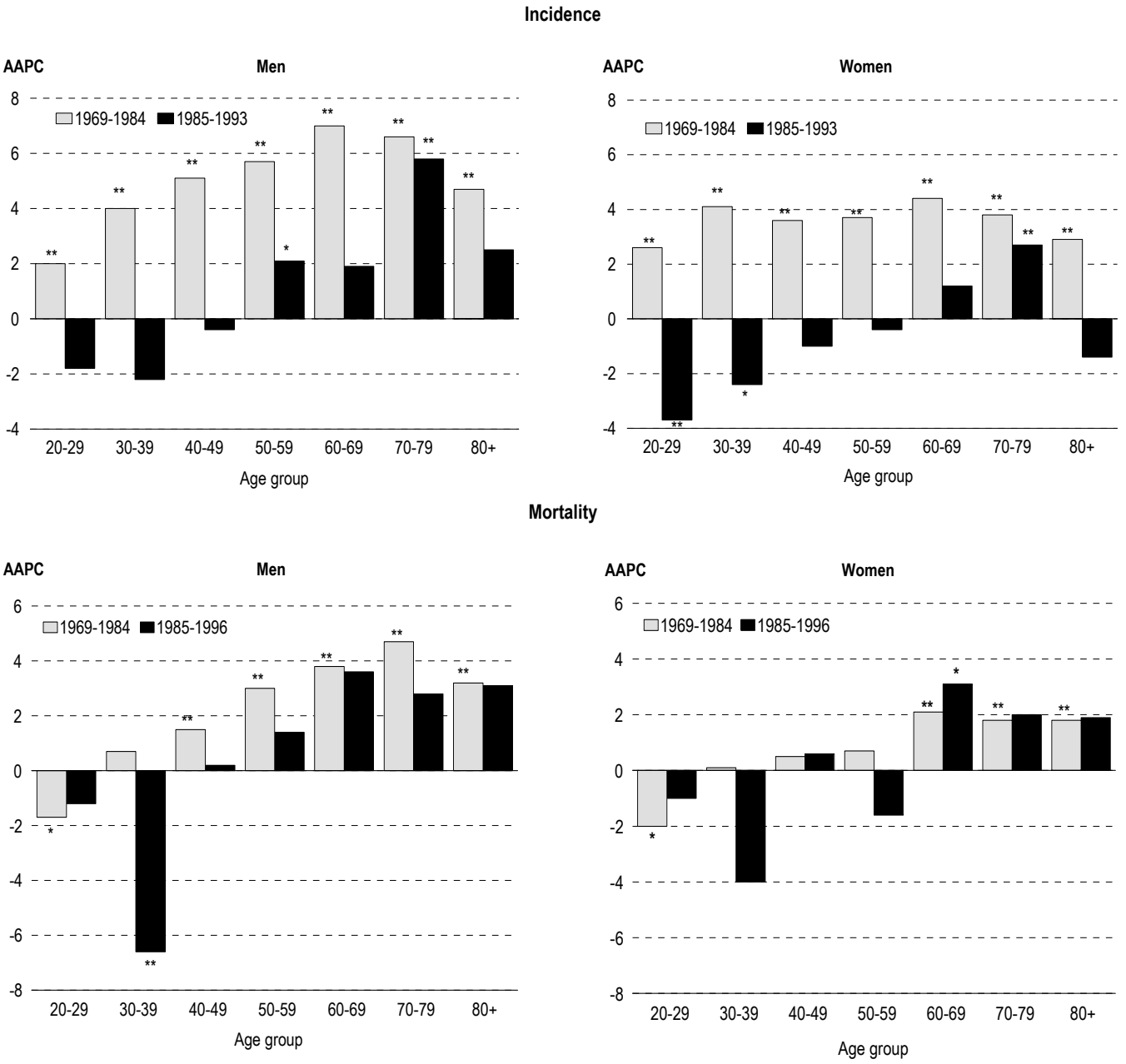
Codes from the International Classification of Diseases for Oncology, Second Edition[15] were used to identify melanomas by histology: 8720-8790. The major histological forms are:

Superficial spreading melanoma: 8740, 8741, 8743
Lentigo maligna melanoma: 8742
Nodular melanoma: 8721
Acral lentiginous melanoma: 8744.

incidence rates declined for all age groups under 60, with significant decreases for those in their twenties and thirties. Only among women aged 70 to 79 did rates rise significantly, and at a pace comparable with the earlier period. These trends were less pronounced among men, with non-significant declines among those younger than 50, increases of about 2% at ages 50 to 69 and 80 and older, and a larger, statistically significant increase for 70- to 79-year-olds.

Trends in age-specific mortality rates also changed in the more recent period. For those aged 60 and older, mortality rates rose among both sexes in both time periods. Among women, non-statistically

Chart 2
Average annual percentage change (AAPC) in age-specific melanoma rates, Canada, 1969 to 1984 and 1985 to 1993



Data sources: *National Cancer Incidence Reporting System, Canadian Cancer Registry, Canadian Vital Statistics Data Base*
** Significantly different from zero (p < 0.05)*
*** Significantly different from zero (p < 0.01)*

significant declines occurred in most age groups under 60. Among men, there was a statistically significant decrease for those aged 30 to 39; at ages 40 to 59, rates did not increase significantly.

