



CHILDHOOD/ADOLESCENT CANCER IN MASSACHUSETTS 2009-2018

Massachusetts Department of Public Health

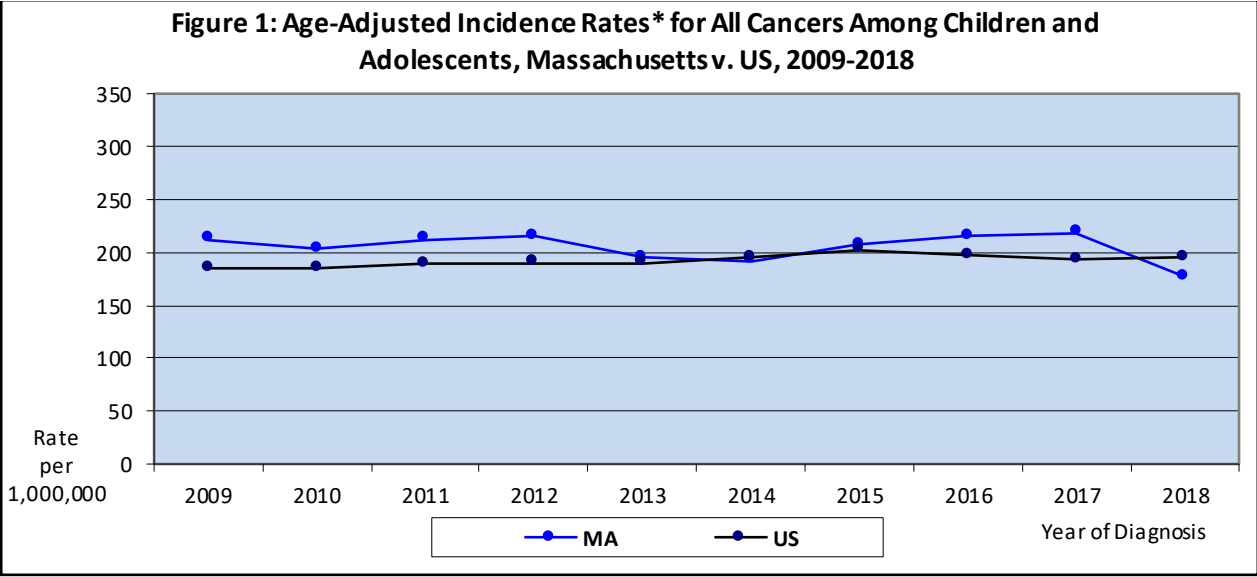
JANUARY, 2023

The purpose of this report is to present data on cancer in children (0-14) and adolescents (15-19) in Massachusetts from 2009 to 2018. It is the third of a continuing series of childhood and adolescent reports, the previous ones covering 1990-1999 and 2000-2009. This report provides incident data on all cancers by four age groups, sex, and race/ethnicity including trends. There is additional information on the various groups of childhood/ adolescent cancers. Mortality trends are also presented in addition to a ranking of cancer deaths by type of cancer. Childhood cancers are classified differently from adult cancers. Whereas adult cancers are defined first using the cancer origin organ (primary site) and then by its tissue type (histology), childhood cancers are predominately classified according to histology regardless of primary site. Please refer to the technical notes for further information on classification and age adjustment of childhood/ adolescent cancers. Ten years of data were analyzed for this report to allow for longer trend analyses and to have larger numbers when comparing the different cancer types and more statistical power.

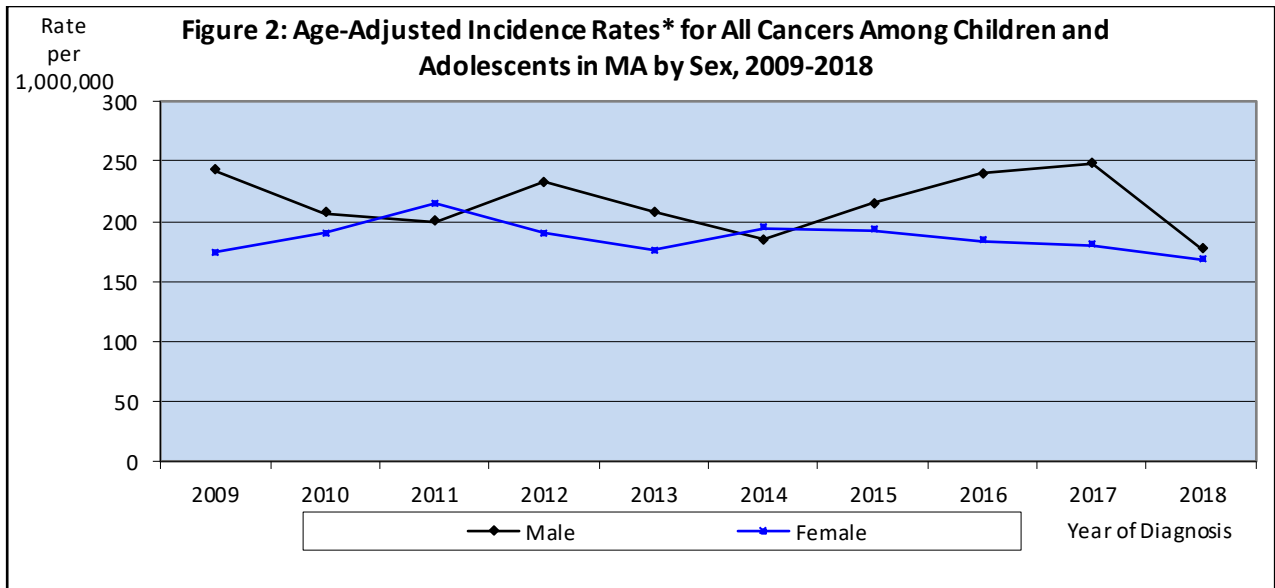
CANCER INCIDENCE RATES AND TRENDS:

From 2009-2018, there were 3,376 cancer cases diagnosed among Massachusetts children and adolescents through the age of 19. The overall incidence rate was 207/1,000,000. The incidence in males (218/1,000,000) was significantly higher than females (195/1,000,000).

