

Childhood Cancer in Kentucky



2014-2023

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The population-based childhood cancer incidence data presented in this report was made possible by the Kentucky General Assembly that passed Senate Bill 41 in April 1990. This legislation formally established the Kentucky Cancer Registry (KCR) as the official cancer surveillance program for the Commonwealth of Kentucky and mandated reporting of all cancer cases to KCR beginning on January 1, 1991. Kentucky Revised Statute (KRS) 214.556 continues to require reporting from all health care facilities that either diagnose or treat cancer patients. Facilities include acute care hospitals, freestanding treatment centers, non-hospital (private) pathology laboratories, physician offices and genomic testing facilities. KCR gratefully acknowledges the full and active participation of facilities throughout Kentucky and a number of facilities located outside of Kentucky. Their efforts are essential to complete, timely, and accurate reporting of all childhood cases occurring in Kentucky.

Beginning in 1994, KCR was awarded funding from the Centers for Disease Control and Prevention (CDC) through the National Program of Cancer Registries (NPCR). This additional funding allows KCR to maintain a formal quality assurance program, implement complete death clearance follow back, and ensure that all cases of cancer are systematically reported by Kentucky's non-hospital facilities. In 2001, KCR was awarded critical support from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program, to further improve patient follow-up information and support expanded quality assurance activities. KCR has been successful in re-competing and sustaining all of these funding sources since the initial awards. KCR was awarded contract renewals to continue through 2028 as an NPCR registry and as a SEER Program Registry. KCR has recently received two competitive awards to participate in the development of the National Childhood Cancer Registry, an initiative led by the National Cancer Institute.

Finally, special recognition is given to the professional staff of KCR. Informatics staff develop, maintain and support software, databases and technical infrastructures used throughout Kentucky. Operations staff have developed training programs and provide ongoing support to all of the reporting facilities throughout the state. Biostatistics and epidemiology faculty provide support for cancer prevention and control activities and research with KCR data. All of these individuals are highly engaged in cancer surveillance activities and standards development at the national and international levels. KCR could not be successful without the consistent contributions of these talented and dedicated individuals.

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Table of Contents

Childhood Cancer Incidence in Kentucky, 2014-2023

1	Introduction and Overview
3	Proportion of Cases by Sex, All Sites
4	Cases by Sex and Age at Diagnosis, All Sites
5	Cases by Site Group and Sex
6	Proportion of Cases by Site Group
7	Proportion of Cases by Site Group and Age Group
8	Incidence Rates by Site Group, Both Sexes, Male, Female
9	Incidence Rates and Trend, All Sites, Both Sexes
10	Incidence Rates, All Sites, Male
11	Incidence Rates, All Sites, Female
12	Incidence Rates by Area Development District, All Sites
13	Incidence Rate Comparisons by Area Development Districts, All Sites
14	Incidence Rate Comparisons by Appalachian Region, All Sites
15	Incidence Rate Comparisons by Urban/Rural Region, All Sites

Childhood Cancer Survival Rates in Kentucky

17	Survival Analysis for Childhood Cancer
18	Survival Rates, All Sites, 2014-2023
19	Survival Rates in Kentucky Compared to U.S., Leukemia, Lymphoma, Brain and CNS, 2012-2022

Childhood Cancer Incidence Rates in Kentucky Compared to U.S., 2013-2022

21	Kentucky Incidence Rates Compared to U.S. by Sex
22	Kentucky Incidence Rates Compared to U.S. by Site Group
23	Kentucky Rankings Compared to U.S. States by Site Group

Supplemental Information

25	Definitions
26	Staff of the Kentucky Cancer Registry
27	Additional Resources

Introduction

This interim report of population-based childhood cancer incidence for the Commonwealth of Kentucky represents the most accurate data available at the time of publication. This report includes complete data through the 2023 diagnosis year that are available from KCR and through the 2022 diagnosis year that are available nationally. KCR collects uniform, high quality data on approximately 229 new primary cases of childhood cancer occurring in Kentucky residents each year. Childhood cancer is defined as all newly diagnosed malignant invasive neoplasms occurring among all children living in Kentucky under the age of 20. This report provides detailed information about childhood cancer in Kentucky for the most recent ten year period of complete, population-based data collected and validated by KCR. Information includes case counts by sex, age and site groups. Site groupings by body site and histologic type are defined by the International Classification of Childhood Cancer (ICCC) [1] and permit comparisons of incidence rates within and outside of Kentucky. This report also provides information about age-adjusted childhood cancer incidence rates, defined as the number of new cases diagnosed, divided by the numbers of persons at risk during the calendar year(s). Age-adjustment calculates the rates according to a standard age distribution. This is necessary to allow comparisons between regions with different age distributions. All rates in this report are per 1,000,000 (million) individuals at risk for the given cancer. It should be noted that rates per million differ from reports that include adult cancers which are typically reported per 100,000. Because of the relatively small numbers of cases, rates for small geographic regions can be deemed unstable, meaning too few cases to calculate a reliable rate. Unstable rates tend to exhibit large fluctuations with the increase or decrease of even a single case from year to year and can therefore be easily misinterpreted as representing a greatly increased or diminished risk of diagnosis. As a result, unstable rates with the number of cases less than 15 are not included in this report.

This report provides information that permits regional comparisons among Kentucky's Area Development Districts (ADD), Appalachian/non-Appalachian counties, and Urban/Rural counties within the state. ADD maps display four distinct colors. Each color represents a quartile, or one-fourth of the range of incidence rates from lowest in yellow, to highest in red. Information is also provided to permit comparisons of age-adjusted rates in the U.S. with Kentucky and Appalachian Kentucky.

Overview

Childhood cancer is relatively rare, with less than 1% (2,292 / 289,015) of all cancers diagnosed in Kentucky occurring among children under the age of 20 during the years 2014-2023. However, a cancer diagnosis is severely burdensome for these children and their families. In addition to the side effects from surgeries, chemotherapeutics and/or radiation on developing body systems, there are often lifelong economic and social costs for affected families. Over 83% of children diagnosed with cancer survive at least 5 years [2], yet cancer remains the leading cause of disease-related death among U.S. children. Brain and central nervous system (CNS) tumors have recently overtaken leukemia as the leading cause of cancer-related death among children [3].

From 2014 through 2023, of the most recent ten years' complete data presented in this report, 2,292 Kentucky children were diagnosed with invasive cancer. Cancer occurred more frequently among males (53%) than females (47%).

The frequency of cancer diagnoses in Kentucky children varied by age, with cancers occurring most frequently among children ages 15-19, followed closely by children ages 0-4, then 10-14, and 5-9, respectively. Males were diagnosed with more cancers across all site groups except for epithelial tumors and melanoma, renal tumors, and retinoblastoma. Among all Kentucky children, leukemia occurred most frequently (23%), followed closely by brain and CNS tumors (18%), lymphoma (16%), and epithelial tumors and melanoma (14%). These top four site groups represent 71% of all childhood cancer diagnoses during this time period.

The frequency of diagnoses by cancer site group also varied by age group. Of note, a greater proportion of hepatic tumors occurred among children ages 0-4, while more leukemia cases occurred among children ages 0-4 and 5-9. Children ages 5-9 also experienced the greatest proportion of brain and CNS tumors. Lymphoma, epithelial tumors and melanoma, and germ cell and gonadal tumors increased proportionally with age, while sympathetic nervous system tumors, and renal tumors decreased proportionally with age. It is important to note that while lymphoma increased proportionally with age, the greatest occurrence was among children ages 10-14. Retinoblastoma occurred primarily among children ages 0-4 and was almost nonexistent in other age groups. The greatest proportion of soft tissue sarcomas occurred among children ages 5-9. Bone tumors occurred primarily among children ages 10-14. The age-adjusted incidence rates of childhood cancer in Kentucky increased by 4.28% annually from 2014 through 2017 and then decreased by 2.48% annually through 2023. A somewhat similar pattern has been observed throughout the U.S. that showed a 0.5% annual increase through 2016, followed by an annual average decrease of 2.1% through 2019. [2] Due to the impact of the COVID pandemic, significant drops of cancer incidence were found in Kentucky and the U.S. in 2020.

Regional comparisons within Kentucky indicate that the highest rates tend to occur in the eastern regions of the state with Appalachian Kentucky experiencing a higher rate than non-Appalachian Kentucky. According to the most recent national data available (2013-2022), Kentucky's age-adjusted childhood cancer incidence rate for all cancer sites is approximately 6.8% higher than in the U.S. [4]. Rates in Kentucky and Appalachian Kentucky are predominantly higher than in the U.S. for both males and females. Comparisons to U.S. rates by site group indicate that Kentucky children and/or Kentucky Appalachian children have higher rates across most major site groups. Rates of leukemia are lower than the U.S. for all Kentucky children and Appalachian children. Of particular concern, rates of brain and CNS tumors, and epithelial tumors and melanoma are significantly higher in Kentucky compared to the U.S. Lymphoma, germ cell and gonadal tumors, sympathetic nervous system tumors and hepatic tumors are also significant higher compared to the U.S. Rates for epithelial tumors and melanoma are also significantly higher among Kentucky Appalachian children. Kentucky is ranked as having the 5th highest rate for all invasive cancer sites combined. However, Kentucky has the highest rate of hepatic tumors, 5th highest rate of epithelial tumors and melanoma, 6th highest rate of brain and CNS tumors, 7th highest rate of retinoblastoma, and 9th highest rates for lymphoma, germ cell and gonadal tumors, and sympathetic nervous system tumors.