Changes in trends related to birth cohort

These changes in trends for age-specific rates are influenced by birth cohort effects, which were analyzed by plotting trends in the age-specific incidence rates by the median year of birth (data not shown). The largest increases in melanoma incidence rates among men occurred for those born between 1905 and 1909 and 1925 and 1929. Among women, the largest increases occurred in those born between 1915 to 1919 and 1925 to 1929. These results are similar to those reported in Norway for incidence data,[16] and in Australia[17] and England and Wales[18] for mortality data (see *International trends*). A slight decline in incidence was also noted for Canadian women born in 1950 or later, while men's rates tended to level off. These results are similar to those found in the mortality analyses.[17,18]

In addition to birth cohort effects, a period effect is evident since rates have levelled off or declined in most age groups for men under 45, and women

What is melanoma?

In 1998, melanoma accounted for an estimated 3,150 new cases, ranking ninth among the major forms of cancer for both Canadian men and women.[19] This was only about 5% of the estimated 64,000 new cases of other forms of skin cancer, primarily basal and squamous cell carcinomas. Melanoma, however, is by far the most serious form of skin cancer, accounting for about three times as many deaths (an estimated 740 in 1998) each year as all other forms of skin cancer combined. Although melanoma was once considered a near-lethal disease, survival rates five years after diagnosis are now relatively high: 88% for women and 74% for men.[20]

Malignant melanoma is a cancer morphology (or cell type) that can occur at primary sites other than the skin. Melanomas develop from cells that produce the pigment melanin. They can arise from nevi, or pigmented moles, which normally pose no health threat. Superficial spreading melanoma (SSM), the most common form in both men and women, generally arises from a pre-existing nevus. In Canada, it accounts for about 40% to 50% of melanomas of the trunk, arms and legs. Initially, its growth pattern is flat, however, the surface may become elevated and irregular as it reaches into the dermis (the thick layer of tissue just below the skin's surface).[21] Intermittent, rather than chronic, exposure to the sun[22] and development of atypical nevi during childhood[21] are associated with its development.

Nodular melanoma also tends to form from a pre-existing lesion, but the growth is more vertical than the horizontal growth pattern of SSM.[21] It accounts for about 10% of all melanomas at any site, including the head. Lentigo maligna melanomas (LMM) are flat, tan-coloured lesions, associated with occupational exposure. They occur in skin chronically exposed to the sun.[21] In Canada they are found primarily on the head and face, accounting for about 25% of melanomas at that site. A fourth form, acral lentiginous melanoma, occurs primarily on the palms of the hands or soles of the feet and is most commonly found in dark-skinned populations.[21]

The relationship of sun exposure and risk of melanoma is more complex than for other forms of skin cancer, which are directly related to chronic exposure to ultraviolet light from the sun.[23] Intense but intermittent exposure to sunlight during childhood and/or vacations are the main risk factors for melanoma, with chronic exposure playing a lesser role. Ultraviolet light is now thought to act both as an initiator of the carcinogenic process during childhood, and then as a promoter of subsequent pre-malignant and malignant change from early adulthood.[24] Other reported risk factors include a history of sunburns, fair skin, increased number of nevi, dysplastic nevi, previous melanoma and family history.[23]