The Massachusetts age-adjusted incidence rates of all cancers combined among children and adolescents did not change significantly from 2009-2018. National data from the Surveillance, Epidemiology, and End Results Program (SEER) showed that incidence rates among children and adolescents increased significantly by 0.7% (Figure 1). The increase may be the result of several factors including more frequent diagnosis by advanced imaging, exposures to high doses of ionizing radiation, high birth weight, certain genetic syndromes, air pollutants, tobacco or pesticide use, older parental age, and fewer children per family. ([Cancer in Children | The Cancer Atlas](#)). There were no significant cancer incidence trends for Massachusetts children by gender or sex from 2009-2018 (Figure 2).



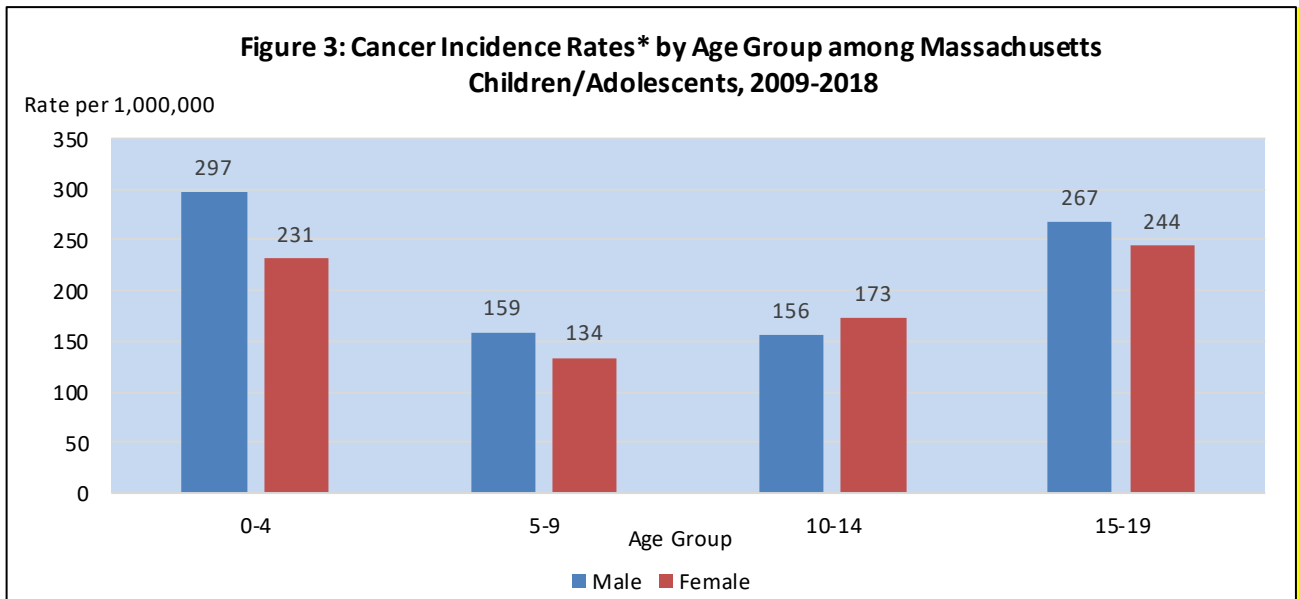
Source: Massachusetts Cancer Registry and SEER 21 Registries. *Rates are age-adjusted to the US standard 2000 population for ages 0-19.



Source: Massachusetts Cancer Registry. * Rates are age-adjusted to the US standard 2000 population for ages 0-19.

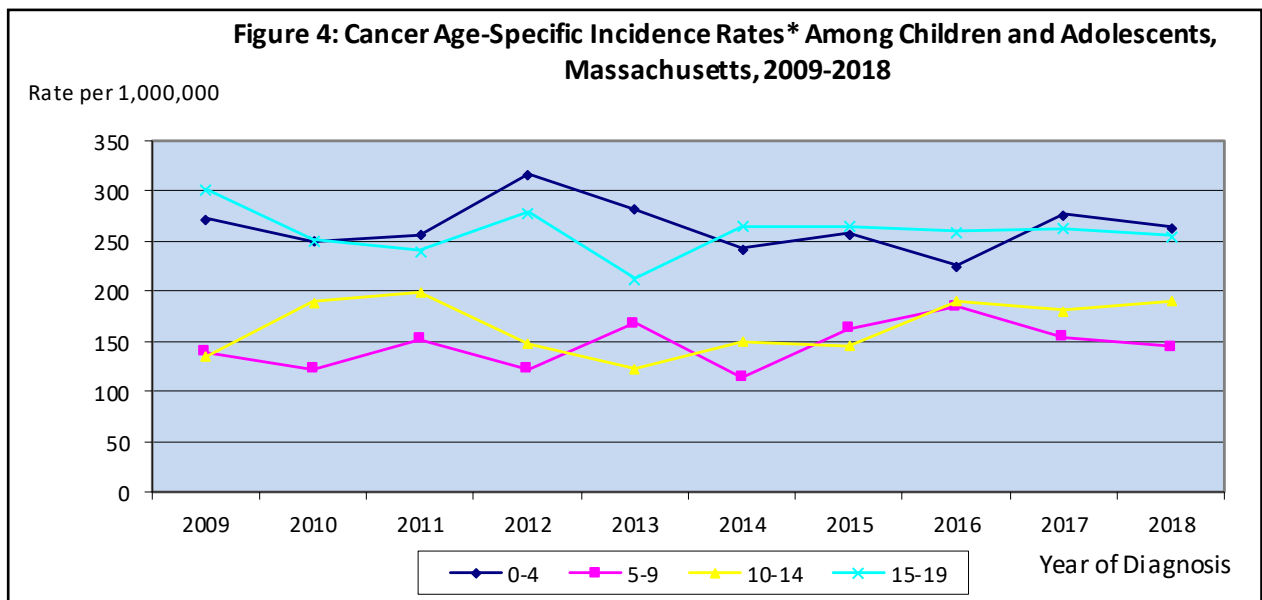
CANCER BY AGE GROUP:

The age-specific incidence rate of cancer was highest among males 0-4 and females 15-19. Males and females 0-4 and 15-19 had significantly higher rates compared to the other age groups (Figure 3).