1. Steliarova-Foucher E, Colombet M, Ries LAG, Hesselning P, Moreno F, Shin HY, Stiller CA, editors (2017). International Incidence of Childhood Cancer, Volume III (electronic version). Lyon, France: International Agency for Research on Cancer. Available from: <http://iicc.iarc.fr/results/>.

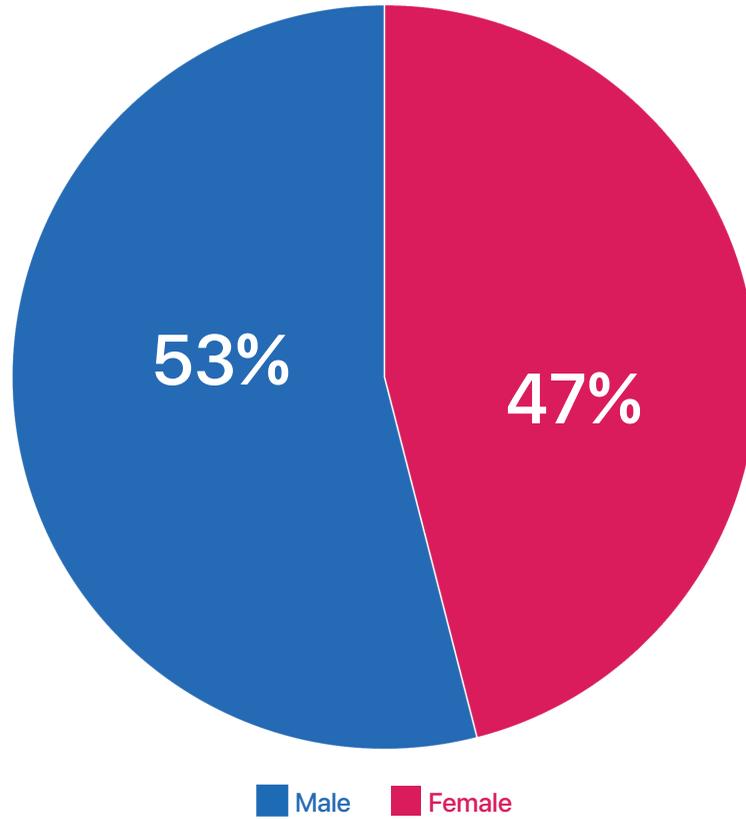
2. David A Siegel, Jessica B King, Philip J Lupo, Eric B Durbin, Eric Tai, Kathi Mills, Elizabeth Van Dyne, Natasha Buchanan Lunsford, S Jane Henley, Reda J Wilson, Counts, incidence rates, and trends of pediatric cancer in the United States, 2003-2019, JNCI: Journal of the National Cancer Institute, Volume 115, Issue 11, November 2023, Pages 1337-1354, <https://doi.org/10.1093/jnci/djad115>.

3. Curtin SC, Minino AM, Anderson RN. Declines in cancer death rates among children and adolescents in the United States, 1999-2014. National Center for Health Statistics Data Brief 2016; 257:1-8.

4. United States Cancer Statistics: 1999 - 2022 Incidence, WONDER Online Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; 2024. Accessed at <http://wonder.cdc.gov/cancer-v2022.html>.

CHILDHOOD CANCER INCIDENCE IN KENTUCKY ALL SITES, 2014-2023

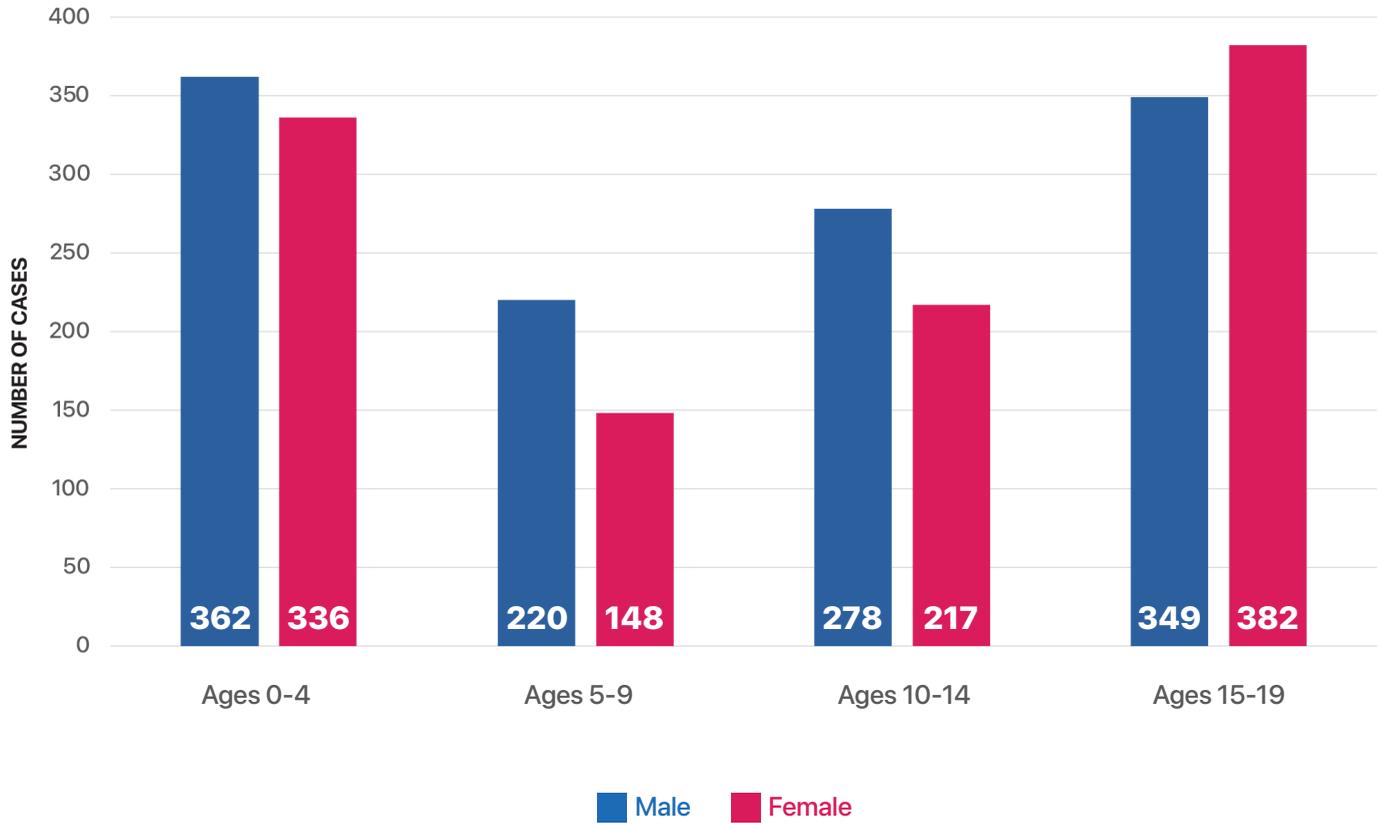
PROPORTION OF CASES BY SEX



Sex	Number of Cases (Percent)
Male	1,209 (53%)
Female	1,083 (47%)
Total	2,292

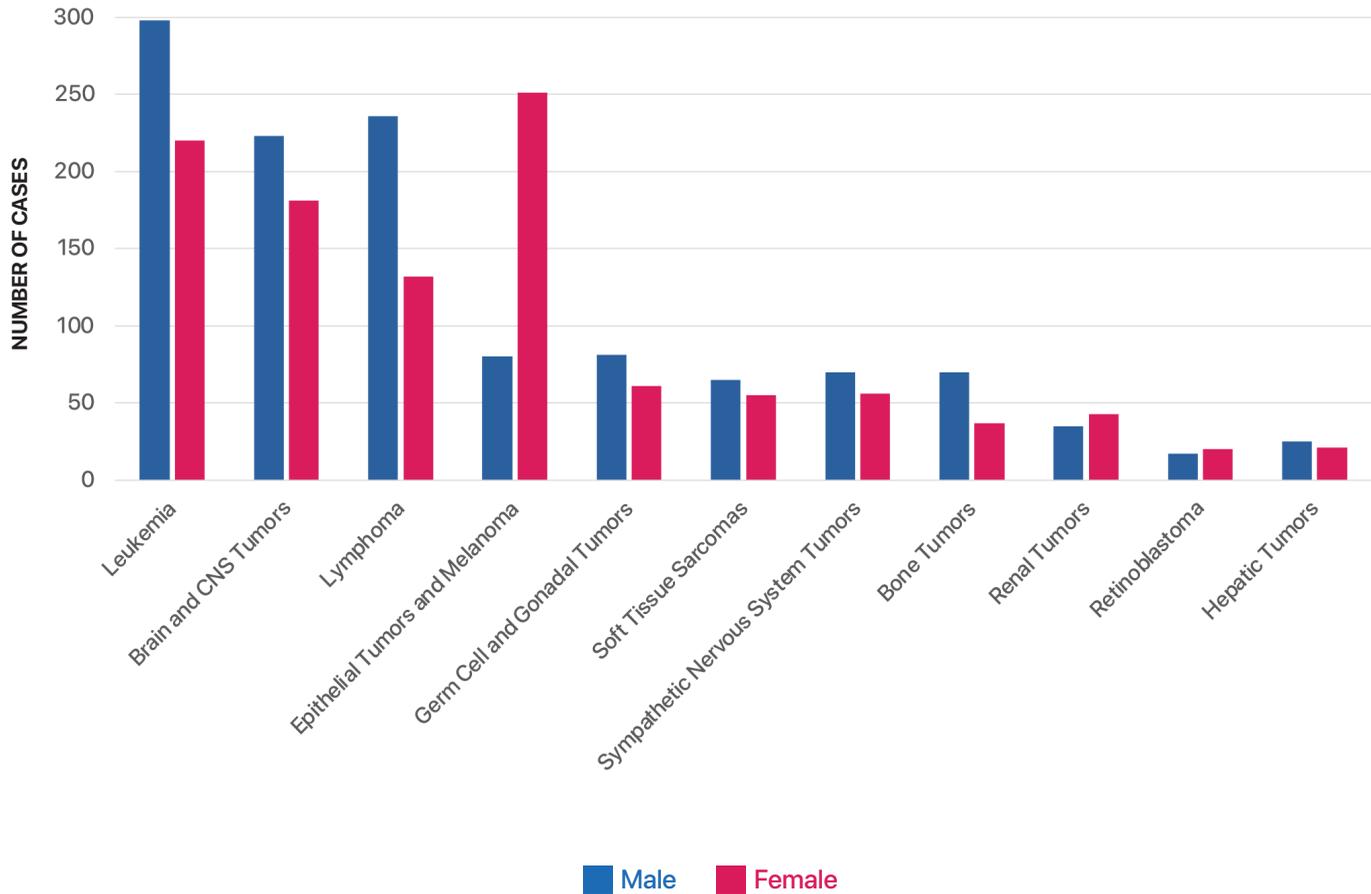
CHILDHOOD CANCER INCIDENCE IN KENTUCKY ALL SITES, 2014-2023

