

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Adolescents and young adults (AYAs) aged 15-29 years are a largely understudied population with regard to cancer. On average, there were 2,075 new cancer cases per year between 1992-2005 and 326 deaths per year between 1991-2004 in this age group. Because cancer occurs relatively infrequently in AYAs, awareness of cancer in this age group is less than in older adults. Moreover, AYAs often do not benefit from the specialized care available to children below 15 years of age.

More recently, AYAs are increasingly recognized as a group with distinct needs. Their unique requirements for psychosocial support are not often addressed in pediatric or adult oncology centres. In addition, their cancers may have biologically distinct behaviours, responding differently to chemotherapy and other treatment for the same cancers in different age groups.²³ Cancers in AYAs may also be detected later in their course because young people may delay seeking medical help upon experiencing symptoms or may not have access to routine medical care.

The small number of cancers in this age group does not appropriately represent the personal and societal costs of cancer in this population, as reflected in the potential years of life lost (Table 9.1). Young adulthood, in particular, is a stage of development involving many life-related changes, including decisions about employment, education, relationships and family that can be severely impacted by a cancer diagnosis.

Epidemiology and surveillance

Between 1992 and 2005, slightly more young females than young males were diagnosed with cancer – 15,043 females and 14,005 males (Table 9.2) – although more young males died from cancer over a similar time period (Table 9.3). A comparison of Tables 9.2 and 9.3 reveals that the most common causes of cancer death differ somewhat from the most commonly diagnosed cancers in AYAs.

Cancers in the AYA population represent a transition between non-epithelial types (especially acute leukemias and embryonal tumours) that are common during childhood and epithelial types (carcinomas) that comprise most cancers of older adults (Figure 9.1). Therefore, the incidence classification system of cancer types in AYAs is a blend of those used for childhood and adult cancers.^{24,25} Epithelial cancers are those that arise in cells lining the inside or outside of the body's organs. As shown in Figure 9.1, about two-thirds of the cancers diagnosed in AYAs during 1992-2005 were non-epithelial (85% in males, 53% in females).

Common cancers

- ◆ Lymphomas (Hodgkin and non-Hodgkin combined) represent the most commonly diagnosed non-epithelial cancer in each sex (Figure 9.1). The male lymphoma rate is nearly 20% higher compared to females, because of higher incidence for non-Hodgkin lymphoma in males.
- ◆ Thyroid cancer, an epithelial type, is the most common cancer overall in young females, representing about 19% of diagnoses per year between 1992 and 2005, followed by Hodgkin lymphoma and melanoma (Figure 9.1). Both thyroid cancer and melanoma are considerably more common in AYA females compared to males.

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- ◆ Germ cell testis cancer, a non-epithelial type, occurs with the highest frequency and accounts for approximately 24% of cancer diagnoses per year in male AYAs between 1992 and 2005 (Figure 9.1). It is followed by Hodgkin lymphoma (14%) and non-Hodgkin lymphoma (10%).
- ◆ Leukemias account for the most cancer deaths in each sex (21% in males and 17% in females), followed by cancer of the brain and other parts of the central nervous system, hereafter called brain. The third most common cancer cause of death is non-Hodgkin lymphoma in males and cancers of the genital organs (mostly cervix or ovary) in females (Table 9.3).

Trends over time

For all cancers combined, the incidence rate rose during the period 1992-2005. Increases are almost entirely due to the rising incidence of epithelial cancers, particularly in females (Figure 9.2). Overall, cancer mortality rates declined between 1992 and 2004 (Figure 9.2). Average annual declines over the most recent 10 years of observed data are estimated to be 2.9% in males (statistically significant) and 1.4% in females (non-significant).

Figure 9.3 shows trends in incidence and mortality rates for the top ten cancers during 1992-2005. The annual percent change (APC) was estimated over the most recent decade (1996-2005) of available data on incidence rates (Table 9.4). Trends for cancers with increases or decreases were as follows:

- ◆ *Germ cell testis cancer* incidence rate has risen significantly by 2.7% per year. Since the risk factors for testis cancer are not well understood, apart from undescended testicle, there is no accepted explanation for the increasing trend. Similar increases have been noted in most countries with largely European populations.²⁶ The mortality rate is very low.
- ◆ *Non-Hodgkin lymphoma* incidence rates are considerably higher in males compared to females. Rates have declined significantly by 2.4% per year in young females and non-significantly by 1.2% per year in males. However, this summary measure hides more complex trends: the incidence rate declined rapidly in males up to 2002 after which the trend stabilized, while it was increasing in females up to about 1998, and was followed by a decline. Trends in mortality rates roughly parallel those for incidence. Immunosuppression is the clearest risk factor for non-Hodgkin lymphoma, particularly apparent by the rise in incidence for this cancer in young males in the 1980s and 1990s as a result of the AIDS epidemic (acquired immune deficiency syndrome).⁵
- ◆ *Soft tissue sarcoma* incidence rate has risen in young males since 2001, following a long, steep decline. The rate has been stable in females.
- ◆ *Thyroid cancer* incidence rate is more than four times higher in young females compared to young males. Although rates have increased in both sexes, the upward trend is much stronger among females (6.5% per year, statistically significant). This increase is driving the rise in incidence of epithelial cancers, particularly in females, since thyroid cancer accounts for nearly 20% of their new cancer diagnoses. Rising thyroid incidence is likely related to changes in diagnostic practices and imaging techniques, resulting in improved detection of earlier stage, asymptomatic cancers.⁷ Thyroid cancer remains a rare cause of death in this age group.

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- ◆ *Cervical cancer* incidence rate has declined by about 2% per year between 1996 and 2005. This continues a long-term drop, most likely related to the uptake of and improvements in Papanicolaou smear (Pap) screening among young females. The incidence of cervical cancer is anticipated to continue declining with the recent introduction of the human papillomavirus (HPV) vaccine for young girls in Canada.