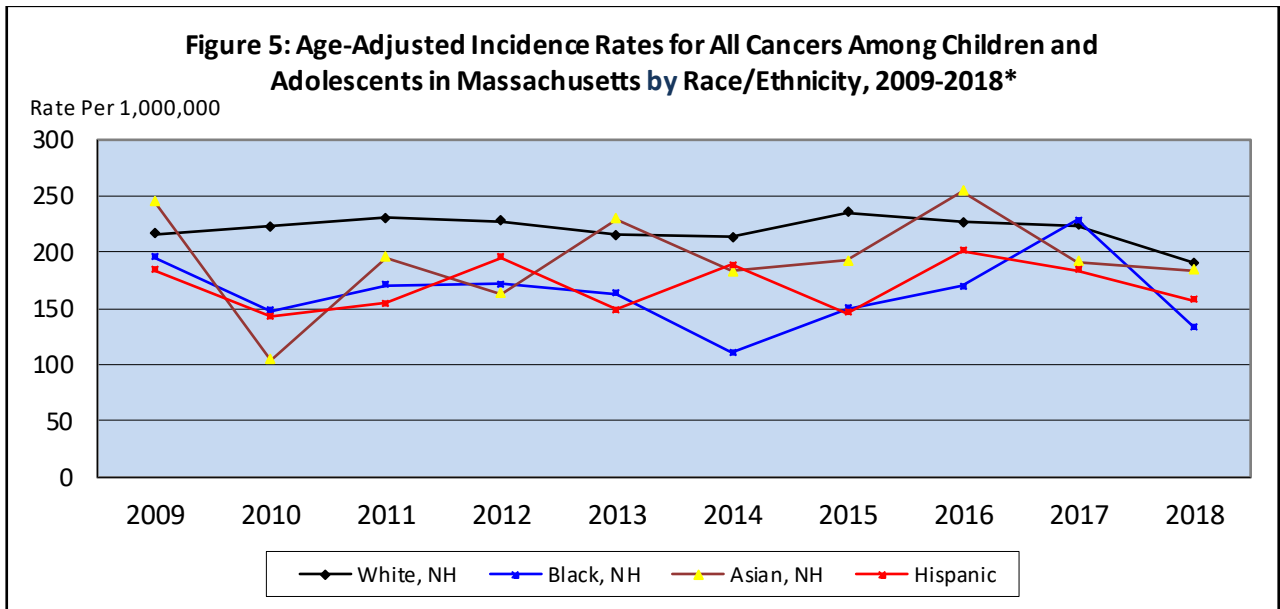


Source: Massachusetts Cancer Registry. *Rates are age-adjusted to the US standard 2000 population for ages 0-19.

There were no significant trends in the incidence of childhood/adolescent cancer from 2009-2018 for either the four age groups (Figure 4) or the four race/ethnicity groups for whom sufficient data were available for analysis. (Figure 5). Other race/ethnicity groups also identified on cancer registry reports include American Indian/Alaska Native, Other (not specified), and Unknown. Please see a table of total cancer counts from 2009-2018 for all reported race/ethnicity groups in the technical notes.



Source: Massachusetts Cancer Registry. *Rates are age-specific rates for each age group.



CANCER TYPES and SUB-TYPES:

Childhood/adolescent cancers are grouped into 12 classifications (see Technical Notes). Figures 6 and 7 show the breakdown of the 12 cancer groups by sex. Central Nervous System (CNS) and intracranial germ cell tumors include both malignant and non-malignant tumors. More detailed information on the types of cancers can be found at the American Cancer Society ([Children and Cancer](#)) and National Cancer Institute ([Childhood Cancers - National Cancer Institute](#)).

Figure 6: Childhood/Adolescent Male Cancer Types, MA, 2009-2018 (N=1,808)

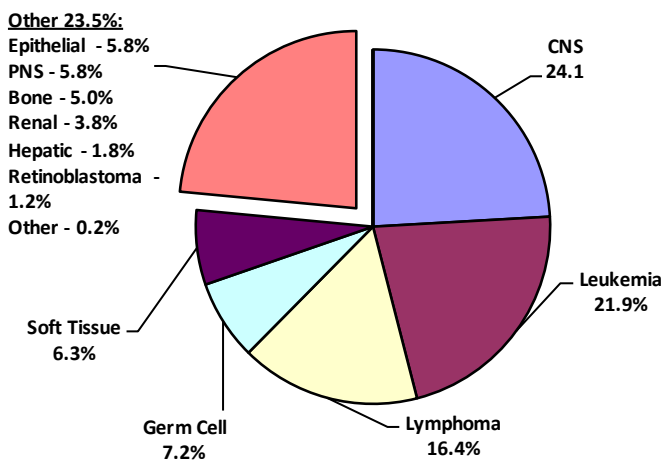
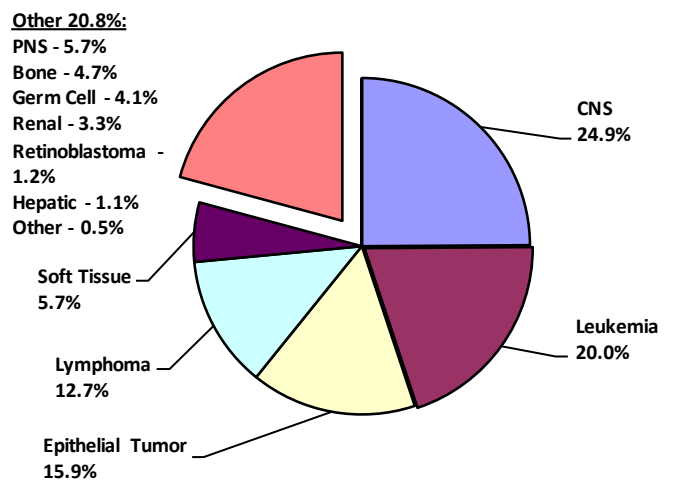


Figure 7: Childhood/Adolescent Female Cancer Types, MA, 2009-2018 (N=1,567)



Source: Massachusetts Cancer Registry

Several of the 12 cancer groups contain multiple sub-groups. Figures 8-14 show the breakdown of total childhood/adolescent cancer types with several sub-groups. Peripheral nervous system (PNS) tumors consist almost exclusively of neuroblastomas, kidney cancers of Wilm’s Tumors (nephroblastomas), and liver cancers of hepatoblastomas. There are no subtypes for retinoblastomas.