CASES BY SEX AND AGE AT DIAGNOSIS



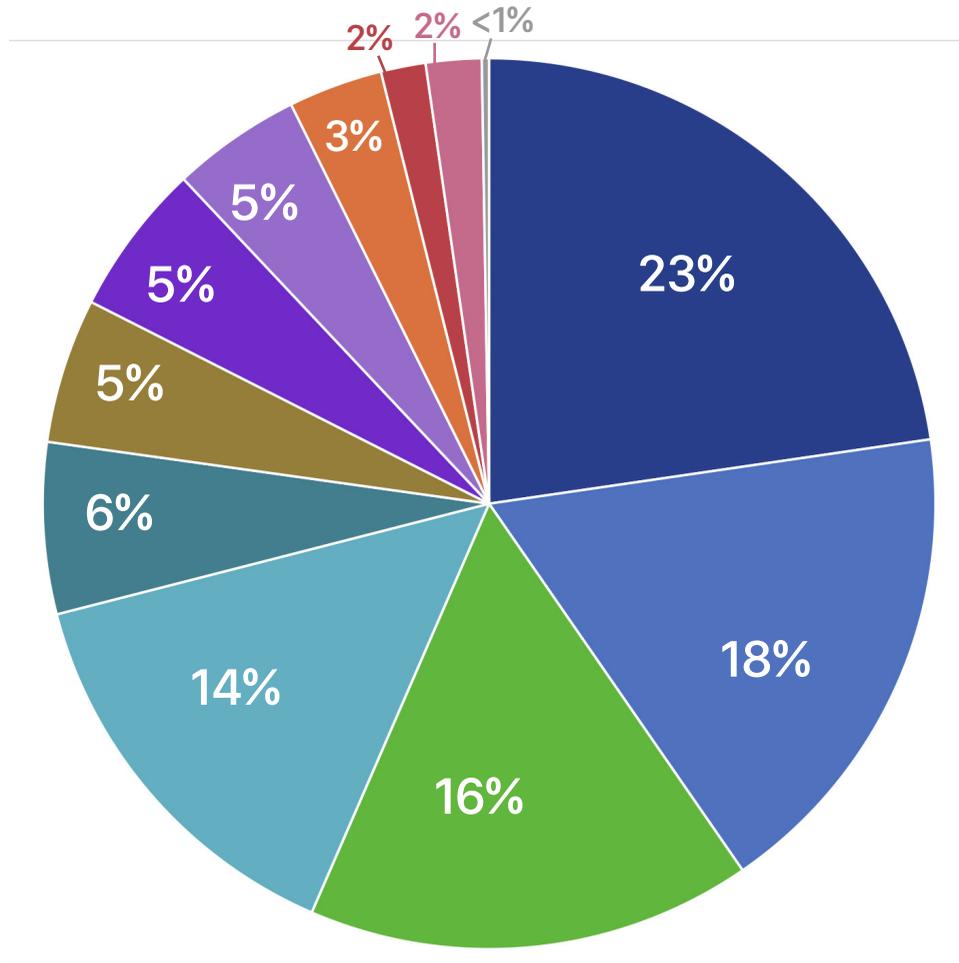
CHILDHOOD CANCER INCIDENCE IN KENTUCKY BY SITE GROUP, 2014-2023

CASES BY SITE GROUP AND SEX



CHILDHOOD CANCER INCIDENCE IN KENTUCKY BY SITE GROUP, 2014-2023

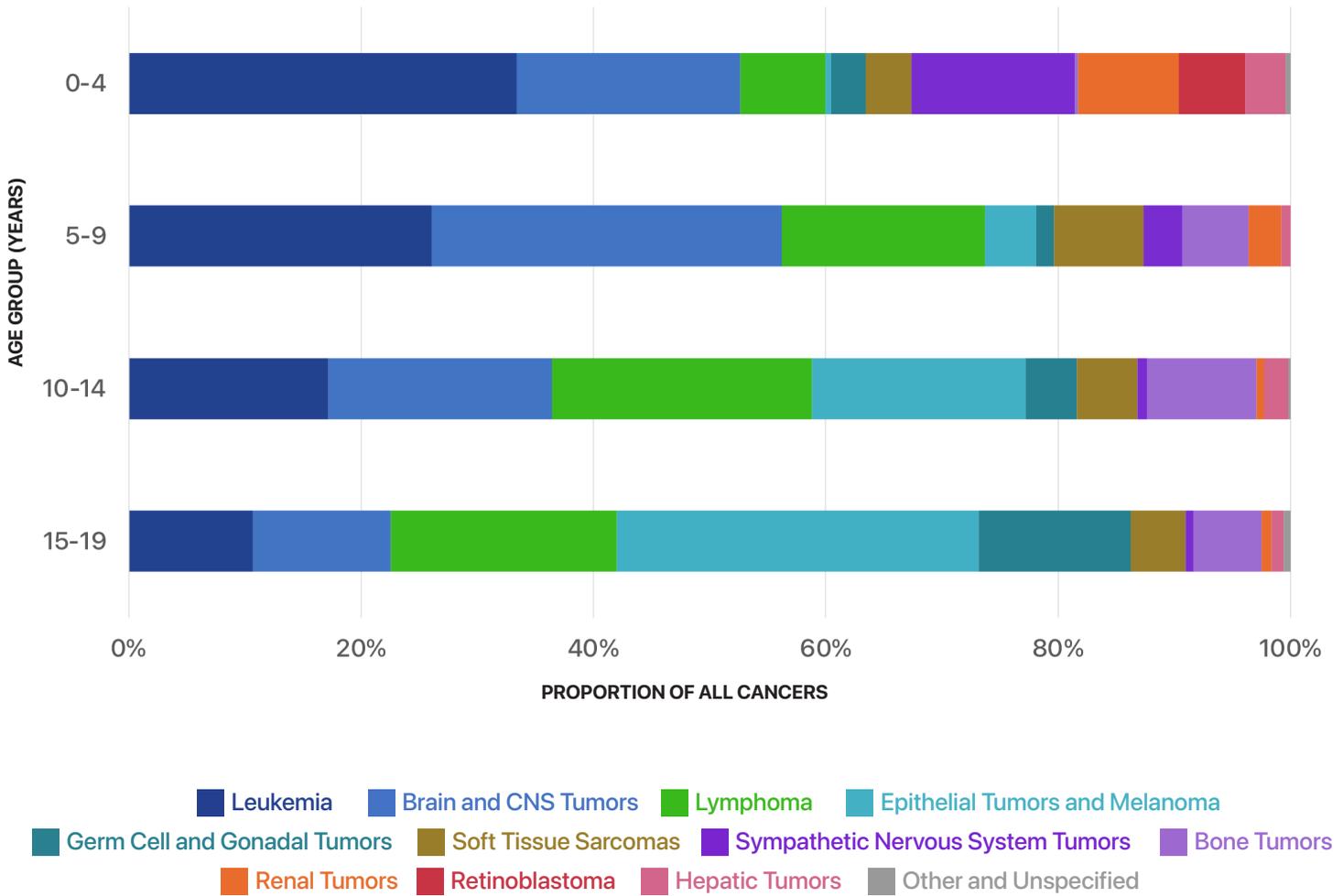
PROPORTION OF CASES BY SITE GROUP



- Leukemia
- Brain and CNS Tumors
- Lymphoma
- Epithelial Tumors and Melanoma
- Germ Cell and Gonadal Tumors
- Soft Tissue Sarcomas
- Sympathetic Nervous System Tumors
- Bone Tumors
- Renal Tumors
- Retinoblastoma
- Hepatic Tumors
- Other and Unspecified