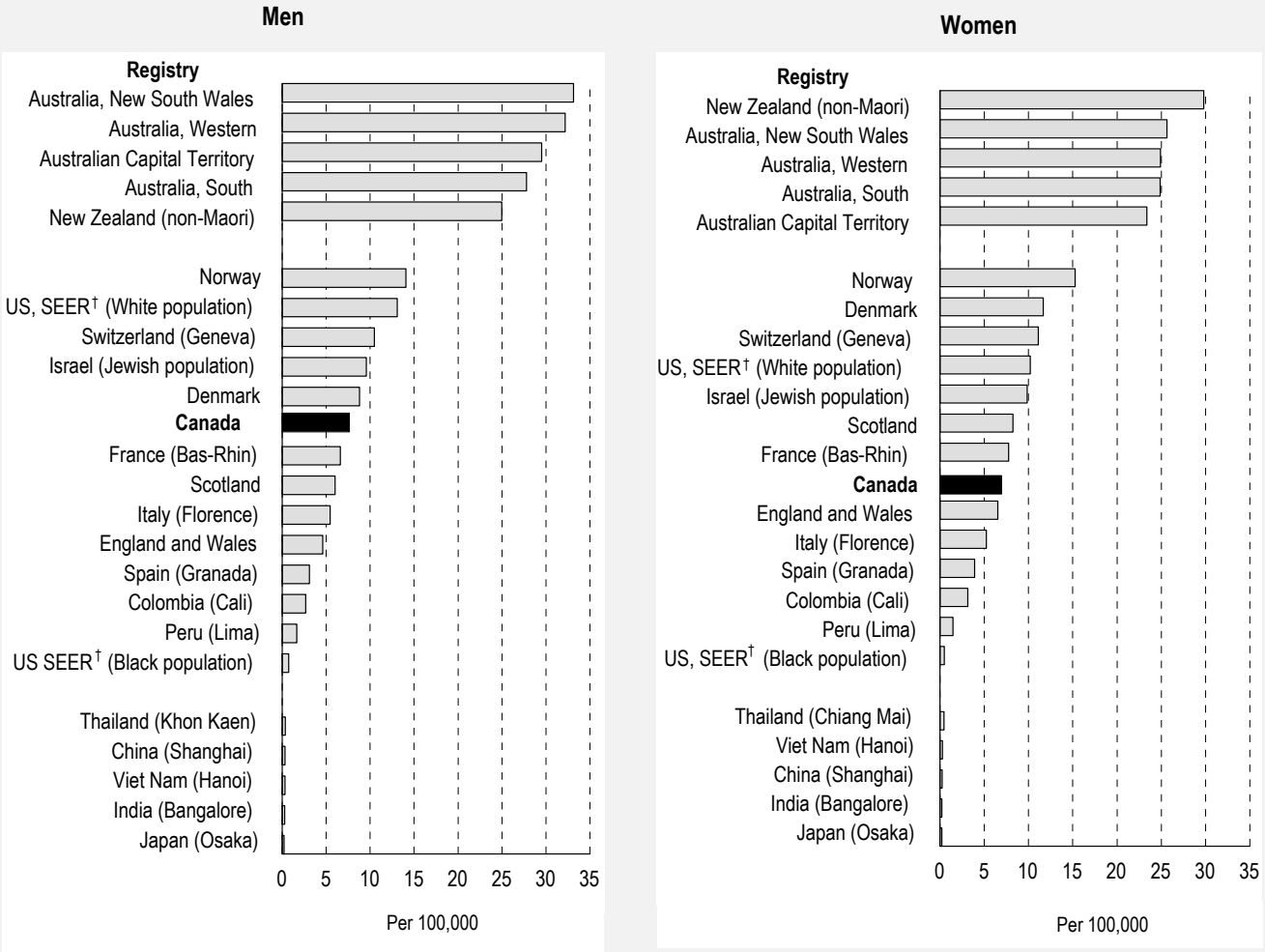
With proper treatment at an early stage, melanoma is potentially curable. Early detection of lesions before they metastasize is generally thought to explain improved survival rates.[23] However, some researchers have reported that increased detection may be identifying invasive melanomas that have no potential to metastasize, without necessarily reducing the number of cases of advanced disease diagnosed.[13,25] Surgery, the main form of treatment, involves excising the tumour (and a wide margin of normal skin around it). Radiation therapy can be used to prevent it from spreading. Chemotherapy and immunotherapy have produced long-term responses only in a minority of cases.[21]

International trends

Melanoma incidence rates are highest among White populations in Australia and New Zealand that live closest to the equator, and lowest in Asian and Black populations in India, China, Japan, Thailand and the United States. Canadian rates are about one-quarter of the highest rates in Australia, but are 25 times higher than the lowest rates.[2]

In recent years, increased melanoma incidence—but flat mortality rates—has been reported in the United States, Denmark and the United Kingdom, with some tendency to decline in younger age groups.[2,18] Greater awareness of melanoma signs and symptoms could be leading to earlier diagnosis of thinner lesions, for which survival is more favourable.[13] A pattern of increasing incidence rates with no decline in mortality rates could also be explained by over-diagnosis of lesions that are essentially benign.[13,25,26] However, this explanation is not supported by recent reports of slight declines in mortality from melanoma among women in Australia and Scotland.[17,27] These declines have been ascribed to lifestyle changes that reduced sun exposure as a result of public education programs.[17]

International age-standardized melanoma incidence rates, 1988-1992



Data source: *Reference 28*
Notes: *Rates are age-standardized to the World Standard Population. Chart includes registries with five highest and lowest rates, plus selected populations with intermediate rates.*
† The Surveillance, Epidemiology and End Results program

under 55. These cohort effects have been related to differences in exposure to sunlight,[17,18] and more specifically, to changing styles of clothing for outdoor recreation.[16]

Rates vary across country

Melanoma incidence and mortality rates vary across Canada (Table 1). Based on five-year averages for 1989 to 1993, the highest incidence rates for both sexes were in British Columbia, Nova Scotia and Prince Edward Island. Rates were also high in Ontario, New Brunswick, Alberta and Saskatchewan. By contrast, Quebec's rates were about half the Canadian average. As well, rates were low for men in Newfoundland.

Melanoma mortality rates among men tended to be high in Ontario and the Maritimes. For women, rates were high in Ontario and British Columbia. For both sexes, mortality rates were relatively low in Quebec and Manitoba, and lowest in Newfoundland.

Not only were melanoma mortality rates lower among women than men, but women's mortality rates were also relatively lower compared with incidence. The ratio of mortality to incidence rates was about 25% for men, but just 16% for women, reflecting women's higher survival. Ratios of mortality to incidence were high in Quebec for both sexes, attributable in part to incomplete registration of new cases.[7,12] However, since Quebec's mortality rates are also just 70% to 85% of the Canadian average, some protective factor may also be playing a role. The unusually low ratio among men and women in Newfoundland may be due in part to small numbers.