Figure 8: Childhood/Adolescent Leukemia Types, MA, 2009-2018 (N=771)

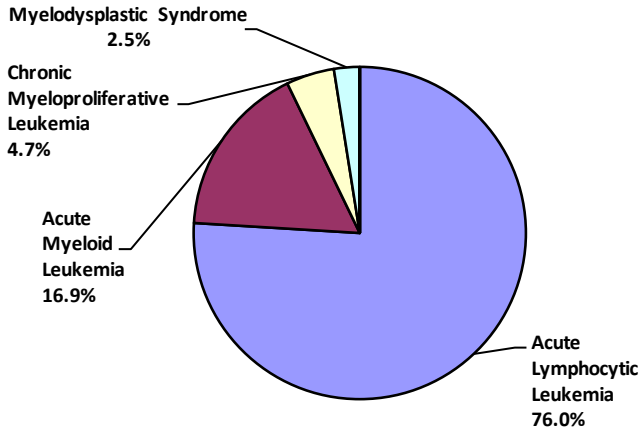
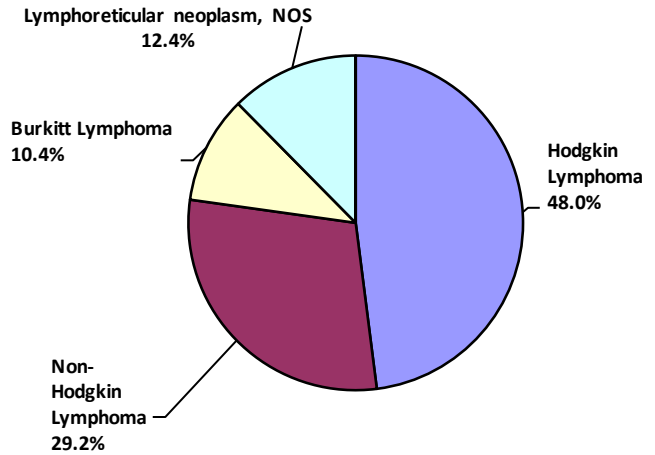


Figure 9: Childhood/Adolescent Lymphoma Types, MA, 2009-2018 (N=469)



Source: Massachusetts Cancer Registry

Figure 10: Childhood/Adolescent Central Nervous System Tumor Types, MA, 2009-2018 (N=825)

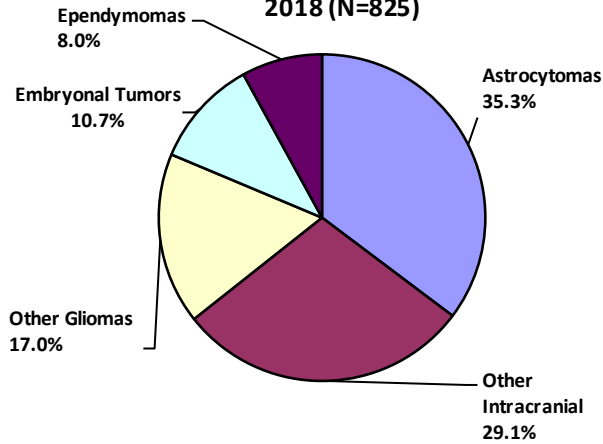
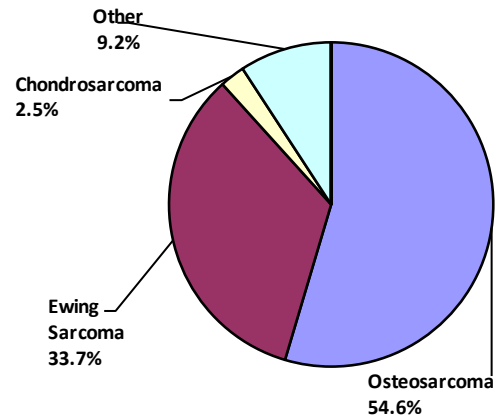


Figure 11: Childhood/Adolescent Bone Cancer Types, MA, 2009-2018 (N=163)



Source: Massachusetts Cancer Registry

Figure 12: Childhood/Adolescent Soft Tissue Sarcoma Types, MA, 2009-2018

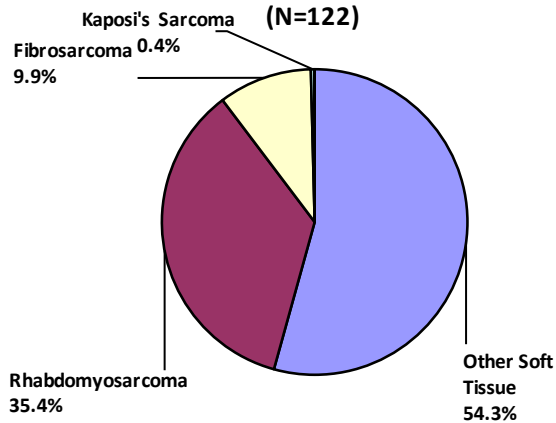
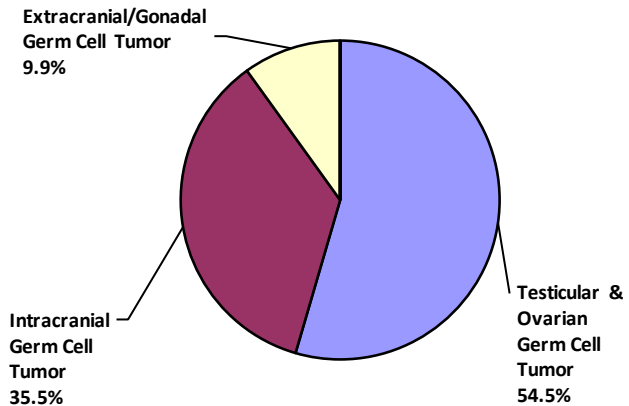
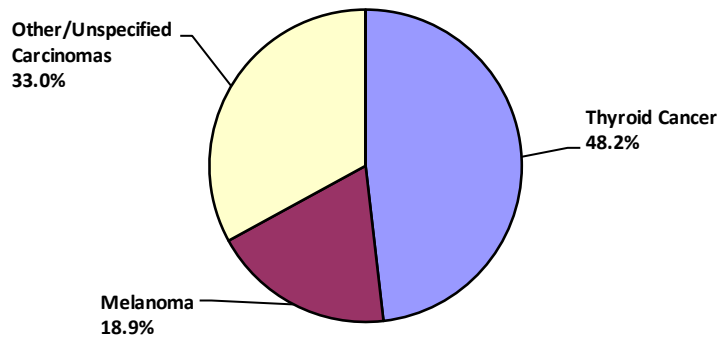