CHILDHOOD CANCER INCIDENCE IN KENTUCKY BY SITE GROUP, 2014-2023

PROPORTION OF CASES BY SITE GROUP AND AGE GROUP



CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY BY SITE GROUP, 2014-2023

SITE GROUP	BOTH SEXES		MALE		FEMALE	
	Cases	Age-Adjusted Rate	Cases	Age-Adjusted Rate	Cases	Age-Adjusted Rate
All Sites	2,292	201.1	1,209	206.9	1,083	195.1
Leukemia	518	45.6	298	51.1	220	39.8
Brain and CNS Tumors	404	35.5	223	38.3	181	32.7
Lymphoma	368	32.2	236	40.3	132	23.7
Epithelial Tumors and Melanoma	331	28.8	80	13.5	251	44.8
Germ Cell and Gonadal Tumors	142	12.4	81	13.8	61	11.0
Soft Tissue Sarcomas	120	10.6	65	11.2	55	9.9
Sympathetic Nervous System Tumors	126	11.2	70	12.1	56	10.2
Bone Tumors	107	9.3	70	11.9	37	6.6
Renal Tumors	78	6.9	35	6.0	43	7.8
Retinoblastoma	37	3.3	17	2.9	20	3.6
Hepatic Tumors	46	4.0	25	4.3	21	3.8

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

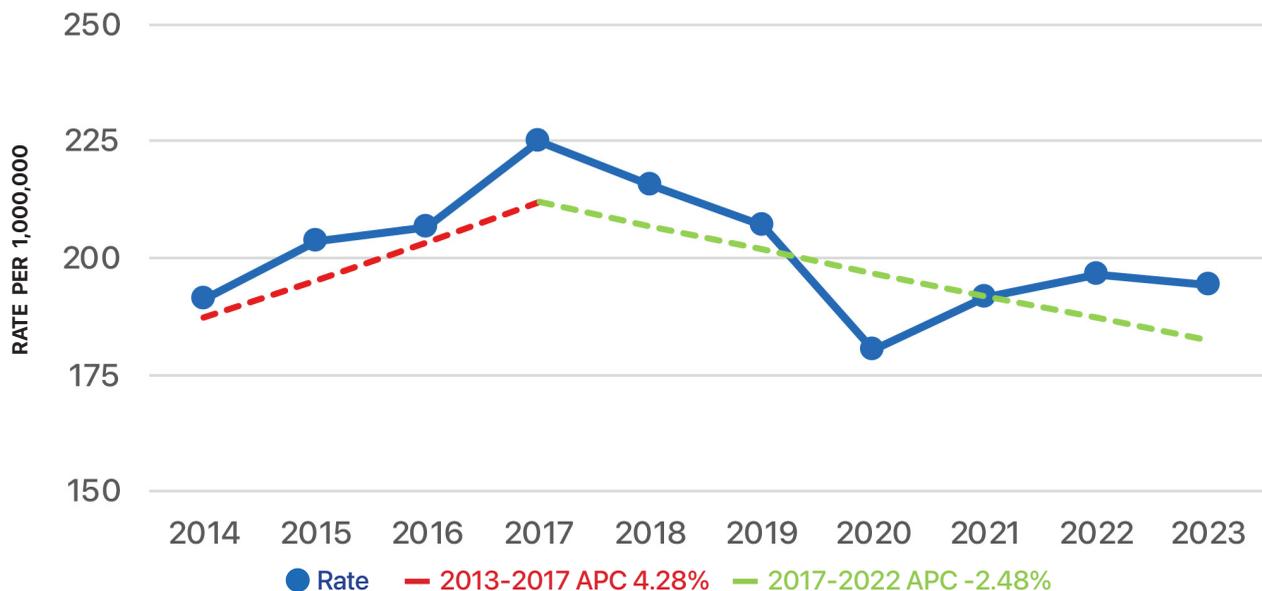
CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2014-2023

BOTH SEXES

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2014-2023
Population at Risk	1,138,004	1,138,580	1,140,194	1,143,096	1,143,975	1,142,945	1,139,959	1,132,781	1,129,407	11,27,710	11,376,651
Total Cases	218	232	236	258	247	237	205	217	222	220	2,292
Crude Rate	191.6	203.8	207.0	225.7	215.9	207.4	179.8	191.6	196.6	195.1	201.5
Age-Adjusted Rate	191.2	203.4	206.4	224.8	215.6	206.8	180.3	191.7	196.4	194.2	201.1
95% CI Lower	166.7	178.0	180.9	198.2	189.5	181.3	156.5	167.0	171.4	169.4	193.0
95% CI Upper	218.3	231.3	234.5	253.9	244.2	234.9	206.8	219.0	224.0	221.7	209.5

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

AGE-ADJUSTED INCIDENCE RATE TREND



The age-adjusted incidence rates of childhood cancer in Kentucky increased with a 4.28% (p-value=0.051) annual percent change (APC) from 2014 through 2017 and then decreased by 2.48% (p-value=0.029) annually through 2023. The trend lines shown in the figure and the APC rates are based on the results from the JoinPoint Trend Analysis software package developed by NCI SEER (<https://surveillance.cancer.gov/joinpoint>)

CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2014-2023

MALE

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2014-2023
Population at Risk	583,739	584,069	584,689	586,400	587,132	586,985	585,217	581,267	579,569	578,488	5,837,555
Total Cases	112	131	119	134	133	115	106	123	127	109	1,209
Crude Rate	191.9	224.3	203.5	228.5	226.5	195.9	181.1	211.6	219.1	188.4	207.1
Age-Adjusted Rate	191.5	223.9	202.9	227.6	226.6	195.5	181.6	211.5	219.0	187.6	206.9
95% CI Lower	157.7	187.2	168.1	190.7	189.7	161.4	148.6	175.8	182.6	154.0	195.4
95% CI Upper	230.4	265.7	242.8	269.5	268.6	234.7	219.6	252.4	260.6	226.3	218.9

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2014-2023

FEMALE

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2014-2023
Population at Risk	554,265	554,511	555,505	556,696	556,843	555,960	554,742	551,514	549,838	549,222	5,539,096
Total Cases	106	101	117	124	114	122	99	94	95	111	1,083
Crude Rate	191.2	182.1	210.6	222.7	204.7	219.4	178.5	170.4	172.8	202.1	195.5
Age-Adjusted Rate	191.0	181.7	210.0	221.8	203.9	218.7	179.1	170.8	172.4	201.1	195.1
95% CI Lower	156.4	148.0	173.7	184.5	168.2	181.6	145.5	138.1	139.5	165.4	183.6
95% CI Upper	231.0	220.8	251.7	264.5	244.9	261.1	218.0	209.1	210.8	242.2	207.0

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2014-2023

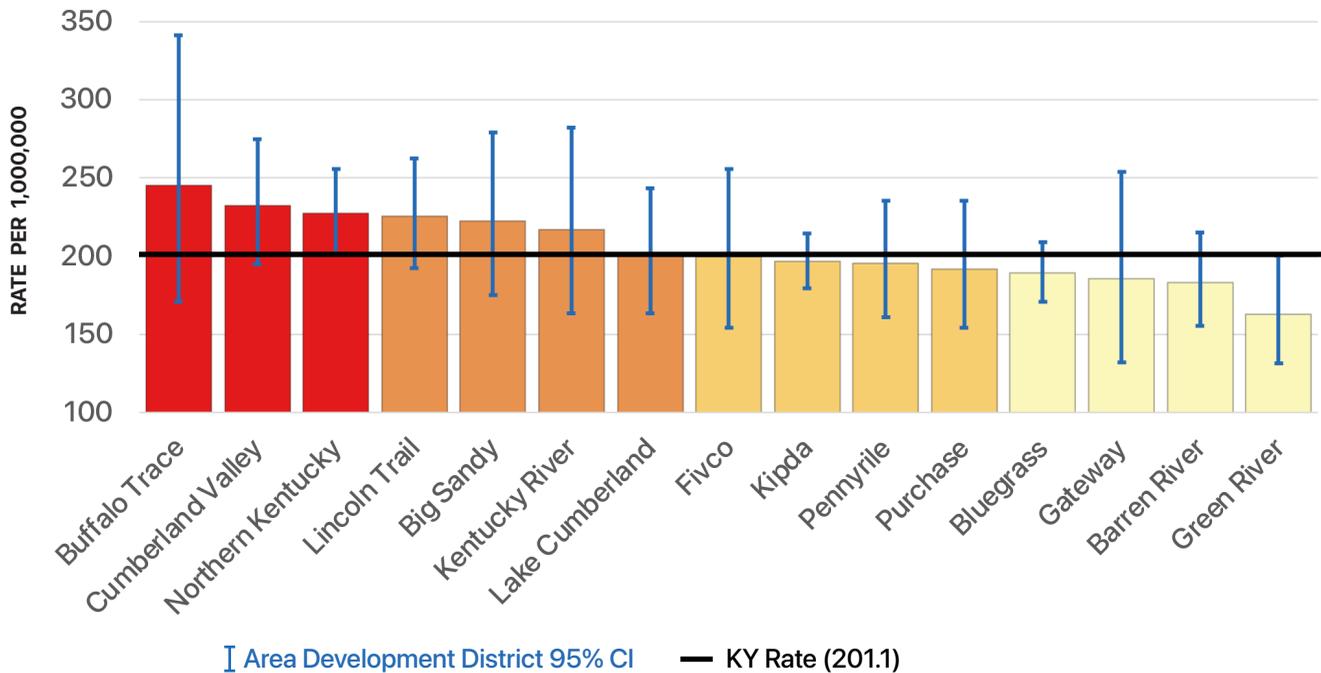
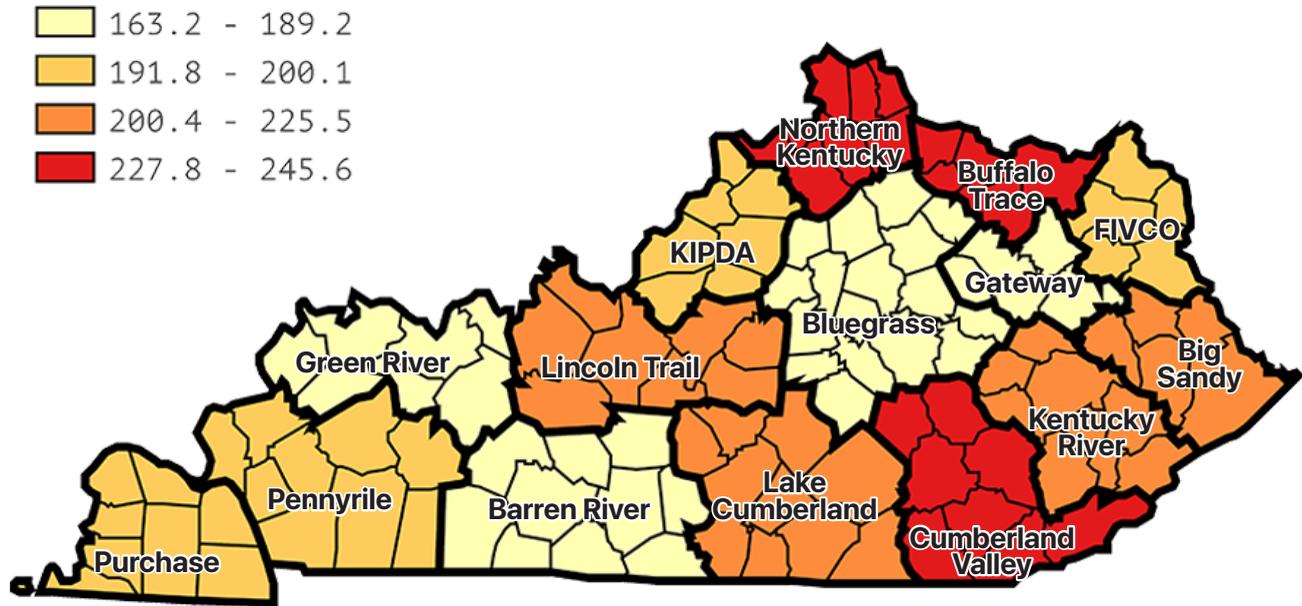
BY AREA DEVELOPMENT DISTRICT