More common among women up to age 50

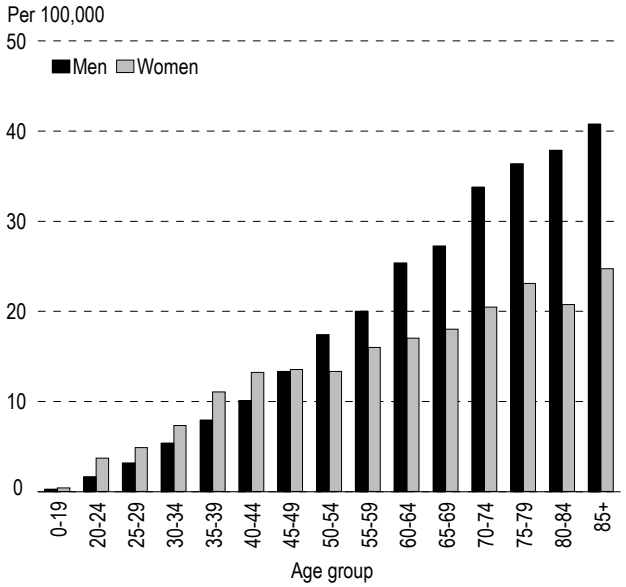
Melanoma is the third most commonly diagnosed cancer in men and women aged 30 to 39. Incidence rates rise steadily with age among men, but among women tend to level off and increase less rapidly after age 45 (Chart 3). Nevertheless, incidence rates are higher among women than men up to age 50.

Table 1
Age-standardized melanoma incidence and mortality rates, by sex, Canada, provinces and territories, 1989-1993

Province	Incidence rate		Mortality rate	
	Men	Women	Men	Women
	Per 100,000			
Canada	**9.8**	**8.7**	**2.5**	**1.4**
Newfoundland	4.9	7.0	1.0	0.4
Prince Edward Island	12.3	11.5	3.6	1.1
Nova Scotia	12.7	11.5	3.1	1.1
New Brunswick	10.9	10.4	3.0	1.0
Quebec	4.8	4.4	1.8	1.2
Ontario	12.1	9.8	3.0	1.6
Manitoba	9.2	9.1	1.9	1.3
Saskatchewan	10.5	9.3	2.2	1.3
Alberta	10.1	9.9	2.5	1.4
British Columbia	12.4	12.2	2.8	1.7
Yukon	8.1	2.8	5.7	–
Northwest Territories	3.0	6.5	3.0	–

Data sources: *National Cancer Incidence Reporting System, Canadian Cancer Registry, Canadian Vital Statistics Data Base*
Note: *Rates are standardized to the 1991 Canadian population adjusted for net census undercoverage.*
– Nil

Chart 3
Age-specific melanoma incidence rates, by sex, Canada, 1989-1993



Data sources: *National Cancer Incidence Reporting System, Canadian Cancer Registry*

Men affected on trunk, women on leg

The overall increase in melanoma incidence during the 1970s and early 1980s resulted primarily from the dramatic rise in rates for the trunk among men, and for the leg among women (Chart 4). Subsequently, the flattening of men's overall rates has occurred because of the levelling of incidence rates for the trunk, leg and possibly head. Nonetheless, men's rates for melanoma of the arm have continued to increase and are now similar to women's. Among women, slightly declining rates for the leg and trunk underlie the flattening of the overall melanoma rate.

Thus, by 1993, melanoma occurred nearly twice as often on men's trunks as on their head or arms. Among women, the leg was most frequently affected, followed by the arm and trunk. These differences in rates by body site are influenced by different levels of exposure to ultraviolet light, which may be related to clothing styles.[16,29]