Figure 13: Childhood/Adolescent Germ Cell Tumor Types, MA, 2009-2018 (N=196)



Source: Massachusetts Cancer Registry

Figure 14: Childhood/Adolescent Epithelial Neoplasm Types, MA, 2009-2018 (N=354)



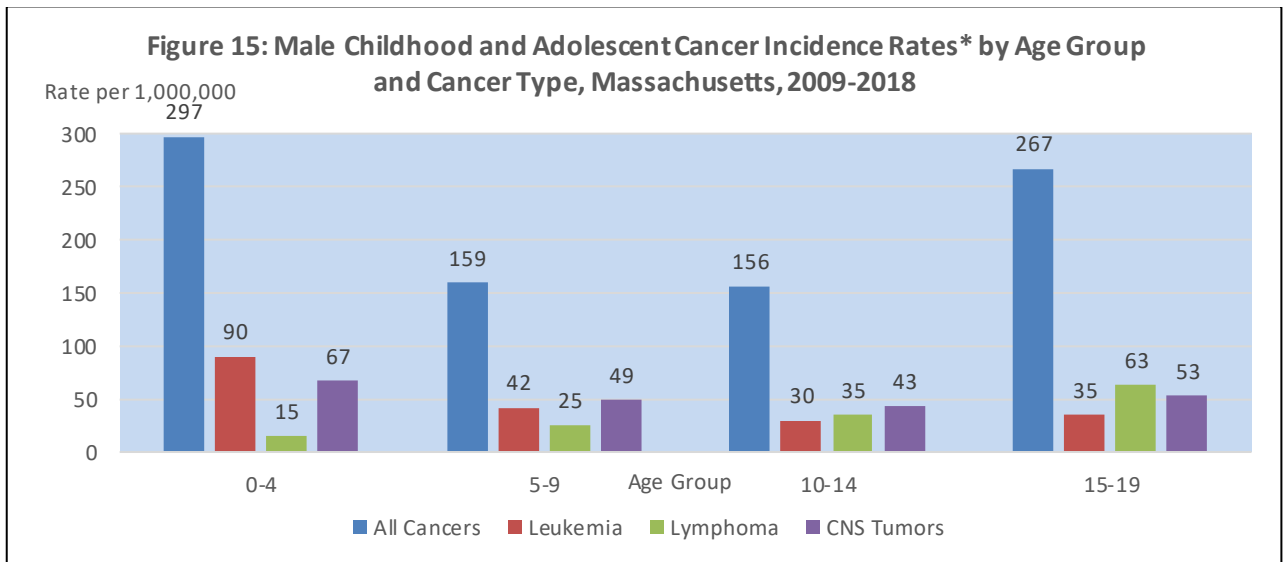
Source: Massachusetts Cancer Registry

Cancer Types by Age Group:

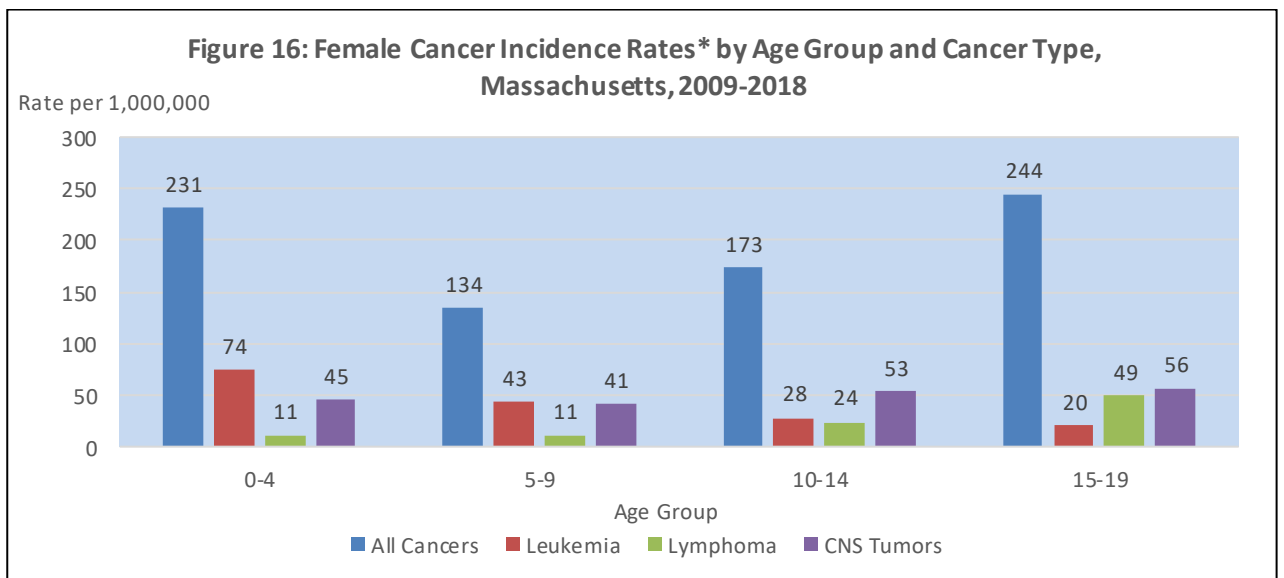
The age-specific incidence rate of childhood cancer was highest among Massachusetts males 0-4 and for females 15-19. The rates for these two groups, while not significantly different, were both significantly elevated when compared to males and females of the other two groups (5-9 and 10-14). This is reflective of national data ([National Childhood Cancer Registry](#)). The most common cancer types varied by age group and sex. Leukemia ranked highest among the youngest age group while CNS tumors ranked among the top two cancers for all four age groups. PNS tumors was only in the top five for the youngest age group while epithelial cancer and germ cell tumors were only in the top five for the two oldest groups. Lymphoma was also absent from the top five of the youngest group. Please refer to Appendix 1 for more detailed information on the top 5 cancers by age group.