Area Development District	Population at Risk	Cases	Crude Rate	Age-Adjusted Rate	95% CI Lower	95% CI Upper
Buffalo Trace	143,163	35	244.5	245.6	171.1	341.6
Cumberland Valley	585,144	136	232.4	232.3	194.9	274.8
Northern Kentucky	1,236,527	281	227.2	227.8	201.9	256.1
Lincoln Trail	731,351	164	224.2	225.5	192.3	262.8
Big Sandy	337,357	75	222.3	222.8	175.2	279.3
Kentucky River	254,572	55	216.1	216.8	163.3	282.2
Lake Cumberland	507,298	102	201.1	200.4	163.4	243.3
FIVCO	322,342	64	198.6	200.1	154.1	255.6
KIPDA	2,536,368	498	196.3	196.5	179.6	214.6
Pennyrile	567,657	112	197.3	195.7	161.1	235.6
Purchase	475,982	91	191.2	191.8	154.4	235.5
Bluegrass	2,083,102	397	190.6	189.2	171.0	208.8
Gateway	213,157	39	183.0	185.7	131.9	253.9
Barren River	817,331	151	184.8	183.4	155.3	215.2
Green River	565,300	92	162.8	163.2	131.6	200.2
Kentucky	11,376,651	2,292	201.5	201.1	193.0	209.5

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2014-2023

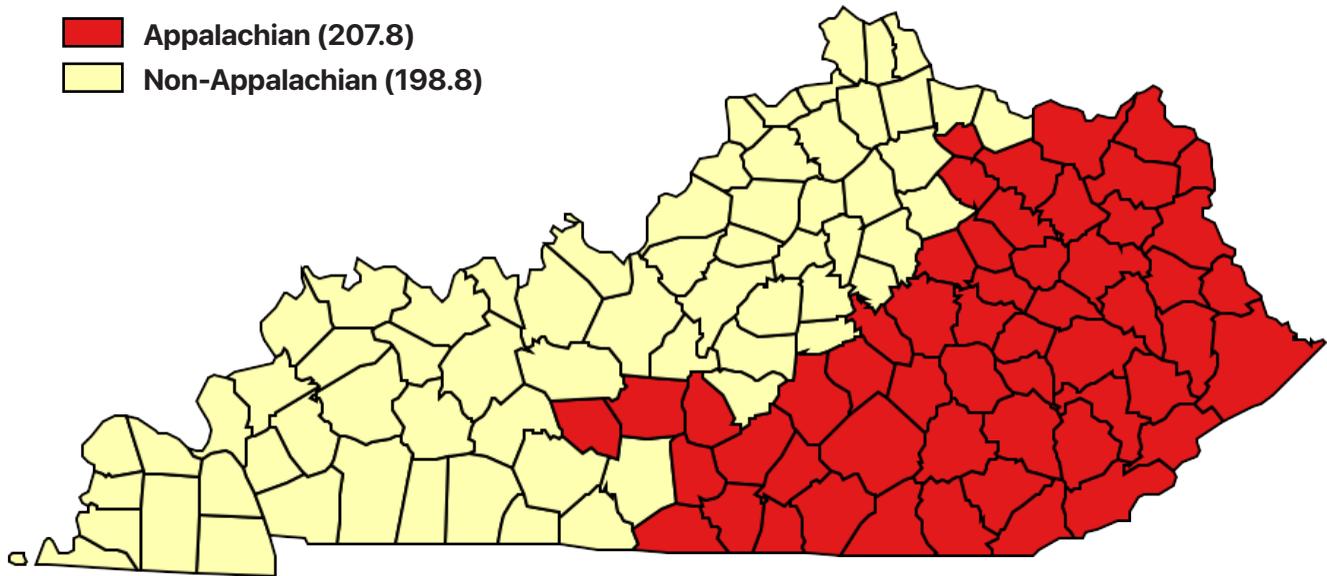
AGE-ADJUSTED RATES BY AREA DEVELOPMENT DISTRICT



Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

CHILDHOOD CANCER INCIDENCE IN KENTUCKY ALL SITES, 2014-2023

AGE-ADJUSTED RATES BY APPALACHIAN REGION

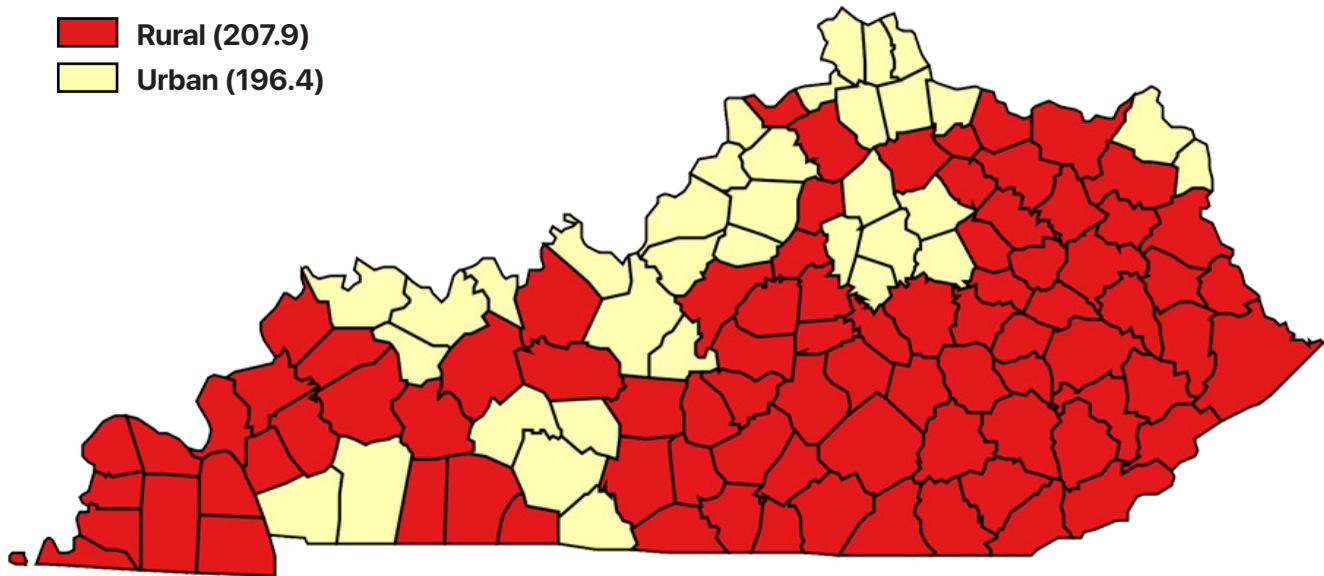


Region	Population at Risk	Cases	Crude Rate	Age-Adjusted Rate	95% CI Lower	95% CI Upper
Appalachia	2,880,607	616	213.8	213.1	196.6	230.6
Non-Appalachia	8,496,044	1,676	197.3	197.0	187.7	206.7
Kentucky	11,376,651	2,292	201.5	201.1	193.0	209.5

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

CHILDHOOD CANCER INCIDENCE IN KENTUCKY ALL SITES, 2014-2023

AGE-ADJUSTED RATES BY URBAN/RURAL REGION



Region	Population at Risk	Cases	Crude Rate	Age-Adjusted Rate	95% CI Lower	95% CI Upper
Rural	4,567,789	952	208.4	207.9	194.9	221.6
Urban	6,808,862	1,340	196.8	196.4	186.1	207.2
Kentucky	11,376,651	2,292	201.5	201.1	193.0	209.5