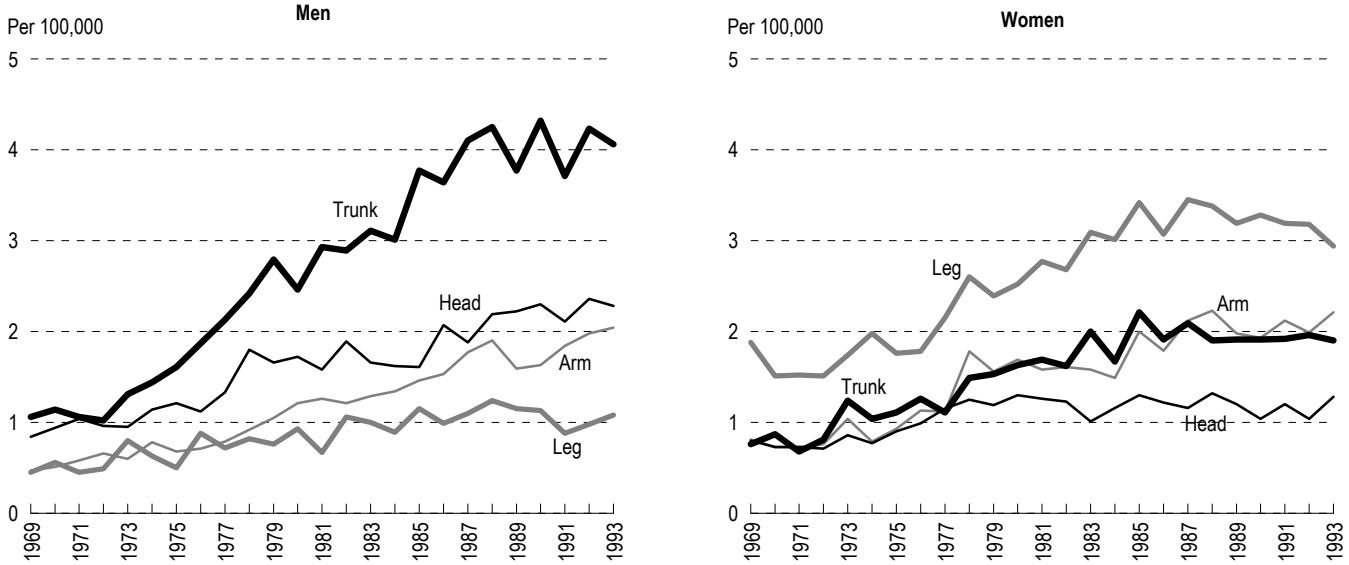
Incidence varies by site

The pattern of age-specific melanoma incidence rates varies considerably by the body part affected (data not shown). This may reflect different sun exposure patterns with respect to lifetime duration, intensity and intermittency,[30] as well as changing clothing styles.[16,31] Melanomas of the head show the most distinctive pattern. Rates for both sexes are similar and low up to age 50. Thereafter, rates rise continuously and exponentially, but those for men are typically at least twice those for women. The higher rates among men, largely due to higher incidence on the ears, scalp and neck,[22] have been attributed to balding among men and women's longer hair styles.[29]

Age-specific incidence rates for melanoma of the trunk rise from age 20 to 24 and are similar for both sexes up to age 35. Women's rates then level off and decline slightly starting around age 50. Men's rates continue to rise until age 60, when they are at least three times those for women. Men's rates then level off and decline from age 80.

Similar age-specific incidence rates for melanoma of the trunk among men and women until age 30 likely reflect similar levels of exposure before puberty. The continued rise in age-specific rates among men is likely a consequence of additional

Chart 4
Age-standardized melanoma incidence rates, by subsite and sex, Canada, 1969 to 1993



Data sources: *National Cancer Incidence Reporting System, Canadian Cancer Registry*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

intermittent sun exposure in young adulthood during both recreational and work activities,[31] whereas women's trunks would be exposed to the sun primarily during recreational activities, particularly sunbathing (see *Sun exposure*).

Men's and women's rates for melanoma of the arm are relatively comparable, rising steadily to peak at ages 70 to 79. Rates for women slightly exceed those for men up to age 50, but are somewhat lower for ages 60 and older. This pattern may be influenced by similar levels of sun exposure of the arm for men and women, perhaps related to similar propensities to wear short-sleeved or sleeveless garments.

Incidence rates for melanoma of the leg among women rise steadily to peak at ages 65 to 74, with

Sun exposure

During the summer of 1996, 34% of Canadians aged 15 and older reported having one or two sunburns and 19% had three or more. Men were more likely than women to have had three or more sunburns: 23% compared with 16%. The proportion experiencing three or more sunburns declined steadily with age, from 30% at ages 15 to 24 to just 7% at age 65 and older.

Among Canadians experiencing at least one sunburn, the trunk, including the back, shoulders and chest, was the most common site (47%) of the most serious sunburn. However, the site most commonly burned varied by age and sex. The head, including the face, was the most common site burned at ages 45 to 64, particularly for men. By contrast, the trunk was the main body part burned among those under 35.

Canadians used a variety of strategies to protect themselves from the sun. About 4 in 10 reported wearing protective clothing, covering their head, seeking shade, or using sunscreen on their face. More often than men, women sought shade and used sunscreen. Men were more likely to cover their head or to wear protective clothing.

Measures taken to limit sun exposure differed by age. Older people were much more likely to report that they sought shade, wore protective clothing or covered their heads. Those aged 35 to 44 were the most likely to use sunscreen.

Sunburns and body parts affected, by sex and age group, population aged 15 and older, Canada excluding territories, 1996

	% of population sunburned		Main body part burned (most serious sunburn)				
	1 or 2 times	3+ times	Total	Trunk	Head	Arms	Legs
				%			
Both sexes	**34**	**19**	**100**	**47**	**30**	**17**	**6**
Men	34	23	100	47	31	17	5
Women	34	16	100	47	29	16	8
Age group							
15-24	38	30	100	54	28	14	4
25-34	42	26	100	54	28	14	6
35-44	42	21	100	47	28	17	7
45-54	33	15	100	35	36	21	9
55-64	26	11	100	36	38	17	8
65+	14	7	100	23	33	37	2

Data source: *1996 Sun Exposure Survey*

Protective behaviours during leisure hours, by sex and age group, population aged 15 and older, Canada excluding territories, 1996