Prevention and screening

Little is known about risk factors for many of the leading cancers in AYAs. Certain congenital anomalies (e.g., undescended testicle) or a family history of cancer appears to increase the risk for certain cancers (e.g., testis, breast, colorectal), while exposure to infectious agents such as HPV, human immunodeficiency virus (HIV), and Epstein-Barr virus may increase the risk for other cancers such as cervical cancer, Kaposi sarcoma, Hodgkin and non-Hodgkin lymphoma.²⁷ In addition, there is growing evidence that exposure to ultraviolet radiation through the use of tanning beds and sunlamps, may increase skin cancer risk, including malignant melanoma, especially if exposure begins in adolescence or young adulthood.²⁸ However, most cancers in AYAs do not appear to be due to environmental carcinogens since individuals in this age group have not had enough time to accrue the mutations that lead to cancer. When a malignancy in AYAs has been linked to a specific cause, that cause is usually exposure before birth or during childhood to known carcinogens or is a second cancer in patients who were treated with chemotherapy and/or radiotherapy for a prior malignancy.²⁷

The lack of identifiable causes of cancer means there is limited opportunity for primary prevention in this age group. Organized cancer screening in AYAs is largely inefficient due to the rarity of cancers, their short latency period, and aggressive growth. One exception is cervical cancer which can, for the most part, be avoided or easily treated if detected early. The Pap test is effective in identifying both invasive cervical cancer and its precursor lesions. Population screening with the Pap test has been shown to effectively reduce rates of cervical cancer incidence and mortality. Screening for cervical cancer is recommended for sexually active women of all ages. The Public Health Agency of Canada is working with the Canadian provincial and territorial health ministries to help with their ongoing efforts to improve the quality of cervical cancer screening programs across the country with the aim of reaching high-risk women, standardize screening practices, assess new technologies, monitor results and provide appropriate follow-up procedures. The Canadian Immunization Committee recommends use of the HPV vaccine in Canada for females aged 9-26 years.²⁹ HPV vaccination campaigns have recently been rolled out in several provinces in conjunction with intensified Pap screening efforts. Together, these two strategies offer the potential to reduce new cases and deaths from cervical cancer. In other cases, genetic testing and diagnostic imaging can be made available to individuals with a strong family history of cancer such as breast and colorectal cancer.

Because behaviours and lifestyles adopted in adolescence and young adulthood are thought to impact cancer risk later in life, cancer prevention and control strategies targeting risky sexual activity, alcohol and drug abuse, poor diet and lack of physical activity should be addressed as early as possible.

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Diagnosis and treatment

The signs and symptoms of cancer in AYAs may be different from those of younger and older patients, reflecting the specific patterns of cancer in this age group. Common symptoms are lumps in the neck, breast, abdomen, and testicle as well as abnormal, pigmented skin lesions. Others include headache, neurologic deficits, lethargy, and isolated limb pain or masses.

Unfortunately, there may be a delay in diagnosis due to a number of possible factors. Young people are more likely to think of themselves as invincible and may present late for medical care because of concerns about time away from school or work, or due to a lack of knowledge about how to navigate through the healthcare system to find appropriate help. They may be less likely to be receiving routine medical care and may pursue medical help less aggressively. Compliance in both the diagnostic workup and treatment may be less frequent in AYAs because of a lack of oversight by parents or the patient's spouse; financial burden related to loss of work, transportation, and medication; altered body image including hair loss, acne, or weight gain; and reduced sexuality. Treatment delays may occur as a result of physicians being less familiar with cancer signs and symptoms in AYAs. Symptoms may be attributed to fatigue, stress, or other causes, and clinical investigations may be slower. Delays in diagnosis and treatment can be reduced by seeking regular and prompt medical care, especially if AYAs are aware of unusual changes to their skin, breasts, or testes.

AYAs with cancer are often faced with several challenges related to their care and treatment. First, the treatment setting, whether a pediatric oncology centre or a cancer setting for older adults, may not always be the most age-appropriate venue. Because cancers affecting young adults are rare, specialist care for young adults is not always available. Based on data for 1997-2001 from the Pediatric Oncology Group of Ontario and the Ontario Cancer Registry, only 32% of adolescents 15-19 years of age with cancer were treated in a pediatric oncology centre in Canada. In addition, because AYAs with cancer are a relatively small population, many such patients may feel isolated and unable to find peers for emotional support.

Second, while pediatric treatment regimens have often improved outcomes in AYAs, those treated in adult cancer centres may not have access to the most appropriate therapies.³⁰ Adult oncologists are more familiar with epithelial cancers and use drug regimens and doses tested and used in older adults. Unlike older adults, young people are less likely to have co-morbid conditions that could interfere with treatment and are physiologically capable of tolerating more intensive treatment. Compared to other age groups, AYAs may also respond differently to treatment because of their different rate of drug metabolism.²³

Finally, the AYA population is the least likely to participate in clinical trials which, in children, have contributed to improved treatment outcomes and faster gains in survival.³¹ The Canadian Childhood Cancer Surveillance and Control Program estimates that only 10% to 20% of adolescents with cancer participate in clinical trials, which may explain why survival among adolescents is improving at a slower rate than in children.³⁰ The participation rate of young adults in the US is even lower at less than 2%, compared with 60% in children, and 3-5% in older adults.³¹ In adult care centres, referral of adolescents for treatment is on average twice as long as it is in a

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pediatric centre.³⁰ Even when treated in a pediatric centre, adolescents are enrolled in trials far less frequently than children under the age of 15 years. In addition to the minimal advances in treatment outcomes, there has been little progress in developing treatment and monitoring guidelines for AYAs.³¹

Survival

Observed survival proportions estimated for AYAs diagnosed from 1997-2004 are presented in Table 9.5. These estimates were derived using period analysis and exclude data from the province of Quebec (see *Appendix II*). For all AYA cancers combined, the five-year OSP was estimated to be 83%. The corresponding one- and three-year survival proportions were 93% and 86%, respectively. Among common cancers in this age group, the highest five-year survival proportions were observed for thyroid (99%), testis (96%), Hodgkin lymphoma (94%), and melanoma (92%) while the lowest were seen in leukemias (61%) and brain tumours (66%).