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

Childhood Cancer Survival Rates in Kentucky

2014-2023



SURVIVAL ANALYSIS FOR CHILDHOOD CANCER IN KENTUCKY AGES 0-19, 2014-2023

Cancer survival is an important measure of the severity of disease at diagnosis and the quality of cancer care received by the patient. Compared to adult cancer patients, patients who survive childhood cancer are more likely to live for many years following diagnosis and treatment.[1] In this report, the rates of survival for childhood cancer patients from the date of cancer diagnosis to the date of death or date of last contact are examined. This is often referred to as observed survival. Observed survival for children in Kentucky are compared to children in the United States. For this comparison, cancer data for patients outside of Kentucky and reported to the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) are used. Observed survival is also compared by specific cancer sites, sex, and Appalachian residence. Data for Kentucky patients is from the Kentucky Cancer Registry (KCR) , diagnosed 2014-2023. Data compared between Kentucky and non-Kentucky SEER were obtained from the SEER*Stat Database: Incidence - SEER Research Plus Limited-Field Data, 21 Registries (excl IL), Nov 2024 Sub (2000-2022)

The Kaplan-Meier (KM) plots were used to perform the survival analysis. The KM method is commonly used in health science studies to understand how long patients survive after a diagnosis. The graphs, called the KM survival curve, show how survival rates change over time. Data for all cancers combined and the three most common types: leukemia, lymphoma, and brain and central nervous system (CNS) tumors are included. Log-rank tests are used to examine the differences in survival between groups, a p-value of less than 0.05 from the log-rank test indicates significant differences in survival rates. To better understand survival outcomes, we also calculated the percentage of children who survived at 1 year, 5 years, and 10 years after diagnosis, based on the life table method.

The Kaplan-Meier survival curves reveal that the state's overall survival rates are comparable to national averages. For all invasive childhood cancers combined, Kentucky's 5-year survival rate stands at 85.0%, closely matching the SEER national average of 85.3%. This is true for leukemia and lymphoma as well. For leukemia, Kentucky's 5-year survival rate is 85.7% vs. 85.2% from SEER; for lymphoma, Kentucky's 5-year survival rate is 95.0% vs. 94.4% from SEER; however, Kentucky had significantly better survival for brain and CNS tumors (p-value=0.034). For brain and CNS tumors, Kentucky's 5-year survival rate is 78.3% vs. 74.5% from SEER. There are no significant differences found in survival by Appalachian status or sex. The 5-year childhood cancer survival rate for males is 85.5% while 86.0% for female, and 88.1% for children from Appalachian counties compared to 84.8% for non-Appalachian counties.

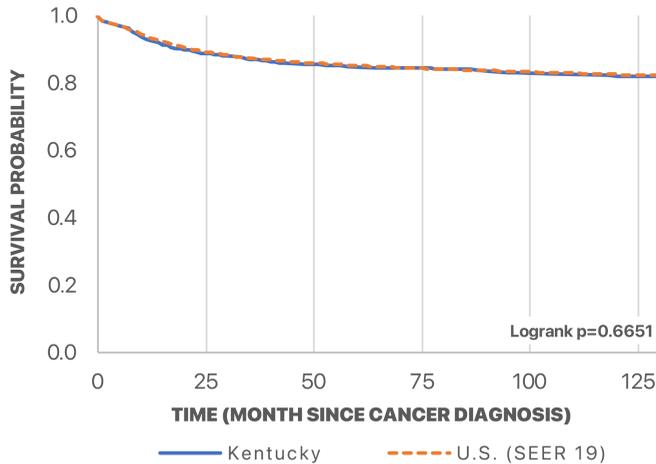
1. Yeh JM, Ward ZJ, Chaudhry A, Liu Q, Yasui Y, Armstrong GT, Gibson TM, Howell R, Hudson MM, Krull KR, Leisenring

WM, Oeffinger KC, Diller L. Life Expectancy of Adult Survivors of Childhood Cancer Over 3 Decades. *JAMA Oncol.*

2020 Mar 1;6(3):350-357. doi: 10.1001/jamaoncol.2019.5582. PMID: 31895405; PMCID: PMC6990848.

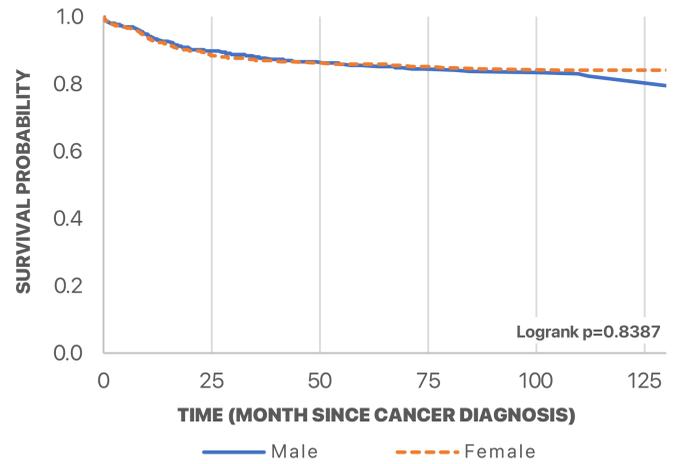
SURVIVAL RATES FOR INVASIVE CHILDHOOD CANCER IN KENTUCKY DIAGNOSED 2014-2023, ALL SITES

SURVIVAL PLOTS BY KENTUCKY AND U.S. (SEER 19) REGISTRIES



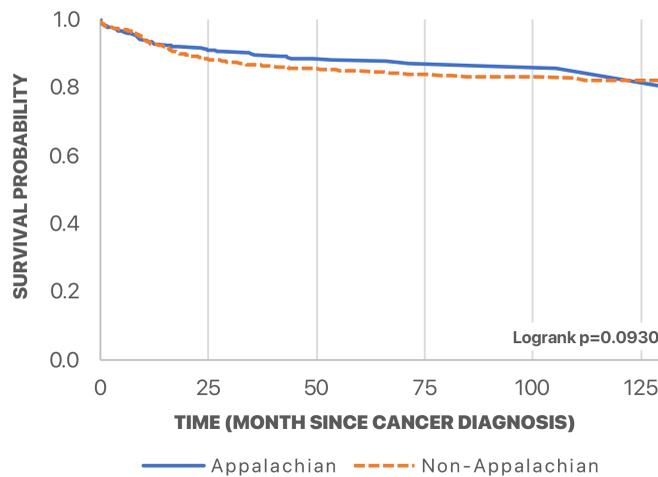
Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	92.8	93.6
5-year	85.0	85.3
10-year	81.9	82.7

SURVIVAL PLOTS BY SEX



Survival Rate %	Male	Female
1-year	93.4	92.6
5-year	85.5	86.0
10-year	82.5	84.0

SURVIVAL PLOTS BY APPALACHIAN REGION

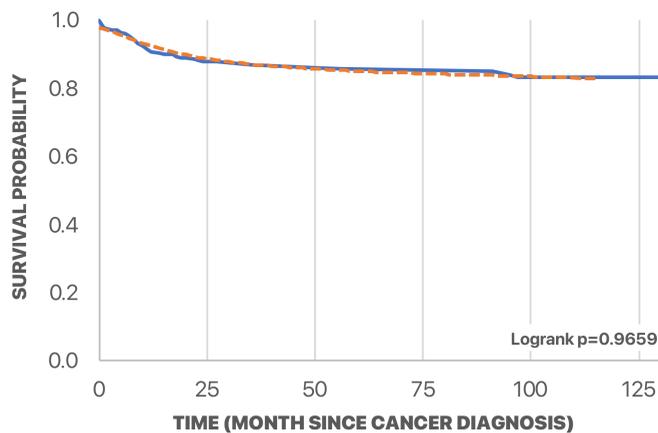


Survival Rate %	Appalachian	Non-Appalachian
1-year	93.4	92.8
5-year	88.1	84.8
10-year	85.8	82.3

The patients compared between Kentucky and non-Kentucky SEER data were from the years 2012–2022 to align with the latest available SEER data (2022, Nov 2024 Submission) and allow for a 10-year follow-up. The curves in the plot represent survival rates over time, estimated using the Kaplan-Meier (K-M) method. The p-value in the plots is derived from the log-rank test. A p-value less than 0.05 indicates statistically significant differences in survival rates.