	Seek shade	Cover head	Wear protective clothing	Use sunscreen on face
		% often or always		
Both sexes	**38**	**43**	**43**	**38**
Men	33	54	47	23
Women	44	31	38	55
Age group				
15-24	26	38	31	35
25-34	35	37	42	40
35-44	39	38	38	43
45-54	41	46	49	35
55-64	50	58	48	38
65+	48	58	56	30

Data source: *1996 Sun Exposure Survey*

slightly lower rates at age 80 and older. Rates among men are lower and rise more slowly, but quite steadily with age up to 80 and older. Women's rates are typically two to three times those of men, except at age 80 and older, where men's rates are just slightly less. The lower rates among men have been attributed to men's legs being less exposed to the sun.[29]

Men and women older than 80 have similar rates of melanoma of the leg, possibly because the women (who were born in 1910 or earlier) wore long skirts in childhood and young adulthood and did not expose their legs to the sun. Among women, the incidence of leg melanomas appears to have levelled off in the mid-1980s and may now be declining after years of rapid increases. The tendency of women to wear longer skirts and pants since the mid-1970s may have provided sufficient protection from the sun to reduce their risk.

Concluding remarks

It is well established that sunburns during childhood may initiate melanoma development. But sun exposure can also play a role in promoting development of melanoma among adults. In Canada, changing incidence and mortality trends appear to be related to changes in sun exposure or protective behaviours in early childhood and among adults. At least part of the increase during the 1970s may be explained by increasing sun exposure among children and adults as patterns of recreational activity and outdoor dress changed over the past century. Declining rates are now observed in younger Canadians, while rates at older ages continue to increase, suggesting that sun exposure patterns may have changed among those born since 1950.

Melanoma incidence rates for some parts of the body have levelled off, or have started to decline over the past decade. This, too, suggests that changes in sun exposure and protective behaviours such as wearing clothing or sunscreen, which may have become more widespread as sun safety messages were developed beginning in the early 1980s, are having an impact on health outcomes.

Melanoma is now more common among men than women. And although survival rates are generally high, men are more likely than women to die from melanoma. Further, men reported more multiple sunburns and used different protective strategies than did women.

These differences in behaviour between the sexes might be considered in the preparation of sun safety messages. As well, health promotion designed to reduce sun exposure may need to consider a variety of strategies. In Australia,[4,32] for instance, efforts have ranged from publishing articles in fashion magazines to providing more shade at public events. Canadian organizations have recently developed consensus recommendations on a wide range of strategies to reduce health risks from ultraviolet radiation.[33]

Acknowledgements

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Appendix

Table A

Number of new cases and age-standardized, crude and age-specific melanoma incidence rates, by sex and year of diagnosis, Canada, 1969 to 1993