Five-year survival among females was similar to, or higher than, among males for each of the most common AYA cancers (Table 9.6). Sex-specific differences in survival were largest for non-Hodgkin lymphoma, soft tissue and other extraosseous sarcoma, and melanoma. Overall, survival among females was 6% higher (expressed as a difference in percentages). While no overall pattern was observed between age at diagnosis and survival, the prognosis for a number of individual cancers (e.g., soft tissue and other extraosseous sarcoma, melanoma, and breast) appeared to be poorer at older ages.

A comparison of five-year survival proportions observed for those diagnosed in the early to mid-1990s and those estimated for persons more recently diagnosed revealed that progress has been made among AYAs (Table 9.7). For all cancers combined, survival for the period 2001-2004 was 5% greater than it was for 1992-1995 (85% vs. 80%). The largest increases during this period were observed for non-Hodgkin lymphoma (78% vs. 66%), leukemia (67% vs. 57%), and soft tissue and other extraosseous sarcoma (72% vs. 63%). No changes were seen in patients with common cancers for which the survival was already relatively high.

Survivorship

Survivorship is the phase of the cancer control continuum that follows the completion of primary treatment. During the post-treatment phase, immediate treatment-related adverse events diminish and surveillance, psychosocial adjustment, and long-term health care concerns predominate. The long-term health care needs of survivors of AYA cancers involve the management of late-effects of treatment, the elevated risk of second primary cancers associated with the initial cancer or its treatment, and general medical and preventive health care.³² The frequency of follow-up visits and testing of cancer survivors varies according to cancer type. Concurrent educational, vocational, lifestyle, and psychosocial needs during this formative stage of life add to the complexity of survivorship needs in AYAs.^{33,34} Currently, few Canadian cancer centres (e.g., Victoria, Vancouver, Winnipeg, Ottawa and Montreal) have support groups open to AYA cancer survivors. The complex survivorship needs are further compounded by the relative rarity of the condition and the lack of dedicated research into the unique needs faced by this age group.³⁵

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Determining the appropriate setting for delivery of long-term survivorship care is yet another challenge. A tertiary oncology survivorship clinic is one venue for delivering survivorship care.³⁶ However, such tertiary care settings are often not feasible or practical on a population basis. Community-based care, while more feasible and practical, raises concern about the knowledge and expertise of primary care physicians with regard to specific cancer treatments as well as optimal clinical surveillance and management. Specific psychosocial needs, such as treatment-related developmental delays and infertility, are just two examples of issues that are encountered by community physicians.³⁶ For this reason, a shared-care model is recommended. Survivorship care plans are one of the tools proposed to facilitate the shared-care approach.^{37,38} Such plans provide a summary about the cancer, its treatment, as well as an individualized approach for delivery of care that is ideally suited to the needs of the AYA population.

Implications and recommendations

A comprehensive report prepared in 2006 by the Working Group on Cancer in Young Adults in Canada described cancer trends and patterns since the early 1980s in young adults aged 20-44 years old.⁵ Several other major reports from the US National Cancer Institute and from the Surveillance Epidemiology and End Results program highlighted poor progress made in improving health outcomes for AYAs.^{39,40} Together, these reports offer several common recommendations for addressing the gaps in AYA oncology and care, including:

- ◆ The need for ongoing surveillance of incidence and mortality, and projection of future burden of disease in AYAs. This included the need to identify the characteristics and risk factors that distinguish the cancer burden in the AYA population;
- ◆ Refining tools to study cancer in AYAs, such as tumour classification and selection of appropriate age groupings;
- ◆ Providing greater oncology education, training, and communication to improve awareness among health care providers;
- ◆ Finding innovative ways to increase and improve communication, diagnosis, treatment, and medical follow-up of AYAs. This includes enhancing prevention efforts, access, and quality of cancer care to AYAs;
- ◆ Ensuring excellence in service delivery across the cancer control continuum – from prevention, screening, diagnosis, treatment, survivorship, to end of life care. There is a need to extend the evidence base for guidelines on long-term follow-up in survivors of AYA cancer and to standardize such guidelines.⁴¹
- ◆ Strengthen advocacy and support for the AYA cancer patient; and
- ◆ Research and surveillance on the effects of cancer diagnosis and its treatment. Clinical research should occur alongside research on quality of life and health services delivery.

Several ongoing activities in the field of AYA oncology are aimed at addressing the above recommendations. For example, the Children's Oncology Group (the major cooperative group of pediatric cancer institutions in North America) and several adult cooperative groups have planned to increase participation of young adult patients in

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clinical trials. It is expected that the Children's Oncology Group will now enrol patients up to age 50 for trials of certain cancers – e.g., Ewing's sarcoma and other cancers that have traditionally been studied almost exclusively in pediatric centres.⁴² Several cooperative groups of adult cancer centres have also planned to lower the age of eligibility for some of their trials of cancers that are mostly prevalent in older adults to allow enrolment of both adolescents and young adults.

National organizations such as Young Adult Cancer Canada and the Lance Armstrong Young Adult Alliance in the US, as well as numerous cancer support websites, are filling the void in peer support for AYAs with cancer as well as for their families, who must typically navigate through the health system in isolation. Greater support is still needed from individuals, communities, and governments to bolster the prevention of cancer in AYAs. This includes personal efforts to engage in healthier lifestyles, community infrastructure and regulations that encourage cancer prevention, and policies that create opportunities for healthy living. Finally, the profile of the AYA age group will need to be raised on the cancer control agenda in order to make it an active area of research with greater funding and exposure in the scientific and medical communities.