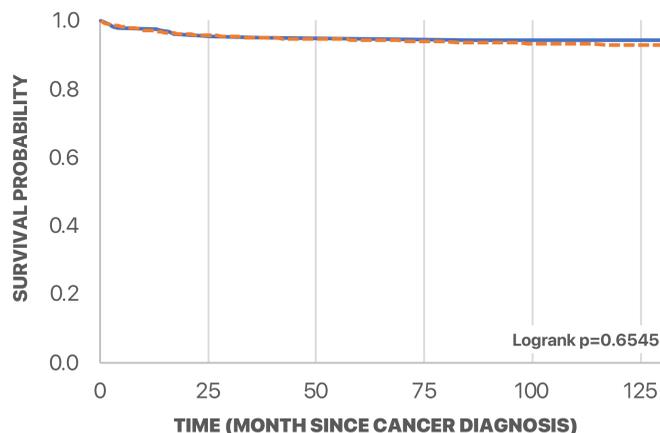
SURVIVAL RATES FOR INVASIVE CHILDHOOD CANCER IN KENTUCKY COMPARED TO U.S., DIAGNOSED 2012-2022, LEUKEMIA, LYMPHOMA, BRAIN AND CNS

LEUKEMIA SURVIVAL PLOTS BY KENTUCKY AND U.S. (SEER 19) REGISTRIES



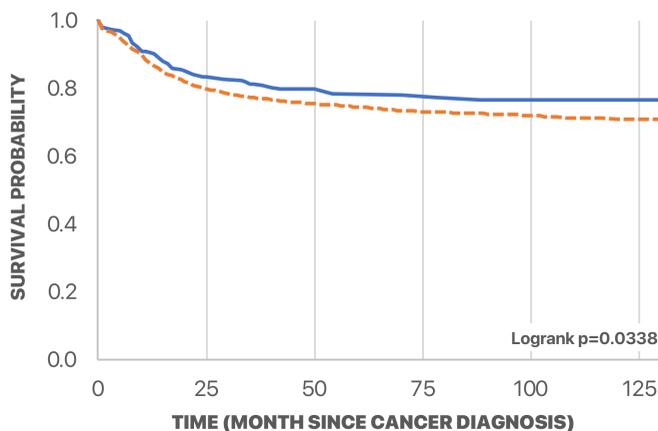
Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	90.7	92.9
5-year	85.7	85.2
10-year	83.4	82.9

LYMPHOMA SURVIVAL PLOTS BY KENTUCKY AND U.S. (SEER 19) REGISTRIES



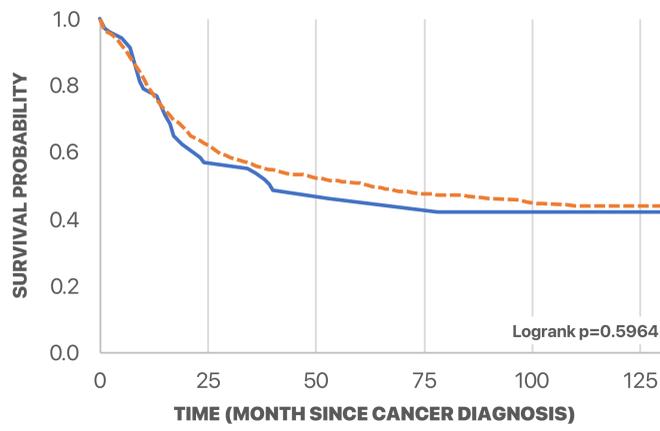
Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	97.7	96.9
5-year	95.0	94.4
10-year	94.1	92.9

BRAIN AND CNS SURVIVAL PLOTS BY KENTUCKY AND U.S. (SEER 19) REGISTRIES



Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	90.6	87.4
5-year	78.3	74.5
10-year	76.7	70.9

HIGH-GRADE BRAIN AND CNS SURVIVAL PLOTS BY KENTUCKY AND U.S. (SEER 19) REGISTRIES

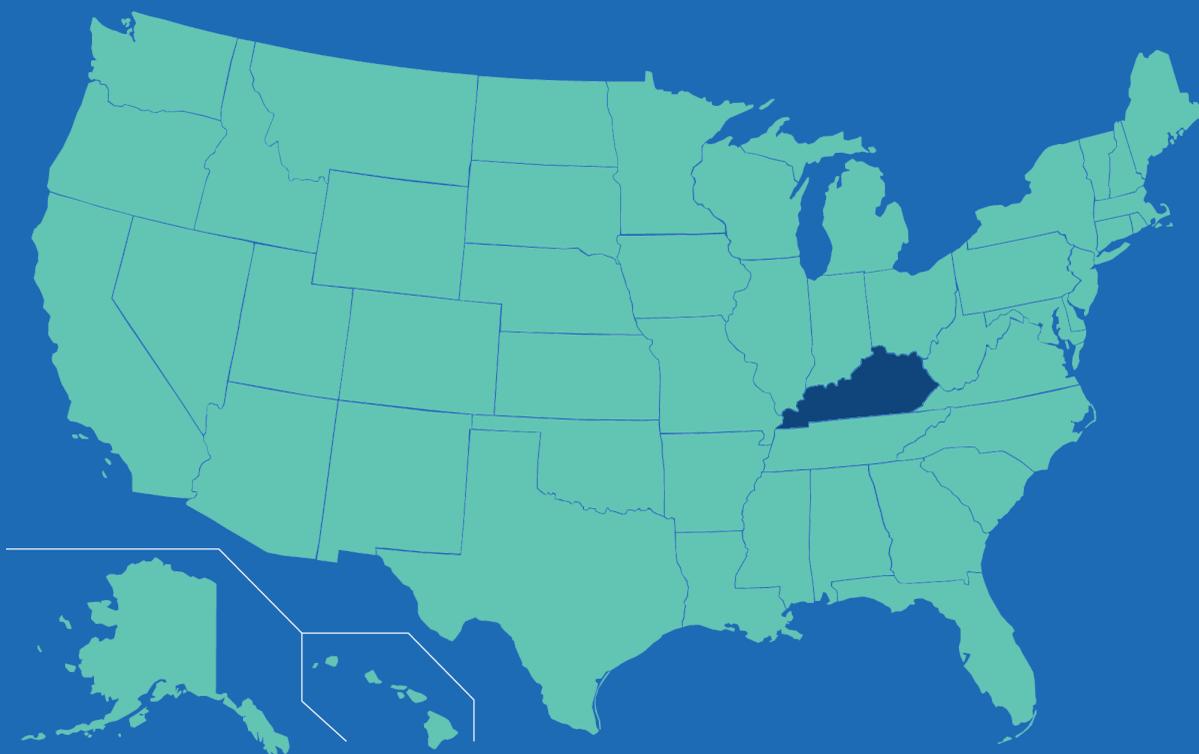


Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	79.2	78.0
5-year	46.3	50.9
10-year	42.1	43.9

The patients compared between Kentucky and non-Kentucky SEER data were from the years 2012–2022 to align with the latest available SEER data (2022, Nov 2024 Submission) and allow for a 10-year follow-up. The curves in the plot represent survival rates over time, estimated using the Kaplan-Meier (K-M) method. The p-value in the plots is derived from the log-rank test. A p-value less than 0.05 indicates statistically significant differences in survival rates.

Childhood Cancer Incidence Rates in Kentucky Compared to U.S.

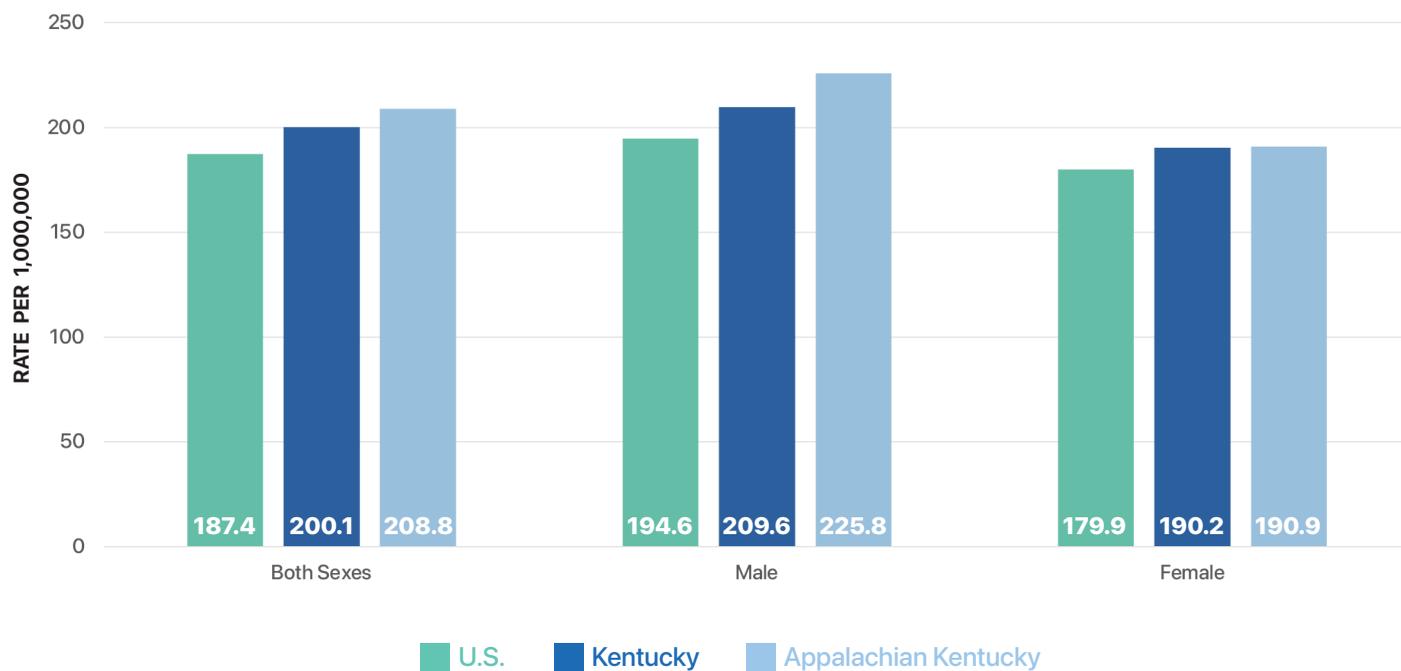
2013-2022



All U.S. rates and rankings were extracted from the CDC Wonder Cancer Statistics - <https://wonder.cdc.gov/cancer.html>