Year	Number of cases	Age-standardized incidence rate	Crude rate	Age group							
				0-19	20-29	30-39	40-49	50-59	60-69	70-79	80+
				Per 100,000 population							
Men											
1969	257	3.2	2.4	0.1	1.9	3.2	3.2	5.2	5.5	9.4	15.8
1970	291	3.5	2.7	0.3	1.2	3.3	4.7	5.8	7.3	9.0	13.9
1971	303	3.4	2.7	0.2	1.6	2.7	4.8	6.3	7.3	9.4	14.8
1972	321	3.6	2.9	0.3	2.1	2.9	4.2	6.0	7.8	10.6	10.4
1973	376	4.1	3.3	0.3	2.0	3.6	4.6	7.9	8.7	9.3	22.8
1974	409	4.4	3.6	0.3	2.0	3.2	5.9	8.6	8.3	11.7	24.7
1975	432	4.6	3.7	0.1	2.5	4.9	4.9	8.1	8.1	16.3	16.4
1976	493	5.1	4.2	0.3	2.2	4.9	7.6	8.3	11.2	12.8	18.3
1977	547	5.5	4.6	0.2	2.5	3.5	9.7	10.4	11.8	13.7	18.8
1978	636	6.5	5.3	0.3	2.7	5.5	8.7	10.1	14.6	16.5	31.3
1979	690	6.8	5.7	0.2	2.6	6.1	8.9	13.2	13.3	19.5	28.1
1980	720	6.9	5.9	0.1	2.3	6.5	8.9	12.7	17.3	20.0	22.4
1981	754	7.0	6.1	0.2	2.9	6.8	8.6	12.7	18.4	17.0	22.5
1982	812	7.5	6.5	0.2	2.5	6.1	8.1	15.0	18.6	22.3	35.1
1983	829	7.6	6.5	0.3	2.3	6.2	9.0	14.6	17.0	22.4	37.0
1984	845	7.4	6.6	0.2	2.9	6.4	10.3	14.0	18.0	19.5	26.6
1985	1,007	8.7	7.8	0.3	2.5	7.3	11.1	16.9	24.7	21.4	30.7
1986	1,043	9.0	8.0	0.3	3.0	6.7	11.6	15.6	22.6	26.1	41.6
1987	1,162	9.7	8.8	0.2	3.1	8.1	13.3	17.1	23.5	31.4	30.7
1988	1,285	10.4	9.6	0.4	3.5	7.7	13.0	18.9	28.8	33.7	32.0
1989	1,178	9.4	8.7	0.2	2.5	7.1	11.3	18.0	23.7	31.7	37.4
1990	1,294	10.1	9.4	0.3	1.9	7.2	12.0	18.7	27.7	35.2	43.1
1991	1,199	9.1	8.6	0.3	3.0	5.7	11.0	17.3	23.6	32.6	35.7
1992	1,390	10.3	9.8	0.4	2.6	6.5	12.1	20.7	28.1	37.2	35.9
1993	1,392	10.1	9.7	0.3	2.5	6.5	11.4	18.5	28.0	37.1	42.7
Women											
1969	402	4.6	3.8	0.3	2.1	4.4	7.5	7.3	9.7	10.3	14.8
1970	374	4.1	3.5	0.3	3.1	4.0	6.1	7.5	6.0	10.5	9.4
1971	368	4.0	3.4	0.2	2.5	3.4	6.3	6.5	6.6	10.4	14.7
1972	385	4.0	3.5	0.4	2.4	4.2	6.6	6.5	6.5	10.6	9.5
1973	502	5.2	4.5	0.3	4.0	5.7	8.6	7.1	8.0	11.6	15.1
1974	501	5.0	4.4	0.3	3.1	4.6	7.8	8.7	9.7	10.4	16.8
1975	526	5.1	4.5	0.3	3.1	5.4	7.2	9.4	9.6	11.6	15.0
1976	589	5.6	5.0	0.3	3.0	6.6	7.6	10.6	10.8	10.2	19.4
1977	644	6.0	5.4	0.2	3.4	6.7	9.8	10.1	9.8	13.1	21.8
1978	834	7.6	6.9	0.5	4.7	9.2	11.3	13.6	12.5	14.5	20.7
1979	790	7.1	6.5	0.3	4.2	7.9	10.9	11.6	14.0	14.7	20.2
1980	861	7.5	7.0	0.4	5.1	8.1	11.8	11.4	15.5	15.2	18.0
1981	914	7.8	7.3	0.2	4.9	9.5	12.0	13.8	13.8	15.4	18.3
1982	905	7.5	7.1	0.3	4.6	9.2	11.1	12.4	13.2	16.6	20.3
1983	989	8.1	7.7	0.5	4.4	10.1	11.7	16.0	13.8	14.2	19.8
1984	966	7.7	7.5	0.5	4.4	9.7	9.8	12.6	15.0	16.9	21.7
1985	1,207	9.4	9.2	0.5	4.9	11.5	14.3	15.7	18.4	18.6	27.2
1986	1,092	8.3	8.3	0.4	5.2	8.9	12.8	13.7	14.9	20.1	22.2
1987	1,241	9.3	9.3	0.4	5.7	10.4	15.0	14.4	18.2	20.3	21.8
1988	1,249	9.2	9.2	0.5	4.9	10.5	14.8	15.9	16.1	19.7	24.9
1989	1,214	8.7	8.8	0.3	4.9	9.9	13.3	15.4	15.2	18.9	25.1
1990	1,222	8.5	8.7	0.5	4.1	8.8	14.1	14.9	17.0	19.1	21.8
1991	1,285	8.8	9.1	0.3	4.9	8.9	13.6	14.5	18.1	22.6	20.9
1992	1,297	8.6	9.0	0.5	4.0	9.5	12.5	13.3	18.9	22.8	21.3
1993	1,356	8.8	9.3	0.4	3.8	8.6	13.4	15.2	18.3	24.2	23.8

Data sources: *National Cancer Incidence Reporting System, Canadian Cancer Registry*

Table B
Number of melanoma deaths and age-standardized, crude and age-specific mortality rates, by sex, Canada, 1969 to 1996