Leukemia, lymphoma, and CNS tumors were the most common cancers overall for children and adolescents. Figures 15 and 16 show how the rates compare by sex and age group. Leukemia rates were highest in the younger group with a drop and subsequent leveling off for the older groups.

Lymphoma rates were lower for all female age groups compared to males, though not significantly. The rates increased with increasing age group. CNS tumor rates were consistent over the four groups for females and were highest for the youngest group of males.



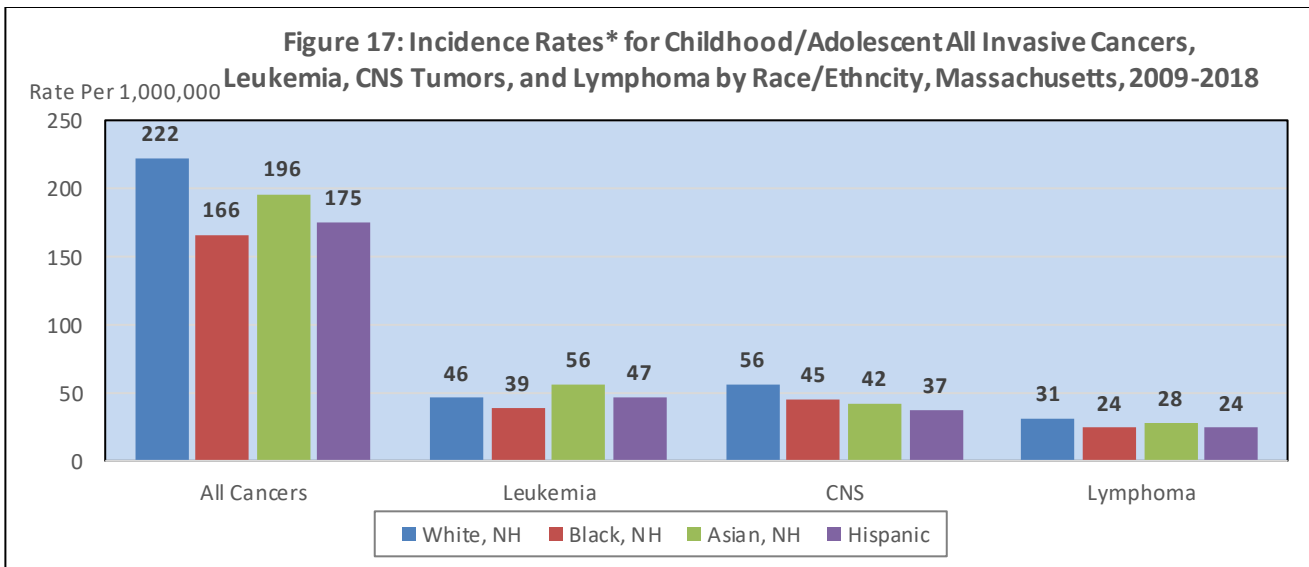
Source: Massachusetts Cancer Registry. *Rates are age-adjusted to the US standard 2000 population for 0-19.



Source: Massachusetts Cancer Registry. *Rates are age-adjusted to the US standard 2000 population for 0-19.

Cancer Types by Race/Ethnicity:

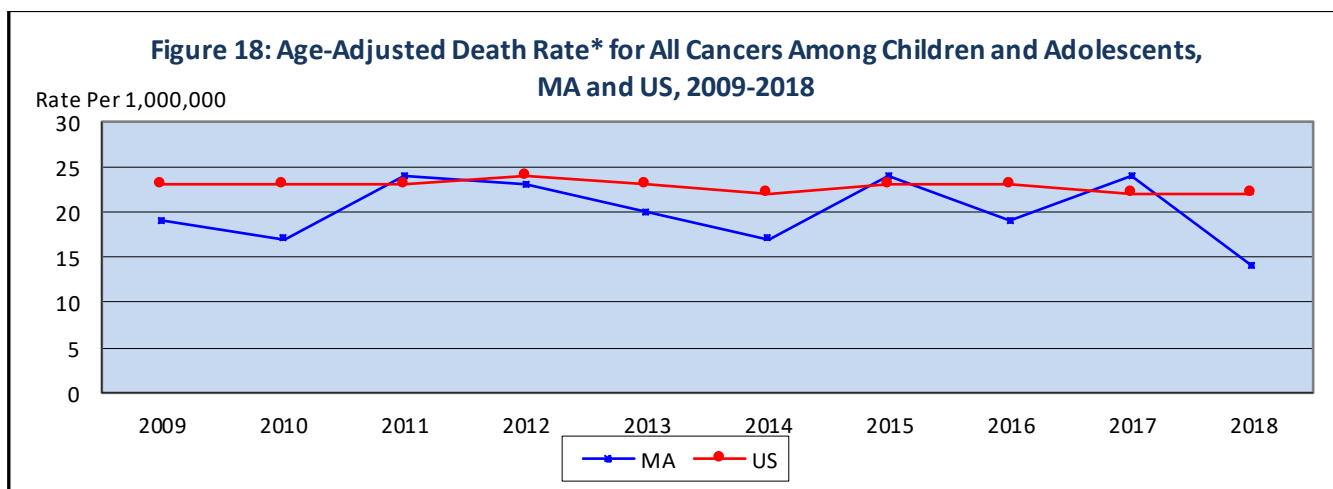
From 2009-2018, Massachusetts White, non-Hispanic (NH) and Asian, NH children and adolescents had a significantly higher age-adjusted incidence rate for all cancers combined compared to Black NHs, and Hispanics (Figure 17). White NHs had a significantly elevated rate of CNS tumors compared to the other groups. There were no significant differences between the four race/ethnicity groups for leukemia and lymphoma.