AGE-ADJUSTED CHILDHOOD CANCER INCIDENCE RATES ALL SITES, 2013-2022

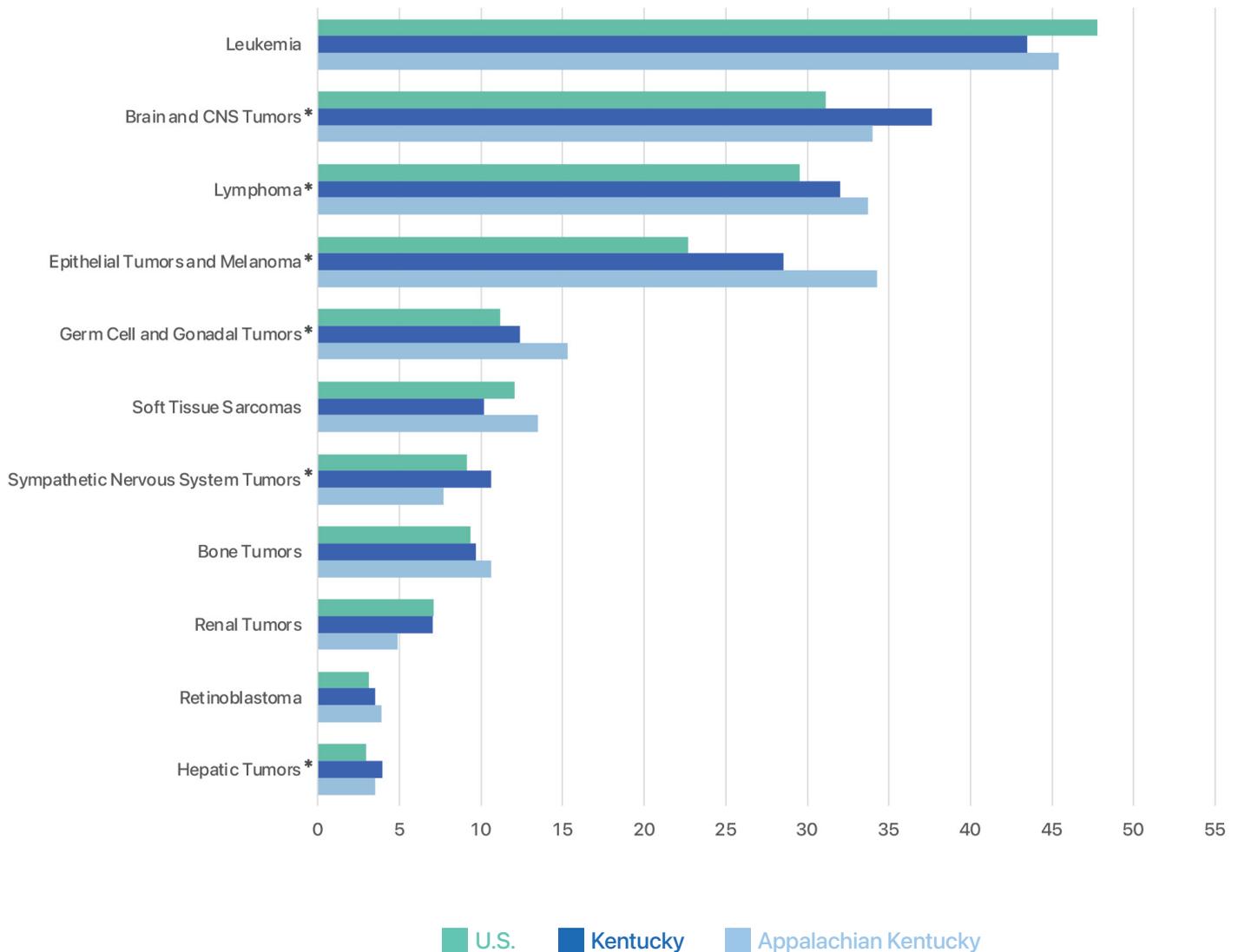
KENTUCKY COMPARED TO U.S. BY SEX



Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

AGE-ADJUSTED CHILDHOOD CANCER INCIDENCE RATES BY SITE GROUP, 2013-2022

KENTUCKY COMPARED TO U.S. BY SITE GROUP



*Rates are significantly different:

Brain and CNS Tumors $P < 0.01$ (Kentucky rate compared to the U.S. rate)

Lymphoma $P < 0.05$ (Kentucky rate compared to the U.S. rate)

Epithelial Tumors and Melanoma $P < 0.01$ (Kentucky and Appalachian Kentucky rates compared to the U.S. rate)

Germ Cell and Gonadal Tumors $P < 0.05$ (Kentucky rate compared to the U.S. rate)

Sympathetic Nervous System Tumors $P < 0.05$ (Kentucky rate compared to the U.S. rate)

Hepatic Tumors $P < 0.05$ (Kentucky rate compared to the U.S. rate)

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Population.

AGE-ADJUSTED CHILDHOOD CANCER INCIDENCE RATES BY SITE GROUP, 2013-2022

KENTUCKY RANKINGS COMPARED TO ALL U.S. STATES

Site Group	Highest Ranking
Leukemia	34th
Brain and CNS Tumors	6th
Lymphoma	9th
Epithelial Tumors and Melanoma	5th
Germ Cell and Gonadal Tumors*	9th
Soft Tissue Sarcomas	42nd
Sympathetic Nervous System Tumors*	9th
Bone Tumors*	17th
Renal Tumors*	30th
Retinoblastoma*	7th
Hepatic Tumors*	1st
All Sites	5th

*One or more states outside of KY not available for comparison due to unstable rates.

Supplemental Information



Definitions

Age-Adjusted Rate	A statistical adjustment applied to crude rates to permit comparisons of populations with different age structures. The 2000 Standard U.S. Million Population is commonly used in age-adjusted rates for cancer research in U.S. For childhood age-adjusted cancer rates, only the population for age groups 0 - 19 from the 2000 Standard U.S. Million population is used.
Annual Percent Change (APC)	Change in annual rates over time. The APC in this report was calculated through a log-transformation of the age-adjusted rates using the Joinpoint Trend Analysis software. https://surveillance.cancer.gov/joinpoint/
Appalachian Region	Groups of counties designated by the Appalachian Regional Commission's authorizing legislation. The region follows the spine of the Appalachian Mountains from southern New York to northern Mississippi. The current Kentucky Appalachian region includes 54 Kentucky counties https://www.arc.gov/appalachian_region/TheAppalachianRegion.asp
Area Development Districts	Groups of contiguous counties in Kentucky, comprising 15 area development districts. https://www.kyatlas.com/kentucky-adds.html
Cases	Total number of new incident cancer cases diagnosed in a given year or time period.
Childhood Cancer	A malignant cancer diagnosed in an individual under the age of 20.
Children's Oncology Group (COG)	A large group of researchers, hospitals, and cancer centers that get support from the National Cancer Institute (NCI) to study childhood cancer. https://www.childrensoncologygroup.org/index.php/aboutus
Crude Rate	An unadjusted incidence rate, calculated as the number of newly diagnosed cases divided by the population at risk.
Diagnosis Year	Year in which a cancer is first diagnosed.
Incidence Rate	Rate of new cancer diagnoses in a given year or time period.
P-value	The P-value, or calculated probability under the null hypothesis is used to quantify the idea of statistical significance of evidence. $P < 0.05$ is a convention generally accepted as representing a statistically significant finding.
Population at Risk	Number of individuals living in a geographical region and at risk of being diagnosed with cancer for a given year or time period.
Site Group	Type of cancer, grouped by topography and histology, as defined by the International Classification of Childhood Cancer. [1]
US Standard Million Population	The age distribution of individuals living in the U.S. in a given year, per million residents, as defined by the U.S. Census.
95% Confidence Interval (CI)	Specifies the precision of the age-adjusted rate measurement, resulting in a 95% certainty that the confidence interval includes the true value of the measurement.

1. Steliarova-Foucher E, Stiller C, Lacour B and Kaatsch P. International Classification of Childhood Cancer, third edition. Cancer 103:1457-67, 2005.

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Additional Resources

American Cancer Society

<https://www.cancer.org/cancer/cancer-in-children.html>

American Childhood Cancer Organization

<https://www.acco.org/types-of-childhood-cancer>

Childhood Cancer Data Initiative

<https://www.cancer.gov/research/areas/childhood/childhood-cancer-data-initiative>

Children's Hospital of Philadelphia

<https://www.chop.edu/centers-programs/cancer-center>

Children's Oncology Group

<https://www.childrensoncologygroup.org>

Cincinnati Children's Hospital

<https://www.cincinnatichildrens.org/service/c/cancer-blood/cancer>

DanceBlue

<http://www.danceblue.org>

Jarrett's Joy Cart

<http://thejoycart.com>

Kids Cancer Alliance

<https://kidscanceralliance.org>

Kentucky Children's Hospital – Pediatric Hematology & Oncology

<https://ukhealthcare.uky.edu/kentucky-childrens-hospital/services/hematology-oncology>

Kentucky Pediatric Cancer Research Trust Fund

<https://chfs.ky.gov/agencies/dph/dpqj/cdpb/Pages/pcrtf.aspx>

National Cancer Institute Center for Cancer Research Pediatric Oncology Branch

<https://ccr.cancer.gov/Pediatric-Oncology-Branch>

National Childhood Cancer Registry

<https://cancercontrol.cancer.gov/research-emphasis/childhood-cancer-registry>

NIH Kids First Data Resource Center

<https://kidsfirstdrc.org>

Norton Children's Cancer Institute

<https://nortonchildrens.com/services/cancer>

raiseRED

<https://raisered.org>

Tracking Pediatric and Young Adult Cancer Cases

<https://www.cdc.gov/cancer/npcr/pediatric-young-adult-cancer.htm>

Vanderbilt University Medical Center Pediatric Cancer Program

<https://www.childrenshospitalvanderbilt.org/service-line/pediatric-cancer-program>

Why Not Kids?

<http://whynotkids.com>



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