Adolescents and young adults (AYAs) aged 15-29 years are a largely understudied population with treatment and care issues that include delays in diagnosis, low participation in clinical trials, lack of age-appropriate care, concerns around social support during cancer treatment, as well as late effects of treatment, second cancers and long-term psychosocial requirements for cancer survivors.

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Table 9.1

Potential Years of Life Lost Due to Cancer, Canada, 2004

	Potential Years of Life Lost (PYLL)					
	Total		Males		Females	
	Years	%	Years	%	Years	%
All Cancers	1,026,600	100	495,000	100	531,700	100
Age Group						
0-14	10,200	1.0	5,200	1.1	5,000	0.9
15-19	4,100	0.4	2,500	0.5	1,600	0.3
20-24	5,400	0.5	3,100	0.6	2,300	0.4
25-29	6,500	0.6	3,400	0.7	3,200	0.6
30-39	33,400	3.3	13,900	2.8	19,500	3.7
40-49	115,700	11.3	48,700	9.8	67,100	12.6
50-59	225,400	22.0	104,000	21.0	121,400	22.8
60-69	260,400	25.4	134,000	27.1	126,400	23.8
70-79	244,400	23.8	126,700	25.6	117,700	22.1
80+	121,100	11.8	53,500	10.8	67,600	12.7

Note: Figures are calculated based on life expectancy. Column totals may not sum to row totals due to rounding.

Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

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Table 9.2

New Cases and Average Annual Age-Standardized Cancer Incidence Rates by Diagnostic Group in Adolescents and Young Adults (15-29 Years), Canada, 1992-2005*

Diagnostic Group [†]	Males		Females	
	New Cases	ASIR per 1,000,000 per year	New Cases	ASIR per 1,000,000 per year
Total (14 years)	14,005	319.5	15,043	359.6
Average Per Year	1,000		1,075	
Oral Cavity and Pharynx	289	6.7	281	6.6
Digestive System	511	12.1	500	12.2
Esophagus	13	0.3	8	0.2
Stomach	67	1.6	72	1.8
Colorectal	312	7.4	297	7.3
Anus	NR	NR	NR	NR
Hepatic Tumours	60	1.4	55	1.3
Gallbladder	<6	NR	<6	NR
Pancreas	29	0.7	46	1.1
Other Biliary and Other Digestive	19	0.4	12	0.3
Respiratory	183	4.3	162	3.9
Larynx	15	0.4	9	0.2
Lung and Bronchus	144	3.4	138	3.3
Trachea, Mediastinum and Other Respiratory	24	0.6	15	0.4
Malignant Bone Tumours	515	11.2	305	6.9
Osteosarcomas	238	5.1	141	3.2
Chondrosarcomas	69	1.6	48	1.1
Ewing Tumour and Related Sarcomas	160	3.4	82	1.8
Other Specified Malignant Bone Tumours	48	1.1	34	0.8
Soft Tissue and Other Extrasosseous Sarcoma	853	19.5	675	15.8
Rhabdomyosarcomas	88	1.8	63	1.4
Fibrosarcoma, Peripheral Nerve Sheath Tumours	102	2.3	88	2.1
Kaposi sarcoma	157	3.9	9	0.2
Other Specified Soft Tissue Sarcomas	401	9.1	434	10.3
Unspecified Soft Tissue Sarcomas	105	2.4	81	1.9
Melanoma	993	23.2	1,655	39.9
Breast	<6	NR	1,041	26.2
Female Genital System	–	–	2,207	54.2
Ovary	–	–	605	14.2
Cervix	–	–	1,405	35.1
Corpus Uteri	–	–	108	2.7
Other Female Genital	–	–	89	2.2
Male Genital System	3,396	78.5	–	–
Testis	3,375	78.0	–	–
Prostate	10	0.2	–	–
Other Male Genital	11	0.3	–	–

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Table 9.2 (continued)

New Cases and Average Annual Age-Standardized Cancer Incidence Rates by Diagnostic Group in Adolescents and Young Adults (15-29 Years), Canada, 1992-2005*

Diagnostic Group [†]	Males		Females	
	New Cases	ASIR per 1,000,000 per year	New Cases	ASIR per 1,000,000 per year
Urinary System	279	6.6	229	5.5
Bladder	149	3.5	98	2.4
Kidney	121	2.8	129	3.1
Ureter	<6	NR	<6	NR
Other Urinary	NR	NR	<6	NR
Central Nervous System	1,133	25.6	929	21.7
Ependymomas and Choroid Plexus Tumour	67	1.5	57	1.3
Astrocytomas	520	11.7	456	10.6
Intracranial and Intraspinial Embryonal Tumours	129	2.8	70	1.6
Other Gliomas	301	7.0	225	5.3
Other Specified Intracranial and Intraspinial Neoplasms	18	0.4	25	0.6
Unspecified Intracranial and Intraspinial Neoplasms	98	2.2	96	2.2
Endocrine	686	16.0	2,903	69.7
Thyroid	658	15.3	2,875	69.1
Other Endocrine Including Thymus	28	0.7	28	0.7
Lymphoma	3,386	76.2	2,795	65.1
Hodgkin Lymphoma	2,009	44.8	1,973	45.6
Non-Hodgkin Lymphoma	973	22.3	622	14.8
Burkitt Lymphoma	109	2.4	26	0.6
Unspecified Lymphomas	295	6.8	174	4.1
Leukemia	1,185	26.2	868	20.1
Lymphoid Leukemia	504	10.8	256	5.8
Acute Myeloid Leukemia	355	7.9	361	8.4
Chronic Myeloproliferative Diseases	219	5.1	154	3.6
Myelodysplastic Syndrome and Other Myeloproliferative	32	0.7	31	0.7
Unspecified and Other Specified Leukemia	75	1.7	66	1.5
Other	595	13.5	493	11.7

– Not applicable

NR Suppressed to meet confidentiality requirements.