Source: Massachusetts Cancer Registry. * Rates are age-adjusted to the US standard 2000 population for ages 0-19.

CHILDHOOD AND ADOLESCENT CANCER MORTALITY:

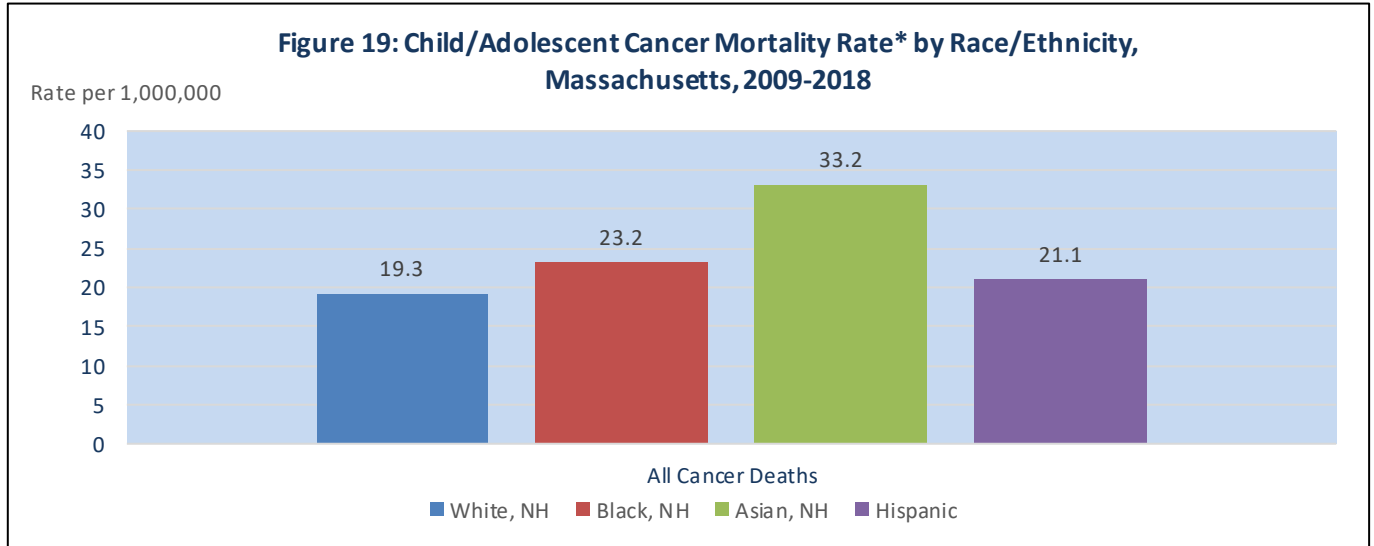
From 2009-2018, cancer was ranked the 4th most common cause of death for Massachusetts children aged 0-4, the most common for children aged 5-9 and 10-14, and the 4th most common for adolescents aged 15-19. During this time, there were 333 deaths with cancer as an underlying cause of death among children and adolescents. Since the number of deaths was small, Massachusetts death data were not broken down by sex. The death rate remained stable for Massachusetts and the US (Figure 18).



Source: Massachusetts Registry of Vital Records and Statistics (MRVS). * Age-adjusted to the US standard 2000 population for ages 0-19.

Asian, NHs had the highest mortality rate for all cancer deaths though it was not significantly elevated (Figure 19). This elevation was driven by Asian, NHs having a significantly higher mortality

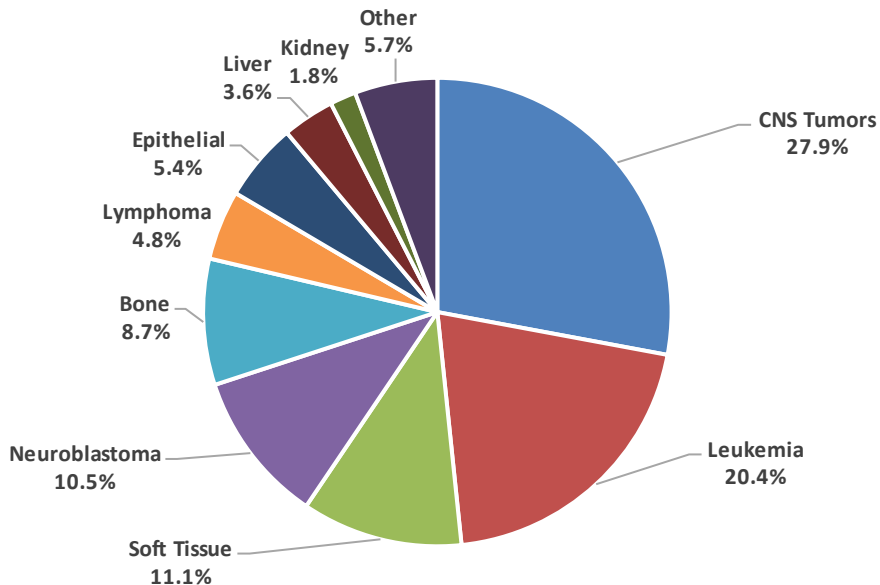
rate for central nervous system cancers compared to the other racial/ethnic groups. The number of central nervous system cancer deaths in this group, however, were small (n=17) and were not increasing on an annual basis.



Source: MRVS *Rates are age-adjusted to the US standard 2000 population for ages 0-19.

Central nervous system cancer was the leading cause of cancer deaths among Massachusetts children and adolescents from 2009-2018, followed by leukemia, cancers of the soft tissue, bone, and adrenal gland (related to neuroblastoma) (Figure 20).

Figure 20: Child/Adolescent Cancer Deaths in MA, 2009-2018 (n=333)



Source: Massachusetts Registry of Vital Records and Statistics.