Year	Number of deaths	Age-standardized mortality rate	Crude rate	Age group							
				0-19	20-29	30-39	40-49	50-59	60-69	70-79	80+
				Per 100,000 population							
Men											
1969	111	1.4	1.1	-	0.6	0.9	1.3	2.0	4.4	3.8	8.3
1970	107	1.3	1.0	-	0.3	0.9	1.1	2.7	3.7	4.1	8.1
1971	100	1.2	0.9	-	0.4	0.4	2.3	1.7	2.8	2.6	8.4
1972	122	1.4	1.1	-	0.5	0.7	1.9	2.2	2.7	5.3	10.4
1973	129	1.4	1.1	-	0.3	1.2	2.3	2.4	3.7	4.1	5.5
1974	149	1.6	1.3	-	0.5	1.0	2.2	2.9	4.3	5.1	8.2
1975	157	1.7	1.4	-	0.7	1.3	1.7	3.0	3.9	6.0	9.6
1976	139	1.5	1.2	-	0.5	1.2	2.0	3.0	2.2	6.0	6.8
1977	145	1.5	1.2	-	0.4	1.2	1.8	3.3	3.8	4.4	6.0
1978	186	1.9	1.5	0.1	0.4	1.1	2.8	3.7	5.0	5.9	7.3
1979	171	1.7	1.4	-	0.3	1.2	1.8	4.0	4.2	4.6	9.8
1980	176	1.7	1.4	-	0.5	1.6	2.2	3.1	3.7	5.5	7.7
1981	220	2.1	1.8	-	0.4	1.4	2.7	4.1	5.6	7.1	10.6
1982	222	2.1	1.8	-	0.4	1.2	1.9	5.0	6.1	6.0	11.5
1983	244	2.3	1.9	-	0.6	1.3	2.4	4.1	6.4	7.5	13.5
1984	229	2.1	1.8	0.1	0.6	1.1	2.2	3.8	5.2	7.0	16.4
1985	279	2.5	2.2	0.1	0.4	1.3	2.5	4.5	7.0	9.5	16.5
1986	255	2.3	2.0	-	0.4	1.7	2.6	3.1	5.7	9.4	12.8
1987	234	2.0	1.8	0.1	0.4	1.3	2.1	4.0	5.7	7.0	8.2
1988	260	2.1	1.9	-	0.5	1.3	2.0	4.6	5.5	9.6	8.4
1989	317	2.6	2.3	-	0.3	1.4	3.2	4.7	6.8	10.6	13.2
1990	318	2.6	2.3	-	0.1	1.7	2.1	4.6	6.4	10.9	19.1
1991	330	2.6	2.4	-	0.2	1.2	2.4	5.1	8.1	10.0	13.5
1992	337	2.6	2.4	-	0.3	1.0	2.1	4.5	8.5	10.9	17.1
1993	323	2.4	2.3	-	0.4	1.1	2.4	4.0	6.7	11.0	13.6
1994	373	2.7	2.6	-	0.4	1.1	2.3	4.9	8.4	12.7	14.1
1995	380	2.7	2.6	-	0.4	0.9	2.3	4.2	9.4	11.4	18.2
1996	367	2.5	2.5	-	0.3	0.5	2.8	5.1	7.6	10.6	15.1
Women											
1969	113	1.3	1.1	-	0.4	0.6	2.3	2.9	2.7	3.6	4.9
1970	95	1.1	0.9	-	0.4	1.1	1.1	1.3	2.2	4.9	5.8
1971	90	1.0	0.8	-	0.2	0.4	1.6	2.1	2.1	3.4	4.9
1972	127	1.3	1.1	0.1	0.7	0.7	1.8	1.9	2.9	4.4	7.6
1973	104	1.1	0.9	-	0.3	1.0	1.5	1.8	1.5	4.5	5.5
1974	129	1.3	1.1	-	0.4	0.8	1.6	2.7	3.1	3.6	7.5
1975	115	1.1	1.0	-	0.4	0.8	1.9	1.5	2.2	3.6	6.9
1976	132	1.3	1.1	-	0.2	1.4	1.5	2.3	2.8	4.1	6.2
1977	131	1.2	1.1	-	0.5	1.0	1.7	1.7	3.0	4.2	6.4
1978	145	1.3	1.2	0.1	0.4	1.0	1.1	2.0	4.4	3.7	6.9
1979	135	1.2	1.1	-	0.3	0.9	1.3	3.0	2.4	4.1	5.2
1980	145	1.2	1.2	-	0.3	0.7	1.7	3.3	1.9	3.6	7.8
1981	151	1.3	1.2	-	0.4	1.1	1.8	2.3	3.2	3.8	5.1
1982	179	1.5	1.4	-	0.3	1.5	1.9	2.9	2.8	4.6	8.2
1983	187	1.5	1.5	-	0.4	1.1	1.9	3.0	3.5	4.9	7.2
1984	184	1.5	1.4	-	0.4	1.2	1.9	2.2	3.5	4.0	8.7
1985	208	1.6	1.6	-	0.3	1.3	2.1	2.5	4.0	5.1	9.3
1986	173	1.3	1.3	-	0.1	1.0	1.3	2.4	3.1	5.6	6.4
1987	201	1.5	1.5	-	0.4	0.9	2.0	3.3	2.8	5.2	7.2
1988	189	1.3	1.4	-	0.3	0.8	1.7	3.0	2.9	4.3	7.7
1989	200	1.4	1.4	-	0.5	0.9	1.7	1.6	3.4	5.5	8.1
1990	179	1.2	1.3	-	0.2	0.9	1.2	2.7	2.4	4.9	7.3
1991	213	1.4	1.5	-	0.3	0.7	1.9	2.2	3.3	5.7	8.9
1992	237	1.5	1.6	0.1	0.2	0.9	2.3	2.4	3.6	5.4	9.4
1993	239	1.5	1.6	0.1	0.2	1.4	1.7	1.8	3.9	5.9	8.1
1994	237	1.5	1.6	-	0.2	0.5	2.1	2.7	4.3	5.0	7.4
1995	271	1.6	1.8	-	0.2	0.7	1.4	2.5	4.6	7.8	9.9
1996	260	1.5	1.7	0.1	0.3	0.7	2.0	2.1	4.1	5.7	9.6

Data source: *Canadian Vital Statistics Data Base*
- Nil