* Data are shown for the most recent period available and exclude non-melanoma skin cancer (basal and squamous) and in situ carcinomas except bladder. Rates are age-standardized to the 1991 Canadian population and due to disease rarity are expressed per million per year. The total (14 years) is rounded to the nearest 5 for males to avoid disclosure of cells less than 6.

[†] Adapted from Weir et al²⁵, see Appendix W1 – www.cancer.ca/statistics

Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

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Table 9.3

Deaths and Average Annual Age-Standardized Cancer Mortality Rates by Diagnostic Group in Adolescents and Young Adults (15-29 Years), Canada, 1991-2004*

Diagnostic Group [†]	Males		Females	
	Deaths	ASMR per 1,000,000 per year	Deaths	ASMR per 1,000,000 per year
Total (14 years)	2,556	57.8	2,007	47.6
Average Per Year	183		143	
Oral (Buccal Cavity and Pharynx)	39	0.9	24	0.6
Lip	0	0.0	0	0.0
Tongue	10	0.2	8	0.2
Salivary Gland	4	0.1	3	0.1
Mouth	5	0.1	3	0.1
Nasopharynx	19	0.4	7	0.2
Oropharynx	0	0.0	2	0.0
Other and Unspecified	1	0.0	1	0.0
Digestive Organs	214	5.0	198	4.8
Esophagus	11	0.3	5	0.1
Stomach	43	1.0	54	1.3
Large Intestine and Rectum	85	2.0	70	1.7
Anus	0	0.0	2	0.1
Liver	28	0.7	24	0.6
Gallbladder	1	0.0	1	0.0
Pancreas	15	0.3	15	0.4
Other and Unspecified	31	0.7	27	0.7
Respiratory System	85	2.0	54	1.3
Larynx	1	0.0	0	0.0
Lung	54	1.3	42	1.0
Other and Unspecified	30	0.7	12	0.3
Bone	241	5.2	133	3.0
Soft Tissue (including Heart)	156	3.5	131	3.0
Skin (Melanoma)	113	2.7	66	1.6
Breast	0	0.0	132	3.3
Genital Organs	133	3.1	224	5.5
Cervix	-	-	123	3.1
Body of Uterus	-	-	1	0.0
Ovary	-	-	85	2.0
Prostate	4	0	-	-
Testis	126	2.9	-	-
Other and Unspecified	3	0.1	15	0.4

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Table 9.3 (continued)

Deaths and Average Annual Age-Standardized Cancer Mortality Rates by Diagnostic Group in Adolescents and Young Adults (15-29 Years), Canada, 1991-2004*

Diagnostic Group [†]	Males		Females	
	Deaths	ASMR per 1,000,000 per year	Deaths	ASMR per 1,000,000 per year
Urinary Organs	44	1.0	22	0.5
Bladder	10	0.2	5	0.1
Kidney	32	0.7	17	0.4
Other Urinary	2	0.1	0	0.0
Eye	4	0.1	0	0.0
Brain and Other Nervous System	389	8.8	264	6.2
Endocrine Glands	45	1.0	38	0.9
Thyroid	9	0.2	5	0.1
Other Endocrine	36	0.8	33	0.8
Hodgkin Lymphoma	154	3.6	118	2.8
Non-Hodgkin Lymphoma [‡]	288	6.5	157	3.7
Multiple Myeloma	4	0.1	5	0.1
Leukemia	528	11.6	351	8.1
All Other and Unspecified Cancers	119	2.7	90	2.2

– Not applicable

* Data are shown for the most recent period available. Rates are age-standardized to the 1991 Canadian population and due to disease rarity are expressed per million per year.

† For ICD-10 codes see Appendix W2 - www.cancer.ca/statistics

‡ Non-Hodgkin Lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

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Table 9.4

Annual Percent Change (APC) in Age-Standardized Incidence Rates for Selected Cancers in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1996-2005

	Males		Females	
	APC	Change-point [†]	APC	Change-point [†]
All Cancers	0.8*		1.4**	
Non-epithelial	0.5		-0.6	
Hodgkin Lymphoma	-0.5		-1.3	
Testis	2.7**		-	
Melanoma	-1.2		-0.9	
Central Nervous System	-0.9		1.1	
Leukemia	1.8		1.0	
Non-Hodgkin Lymphoma [‡]	-1.2		-2.4*	
Soft Tissue and Other Extrasosseous Sarcoma	5.9*	2001	0.3	
Epithelial	2.3*		3.4**	
Thyroid	3.1		6.5**	
Cervix	-		-2.1*	
Breast	-		1.9	

- Not applicable

* Significant, $p < 0.05$

** Significant, $p < 0.01$

[†] Changepoint indicates the baseline year, if the slope of the trend changed after 1996. Changepoints were fit to rates from 1992 to 2005. See *Appendix II: Methods* for further details.