TECHNICAL NOTES

Childhood/Adolescent Cancer Coding: Cases reported from 2009 through 2018 were coded following the International Classification of Oncology version 3 (ICD-O3) system. All cases diagnosed in children and adolescents (birth-19) were then grouped into International Classification of Childhood Cancer, Third Edition (ICCC-3) categories. The ICCC-3 was developed to standardize the classification of childhood cancer cases. The ICCC-3 system groups ICD-O-3 histology and site codes into 12 categories. The ICCC includes some tumors of benign or uncertain behavior in its classification of central nervous system and intracranial and intraspinal neoplasms and are included in this report. The section on cancer types further details the 12 categories. For more details on ICCC-3 coding, please refer to [ICCC, Third Edition \(ICD-O-3\), Main Classification Table - SEER Recodes \(cancer.gov\)](https://seer.cancer.gov/iccc-3/)

Age Standardization for Children and Adolescents: For Massachusetts Cancer Registry (MCR) publications that focus on a specific cancer or cancers among all groups, age-adjustment is based on 19 age groups. The percentage that each age group comprised of the total United States 2000 population is multiplied by the age-specific rate for a cancer to obtain an adjusted rate. The age-adjusted rate for a specific cancer is derived by adding the 19 age group-specific rates into one age-adjusted rate which controls for age differences in cancer incidence. In this report, age adjustment was calculated in the same manner as previously indicated, but the four population groups were limited to those age 0-19. While age adjusted rates are usually presented per 100,000, the childhood/adolescent rates are presented as rates per 1,000,000 residents due to the small counts and to be consistent with the way that national data are presented.

Race/Ethnicity Data: Race and ethnicity data are reported to the MCR from hospital medical records. Race/ethnicity data are presented as White, non-Hispanic, Black, non-Hispanic, Asian, non-Hispanic, and Hispanic. Data counts for Native Americans, Other, not specified, and unknown were too small to perform any analyses. Asian and Hispanic ethnic groups (Chinese, South Asian, Vietnamese, Puerto Rican, Dominican, etc.) were also too small to perform any analyses. Additionally, the percentage of Hispanic and Asian cases without a specified ethnicity prevented an accurate count of specific Hispanic and Asian ethnic groups.

Racial/Ethnic Breakdown of Child/Adolescent Cancer Cases in MA, 2009-2018	
Race/Ethnic Group:	Frequency (descending order)
TOTAL	3,376
White, non-Hispanic	2,402
Hispanic	457
Black, non-Hispanic	229
Asian, non-Hispanic	210
Unknown	50
Other, not specified	22
American Indian/Native Alaskan	6

Breakdown of Asian, NH Child/Adolescent Cancer Cases in MA, 2009-2018	
Ethnic Group:	Frequency (descending order)
TOTAL	210
Other Asian, not specified	36
Chinese	73
South Asian	54
Vietnamese	18
Cambodian	14
Other Asian, specified*	15

* - includes Laotian, Thai, Japanese, Filipino, Hawaiian, and Korean.

Breakdown of Hispanic Child/Adolescent Cancer Cases in MA, 2009-2018	
Ethnic Group:	Frequency (descending order)
TOTAL	457
Hispanic, not specified	165
Puerto Rican	119
Dominican	93
Central/South American	56
Spaniard	13
Other Hispanic, specified*	11

*-includes Mexican and Cuban.

FURTHER READING

This summary report focused on the epidemiology of childhood and adolescent cancer in Massachusetts. For further information on these cancers, including medical description, causes, treatment, and national survival data, please refer to these resources.

National Cancer Institute: [Childhood Cancers - National Cancer Institute](#)

American Cancer Society: [Children and Cancer](#)

The National Childhood Cancer Registry (NCCR) provides national childhood, adolescent, and young adult data at the national level. It can be accessed through this link: [National Childhood Cancer Registry](#)

ACKNOWLEDGEMENTS

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APPENDIX: Age-specific incidence rates and 95% confidence intervals of leading cancers among children and adolescents by age group and sex, Massachusetts, 2009-2018*

Age 0-4 years

Rank	Males	Females
	All Cancers 297 (272, 321)	All Cancers 231 (209, 254)
1	Leukemia 90 (76, 104)	Leukemia 74 (61, 86)
2	CNS 67 (55, 79)	CNS 45 (35, 55)
3	PNS 47 (37, 57)	PNS 39 (30, 48)
4	Renal 23 (16, 30)	Renal 15 (9, 21)
5	Soft Tissue 16 (10, 22)	Soft Tissue 13 (8, 18)

Age 5-9 years

Rank	Males	Females
	All Cancers 158 (141, 176)	All Cancers 134 (117, 150)
1	CNS 49 (39, 59)	Leukemia 43 (34, 53)
2	Leukemia 42 (33, 52)	CNS 41 (32, 50)
3	Lymphoma 25 (18, 32)	Lymphoma 11 (6, 16)
4	Soft Tissue 11 (7, 16)	Renal 10 (5, 14)**
5	Renal & Bone 7 (3, 11)**+	Bone & Soft Tissue 7 (3, 11)**+

Age 10-14 years

Rank	Males	Females
	All Cancers 156 (139, 173)	All Cancers 173 (154, 191)
1	CNS 43 (34, 52)	CNS 53 (43, 63)
2	Lymphoma 35 (27, 43)	Leukemia 28 (20, 35)
3	Leukemia 30 (23, 38)	Epithelial Tumor 26 (19, 33)
4	Bone 14 (9, 19)	Lymphoma 24 (17, 31)
5	Epithelial Tumor 13 (8, 18)	Bone Tumor 18 (12, 24)

Age 15-19 years

Rank	Males	Females
	All Cancers 267 (246, 288)	All Cancers 244 (224, 265)
1	Lymphoma 63 (53, 73)	Epithelial Tumor 78 (67, 90)
2	CNS 53 (44, 63)	CNS 56 (46, 66)
3	Germ Cell 39 (31, 47)	Lymphoma 48 (40, 58)
4	Leukemia 35 (28, 43)	Leukemia 20 (14, 26)
5	Epithelial Tumor 30 (23, 37)	Soft Tissue 13 (9, 18)

Source: Massachusetts Cancer Registry. *Rates are age-adjusted to the US standard 2000 population for ages 0-19.

** - fewer than 20 cases; rate may be unstable. +-These cancers were tied for 5th place.