[‡] Non-Hodgkin lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Note: Annual Percent Change is calculated assuming a log linear model. 'All Cancers' incidence rates include other cancers not listed in this table but exclude non-melanoma skin cancer (basal and squamous). For histology codes used for epithelial and non-epithelial cancers, see Appendix W3 - www.cancer.ca/statistics

Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Table 9.5

Estimated Observed Survival Proportion (95% Confidence Interval) for Selected Cancers in Adolescents and Young Adults (15-29 Years), by Survival Duration, Canada (Excluding Quebec*), 1997-2004

	Observed Survival Proportion (%) (95% Confidence Interval)		
	1-year	3-year	5-year
All Cancers	93 (93-94)	86 (85-87)	83 (82-84)
Thyroid	100 (99-100)	99 (99-100)	99 (99-100)
Testis	99 (98-99)	96 (95-97)	96 (94-97)
Hodgkin Lymphoma	99 (98-99)	96 (94-96)	94 (93-95)
Melanoma	98 (97-99)	95 (94-96)	92 (91-94)
Cervix	96 (94-97)	88 (85-90)	86 (83-88)
Non-Hodgkin Lymphoma [†]	84 (82-86)	76 (73-78)	74 (71-77)
Breast	97 (95-98)	83 (80-86)	73 (69-77)
Soft Tissue and Other Extraosseous Sarcoma	89 (86-91)	76 (73-79)	72 (69-76)
Central Nervous System	88 (86-90)	75 (72-77)	66 (63-69)
Leukemia	81 (78-83)	66 (63-69)	61 (58-64)

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

[†] Non-Hodgkin Lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Table 9.6

Estimated Five-Year Observed Survival Proportion (95% Confidence Interval) for Selected Cancers in Adolescents and Young Adults (15-29 Years), by Sex and Age Group, Canada (Excluding Quebec*), 1997-2004

	Observed Survival Proportion (%) (95% Confidence Interval)				
	Males	Females	Age Group		
			15-19	20-24	25-29
All Cancers	80 (79-81)	86 (85-86)	81 (79-82)	84 (83-85)	83 (83-84)
Thyroid	98 (95-99)	100 (99-100)	100 (97-100)	99 (98-100)	100 (99-100)
Testis	96 (94-97)	—	91 (86-94)	96 (94-98)	96 (95-97)
Hodgkin Lymphoma	93 (92-95)	94 (93-96)	94 (91-96)	94 (91-95)	94 (92-96)
Melanoma	86 (83-89)	96 (95-97)	97 (92-99)	94 (91-96)	91 (89-93)
Cervix	—	86 (83-88)	87 (57-96)	81 (73-87)	87 (84-90)
Non-Hodgkin Lymphoma [†]	69 (65-73)	81 (77-85)	73 (67-79)	76 (71-81)	73 (68-77)
Breast	—	73 (69-77)	79 (36-94)	78 (63-87)	73 (68-77)
Soft Tissue and Other Extraneous Sarcoma	67 (62-72)	77 (72-82)	76 (69-82)	73 (66-79)	70 (64-75)
Central Nervous System	62 (58-66)	70 (65-74)	69 (63-75)	65 (59-71)	64 (59-69)
Leukemia	60 (55-64)	63 (58-68)	62 (56-67)	64 (58-69)	58 (52-63)

— Not applicable

— Estimate unavailable due to the small number of cases.

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

[†] Non-Hodgkin Lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada.

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Table 9.7

Estimated Five-Year Observed Survival Proportion (95% Confidence Interval) for Selected Cancers in Adolescents and Young Adults (15-29 Years), by Calendar Period, Canada (Excluding Quebec*)

	Observed Survival Proportion (%) (95% Confidence Interval)	
	1992-1995	2001-2004
All Cancers	80 (79-81)	85 (84-85)
Thyroid	100 (99-100)	99 (99-100)
Testis	94 (92-96)	95 (94-97)
Hodgkin Lymphoma	95 (93-96)	95 (93-96)
Melanoma	93 (90-94)	93 (91-95)
Cervix	87 (83-90)	87 (83-90)
Non-Hodgkin Lymphoma [†]	66 (62-71)	78 (74-81)
Breast	69 (63-75)	73 (67-78)
Soft Tissue and Other Extrasosseous Sarcoma	63 (57-68)	72 (67-77)
Central Nervous System	65 (60-69)	68 (64-72)
Leukemia	57 (52-61)	67 (63-72)

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

[†] Non-Hodgkin Lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Note: Survival for 1992-1995 was based on the cohort method; for 2001-2004 it was based on the period method.

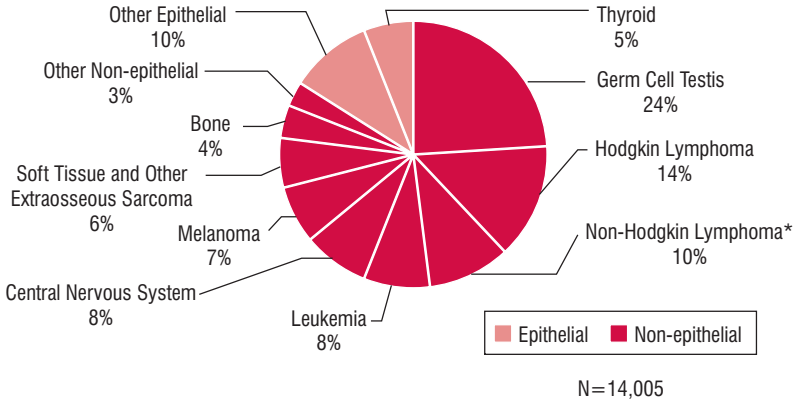
Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.1a

Leading Types of Cancer Among Young Men (15-29 Years), Percentage of New Cases, Canada, 1992-2005



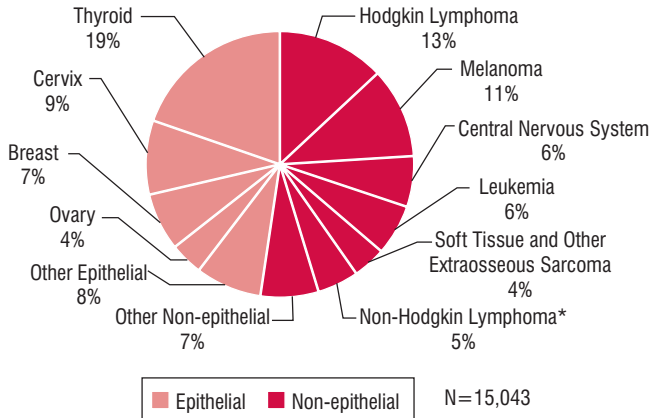
* Non-Hodgkin lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

Figure 9.1b

Leading Types of Cancer Among Young Women (15-29 Years), Percentage of New Cases, Canada, 1992-2005



* Non-Hodgkin lymphoma includes Burkitt lymphoma and unspecified lymphomas.

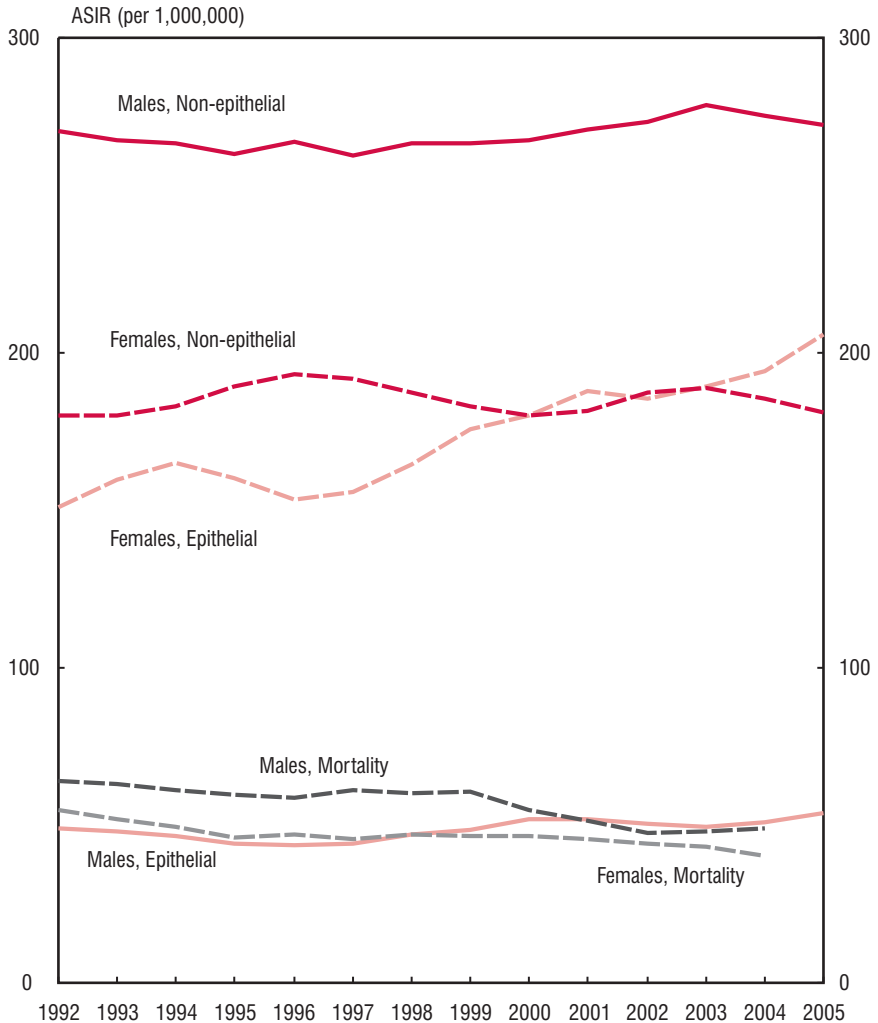
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.2

Age-Standardized 3-Year Moving Average Incidence Rates (ASIR) for Epithelial and Non-Epithelial* Cancers and Overall Mortality Rates (to 2004), in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1992-2005



* For histology codes used for epithelial and non-epithelial cancers see Appendix W3 – www.cancer.ca/statistics. Rates exclude the 0.4% of cases with unknown cancer site and histology in this age group.

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

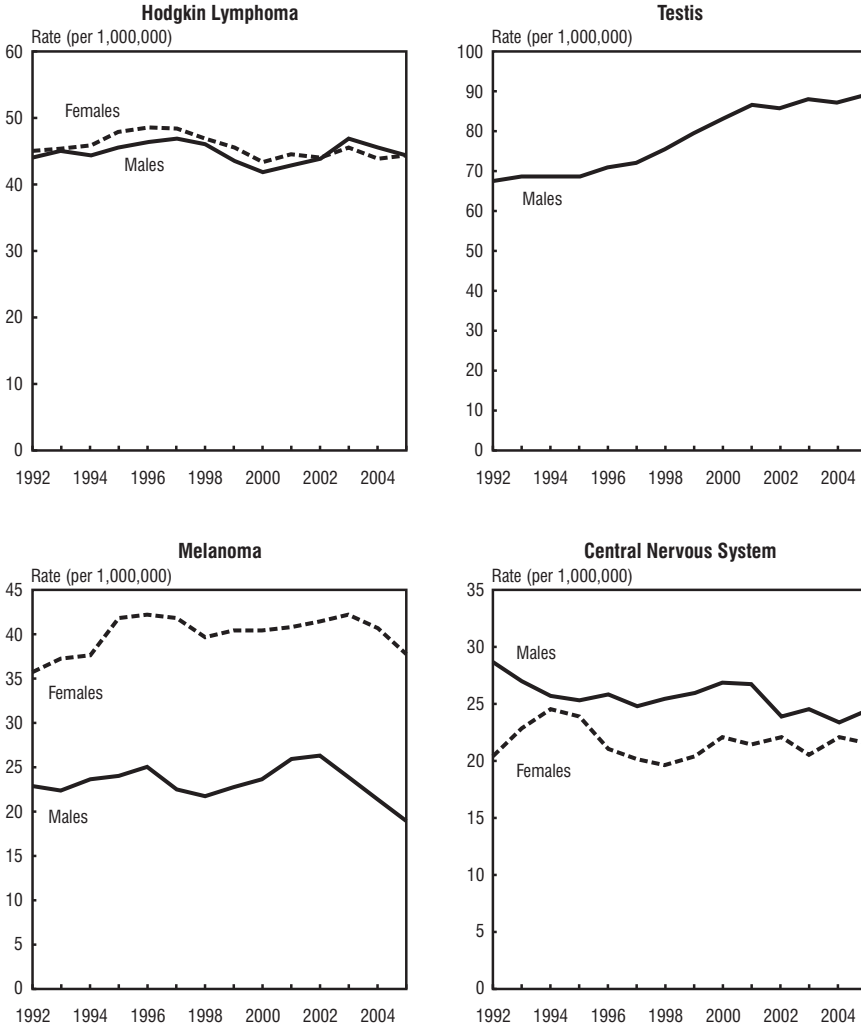
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.3a

Age-Standardized 3-Year Moving Average Incidence Rates (ASIR) for Common Non-Epithelial Cancers, in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1992-2005



Note: The range of rate scales differs widely between the cancers.

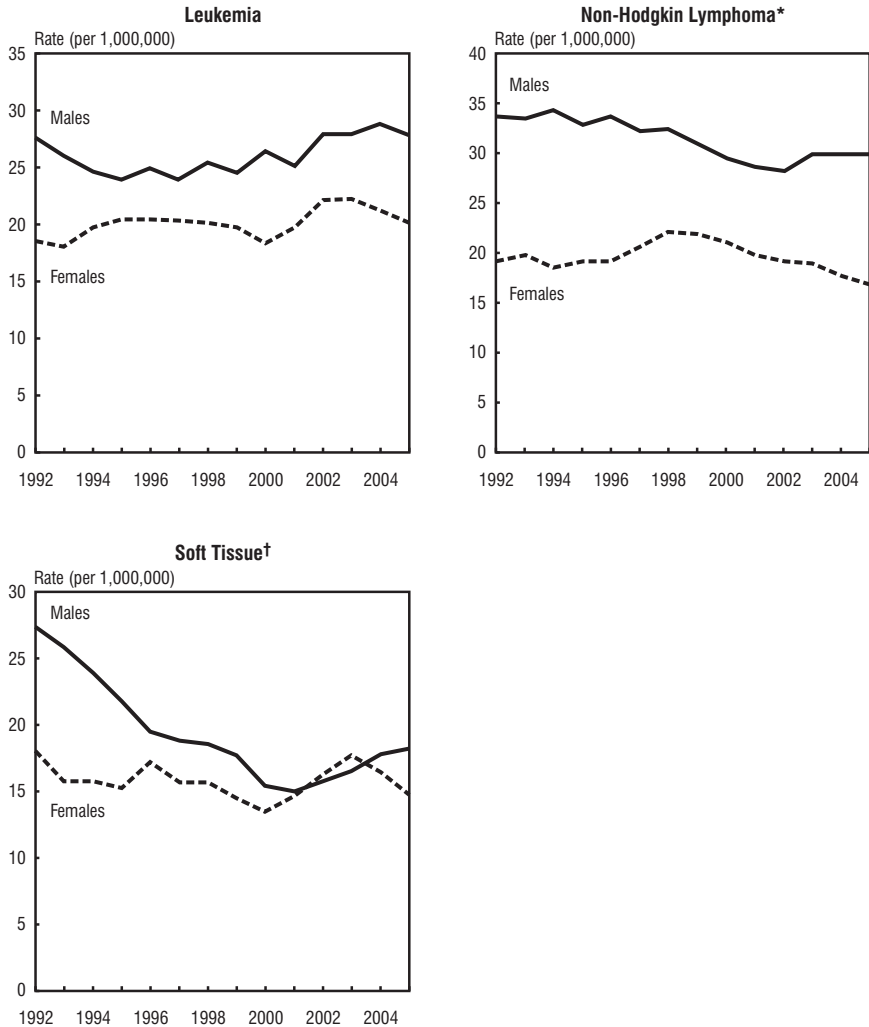
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.3a (continued)

Age-Standardized 3-Year Moving Average Incidence Rates (ASIR) for Common Non-Epithelial Cancers, in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1992-2005



* Non-Hodgkin lymphoma includes Burkitt lymphoma and unspecified lymphomas.

† Soft Tissue includes Other Extraosseous Sarcoma.

Note: The range of rate scales differs widely between the cancers.

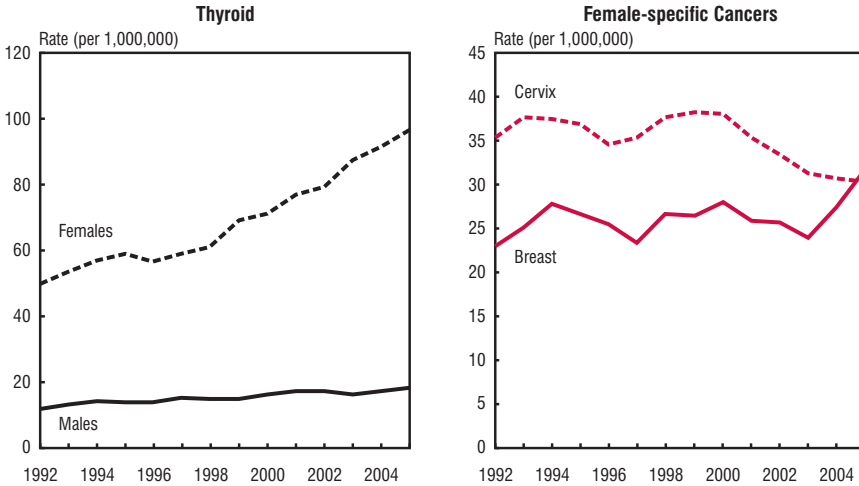
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.3b

Age-Standardized 3-Year Moving Average Incidence Rates (ASIR) for Common Epithelial Cancers, in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1992-2005



Note: The range of rate scales differs widely between the cancers.

Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada