Childhood Cancer in Kentucky

2013-2022

INTERIM REPORT

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Acknowledgements

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, 2013-2022

Childhood Cancer Survival Rates in Kentucky, 2013-2022

Childhood Cancer Incidence Rates in Kentucky Compared to U.S., 2012-2021

Supplemental Information

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 2022 diagnosis year that are available from KCR and through the 2021 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% (2,283 / 283,428) of all cancers diagnosed in Kentucky occurring among children under the age of 20 during the years 2013-2022. 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 2013 through 2022, of the most recent ten years' complete data presented in this report, 2,283 Kentucky children were diagnosed with invasive cancer. Cancer occurred more frequently among males (54%) than females (46%).

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 (22%), followed closely by brain and CNS tumors (19%), lymphoma (16%), and epithelial tumors and melanoma (15%). These top four site groups represent 72% 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 4.13% annually from 2013 through 2017 and then decreased by 2.78% annually through 2022. 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 (2012-2021), Kentucky's age-adjusted childhood cancer incidence rate for all cancer sites is approximately 4.78% 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 all major site groups except for renal tumors. Rates of leukemia are lower than the U.S. for all Kentucky children but higher than the U.S. among 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., and also significantly higher among Kentucky Appalachian children for brain and CNS tumors, epithelial tumors and melanoma, and germ cell and gonadal tumors. Kentucky is ranked as having the 7th highest rate for all invasive cancer sites combined. However, Kentucky has the 2nd highest rate of hepatic tumors, 4th highest rate of brain and CNS tumors, and 6th highest rate of epithelial tumors and melanoma.

1. Steliarova-Foucher E, Colombet M, Ries LAG, Hesseling 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/.

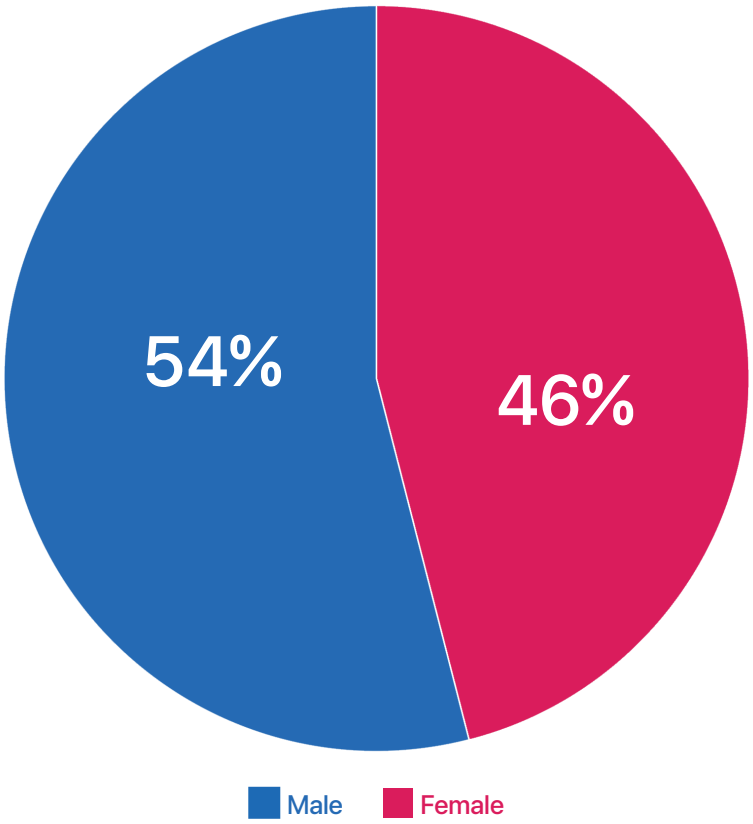
2. David A Siegel, Jessica B King, Philip J Lupo, Eric B Durbin, Eric Tai, Kathi Mills, Elizabeth Van Dyne, Natasha Buchanan Lunsford, S Jane Henley, Reda J Wilson, Counts, incidence rates, and trends of pediatric cancer in the United States, 2003-2019, JNCI: Journal of the National Cancer Institute, 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 - 2021 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-v2021.html.

CHILDHOOD CANCER INCIDENCE IN KENTUCKY
ALL SITES, 2013-2022

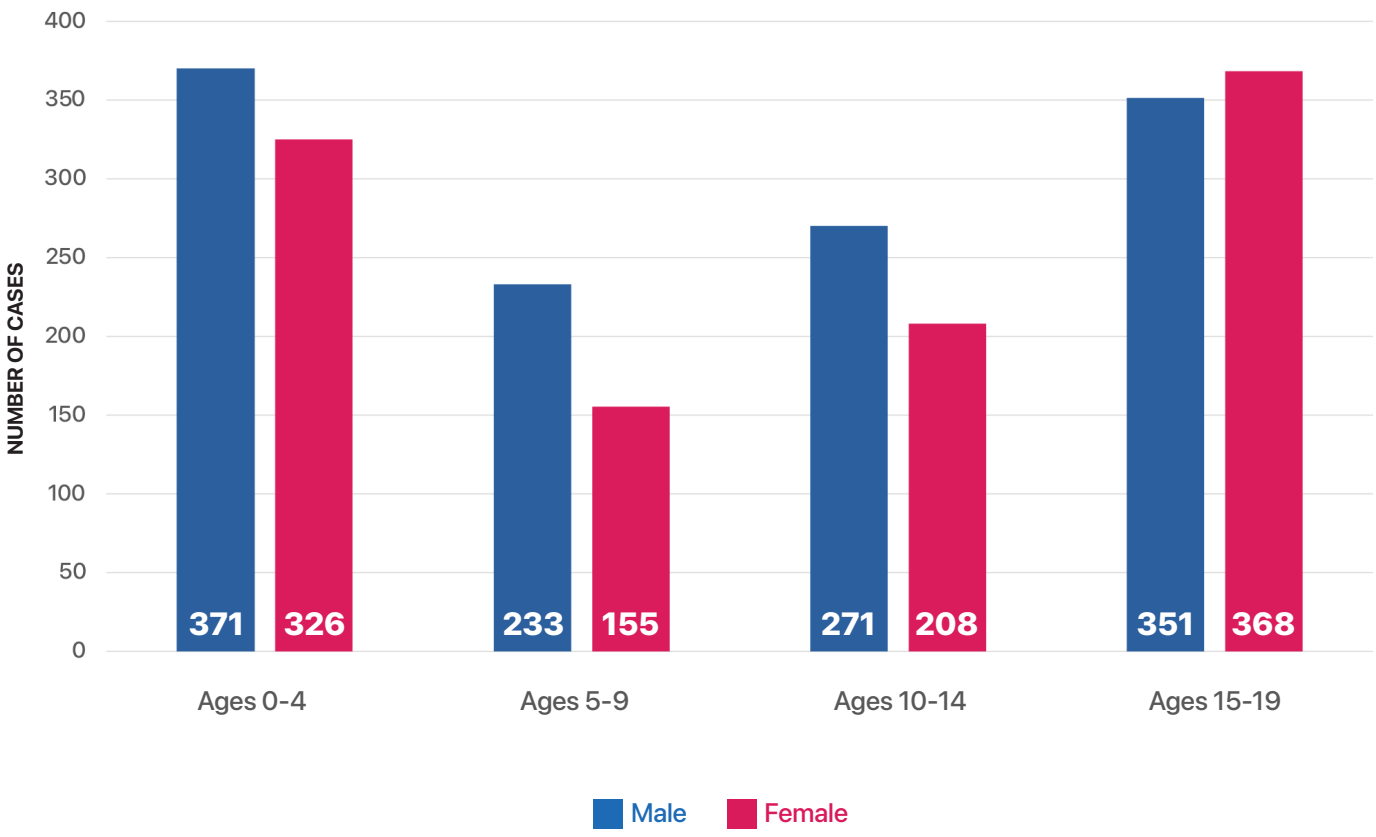
PROPORTION OF CASES BY SEX



Sex	Number of Cases (Percent)
Male	1,226 (54%)
Female	1,057 (46%)
Total	**2,283**

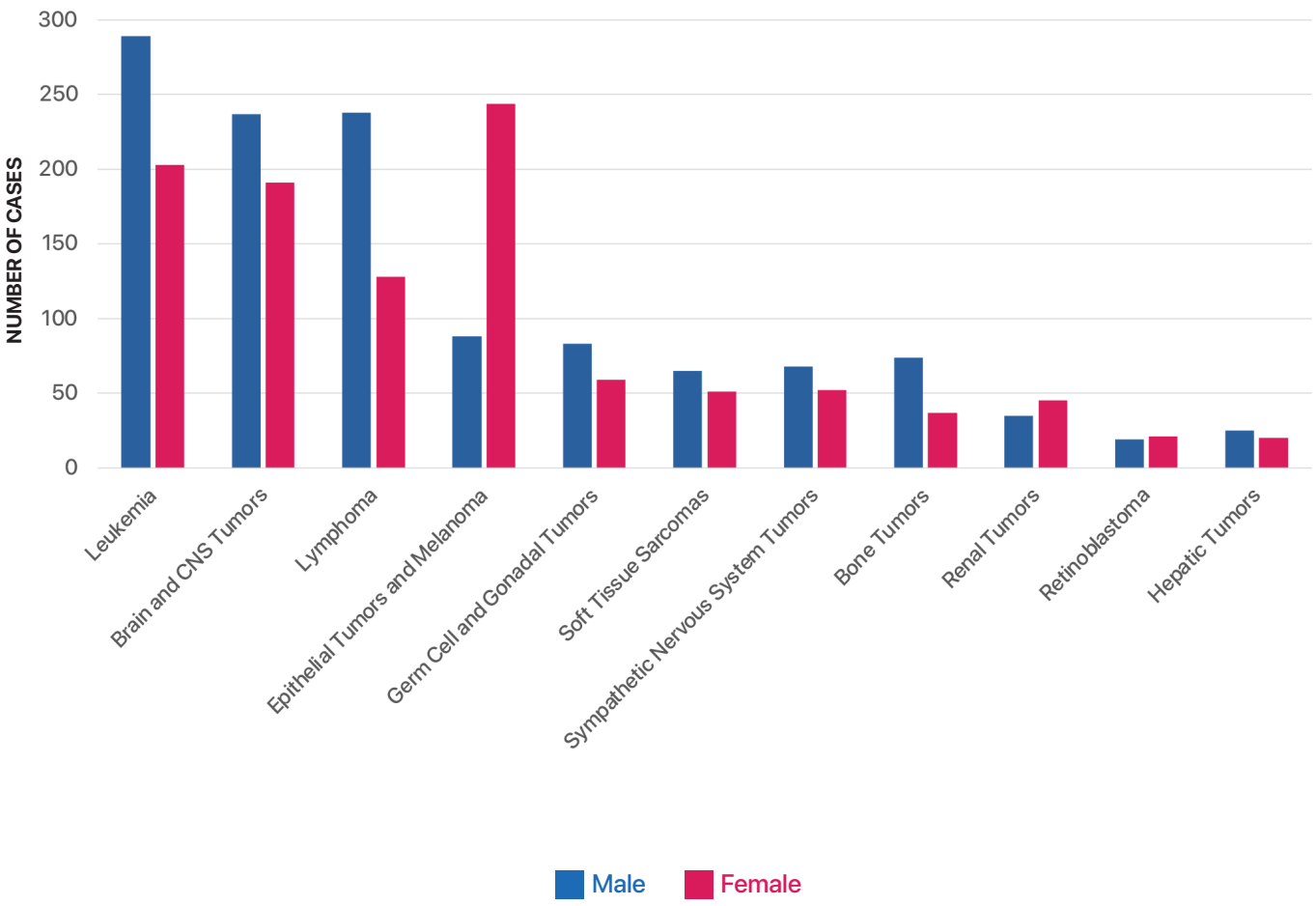
CHILDHOOD CANCER INCIDENCE IN KENTUCKY
ALL SITES, 2013-2022

CASES BY SEX AND AGE AT DIAGNOSIS



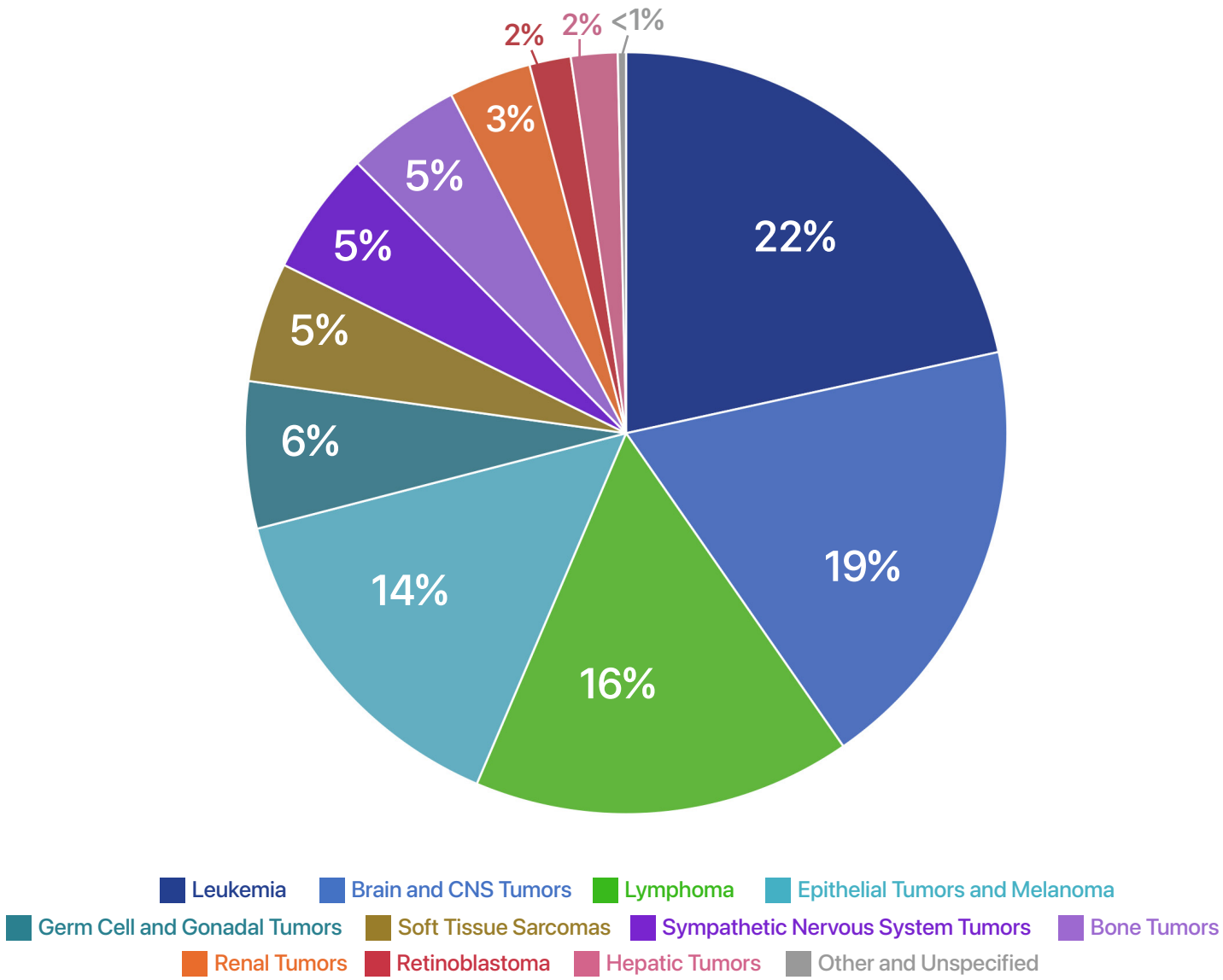
CHILDHOOD CANCER INCIDENCE IN KENTUCKY BY SITE GROUP, 2013-2022

CASES BY SITE GROUP AND SEX



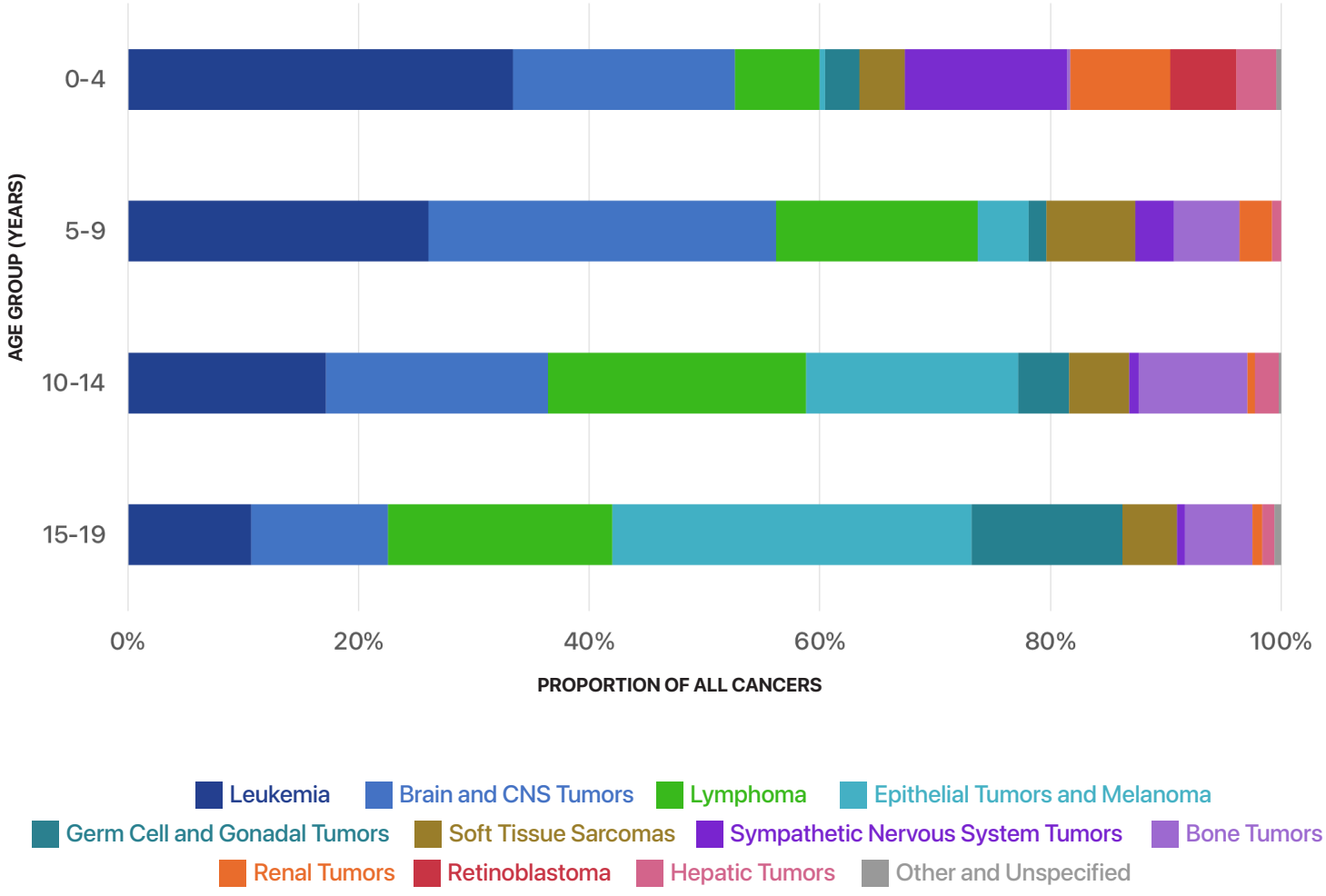
CHILDHOOD CANCER INCIDENCE IN KENTUCKY BY SITE GROUP, 2013-2022

PROPORTION OF CASES BY SITE GROUP



CHILDHOOD CANCER INCIDENCE IN KENTUCKY BY SITE GROUP, 2013-2022

PROPORTION OF CASES BY SITE GROUP AND AGE GROUP



CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY BY SITE GROUP, 2013-2022

SITE GROUP	BOTH SEXES		MALE		FEMALE	
	Cases	Age-Adjusted Rate	Cases	Age-Adjusted Rate	Cases	Age-Adjusted Rate
All Sites	2,283	201.2	1,226	210.7	1,057	191.1
Leukemia	495	43.8	291	50.2	204	37.1
Brain and CNS Tumors	428	37.9	237	40.9	191	34.7
Lymphoma	366	32.2	238	40.8	128	23.0
Epithelial Tumors and Melanoma	332	28.9	88	14.9	244	43.6
Germ Cell and Gonadal Tumors	142	12.4	83	14.0	59	10.6
Soft Tissue Sarcomas	116	10.2	65	11.2	51	9.2
Sympathetic Nervous System Tumors	120	10.7	68	11.8	52	9.5
Bone Tumors	111	9.8	74	12.7	37	6.7
Renal Tumors	80	7.1	35	6.1	45	8.2
Retinoblastoma	40	3.6	19	3.3	21	3.9
Hepatic Tumors	45	4.0	25	4.3	20	3.6

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

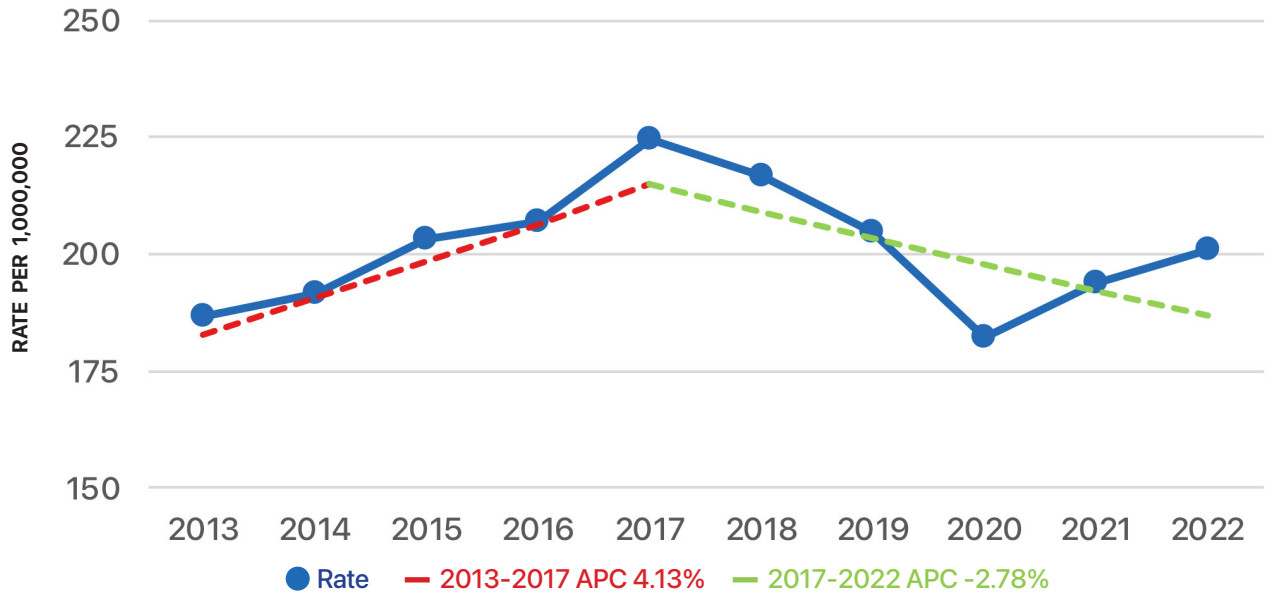
CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2013-2022

BOTH SEXES

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2013-2022
Population at Risk	1,138,299	1,135,044	1,134,815	1,135,568	1,137,648	1,137,678	1,135,826	1,130,680	1,118,632	1,113,478	11,317,668
Total Cases	213	218	231	236	257	247	234	206	217	224	2,283
Crude Rate	187.1	192.1	203.6	207.8	225.9	217.1	206.0	182.2	194.0	201.2	201.7
Age-Adjusted Rate	186.8	191.7	203.1	207.1	224.6	216.5	204.7	182.4	193.9	200.8	201.2
95% CI Lower	162.5	167.1	177.7	181.5	198.0	190.3	179.3	158.3	169.0	175.3	193.0
95% CI Upper	213.6	218.8	231.0	235.2	253.8	245.3	232.7	209.1	221.5	228.9	209.6

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

AGE-ADJUSTED INCIDENCE RATE TREND



The age-adjusted incidence rates of childhood cancer in Kentucky increased with a 4.13% annual percent change (APC) from 2013 through 2017 and then decreased by 2.78% annually through 2022. 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, 2013-2022

MALE

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2013-2022
Population at Risk	584,051	582,251	582,183	582,359	583,633	583,945	583,390	580,542	574,128	571,635	5,808,117
Total Cases	124	112	130	119	134	133	115	106	123	130	1,226
Crude Rate	212.3	192.4	223.3	204.3	229.6	227.8	197.1	182.6	214.2	227.4	211.1
Age-Adjusted Rate	211.9	192.0	223.1	203.7	228.4	227.6	196.6	182.8	213.9	227.2	210.7
95% CI Lower	176.2	158.1	186.4	168.7	191.3	190.5	162.3	149.6	177.8	189.8	199.1
95% CI Upper	252.7	231.1	264.9	243.8	270.5	269.7	236.0	221.1	255.3	269.8	222.9

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

CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2013-2022

FEMALE

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2013-2022
Population at Risk	554,248	552,793	552,632	553,209	554,015	553,733	552,436	550,138	544,504	541,843	5,509,551
Total Cases	89	106	101	117	123	114	119	100	94	94	1,057
Crude Rate	160.6	191.8	182.8	211.5	222.0	205.9	215.4	181.8	172.6	173.5	191.8
Age-Adjusted Rate	160.3	191.3	181.9	210.7	220.7	204.8	213.3	181.9	172.9	172.9	191.1
95% CI Lower	128.7	156.6	148.1	174.2	183.4	168.9	176.7	148.0	139.7	139.7	179.8
95% CI Upper	197.2	231.4	221.0	252.5	263.3	246.0	255.3	221.3	211.6	211.6	203.0

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

CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2013-2022

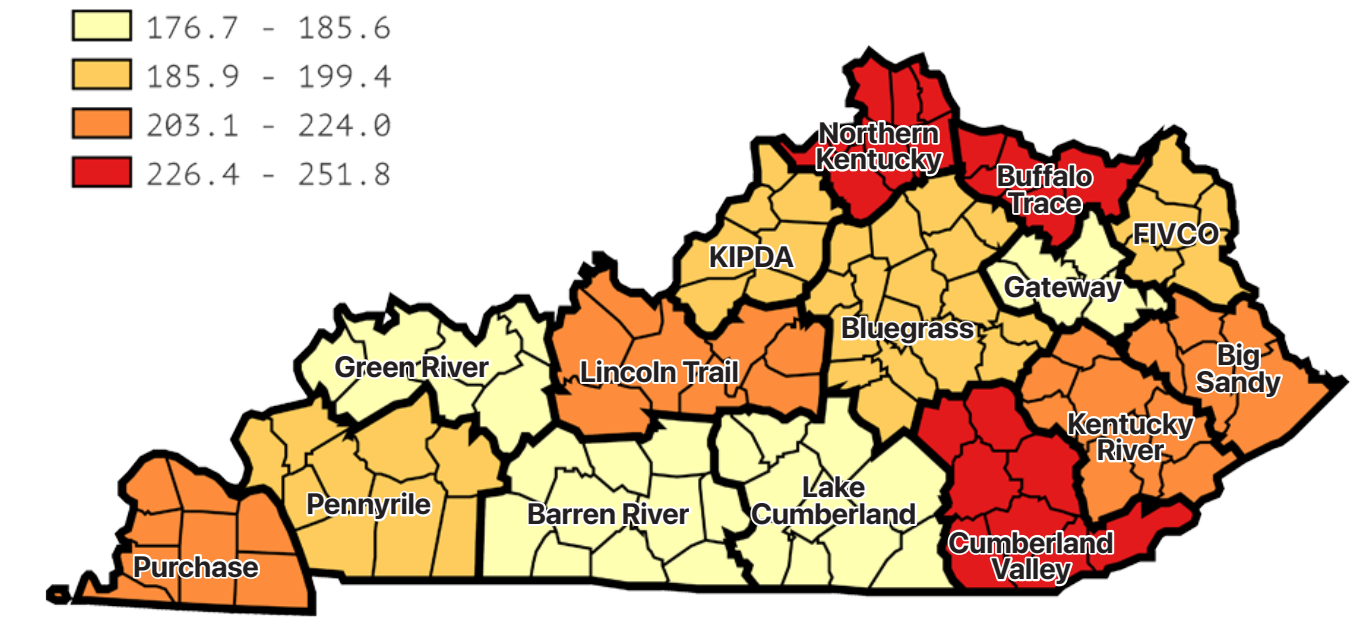
BY AREA DEVELOPMENT DISTRICT

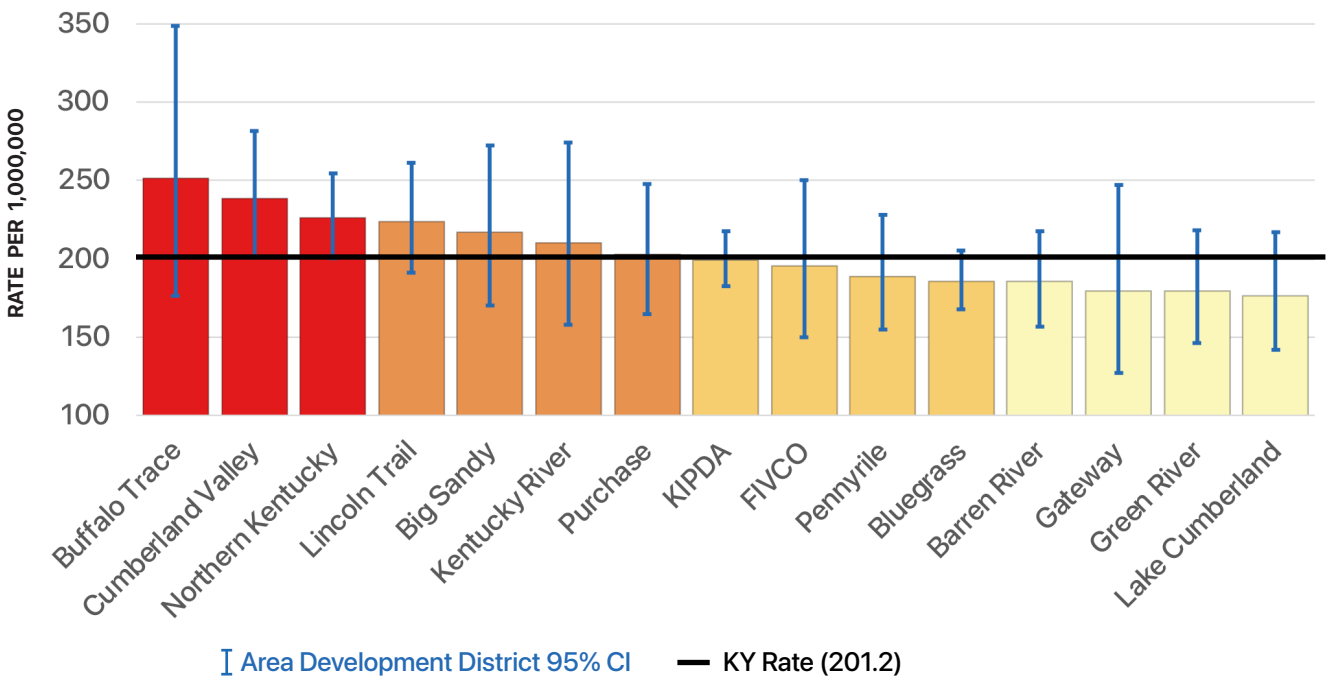
Area Development District	Population at Risk	Cases	Crude Rate	Age-Adjusted Rate	95% CI Lower	95% CI Upper
Buffalo Trace	143,281	36	251.2	251.8	176.4	348.7
Cumberland Valley	585,585	141	240.8	240.4	202.4	283.5
Northern Kentucky	1,230,446	278	225.9	226.4	200.6	254.7
Lincoln Trail	730,195	163	223.2	224.0	190.9	261.2
Big Sandy	341,543	75	219.6	219.8	172.9	275.6
Kentucky River	257,226	54	209.9	210.1	157.8	274.1
Purchase	472,919	96	203.0	203.1	164.5	248.1
Kipda	2,521,577	503	199.5	199.4	182.3	217.6
Fivco	323,702	63	194.6	195.5	150.2	250.1
Pennyrile	566,932	108	190.5	188.9	154.9	228.2
Bluegrass	2,059,766	386	187.4	185.9	167.8	205.4
Barren River	803,820	150	186.6	185.6	157.0	217.8
Gateway	212,002	39	184.0	184.7	131.2	252.7
Green River	562,765	101	179.5	179.7	146.4	218.4
Lake Cumberland	505,909	90	177.9	176.7	142.1	217.3
Kentucky	**11,317,668**	**2,283**	**201.7**	**201.2**	**193.0**	**209.6**

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

CHILDHOOD CANCER INCIDENCE RATES IN KENTUCKY ALL SITES, 2013-2022

AGE-ADJUSTED RATES BY AREA DEVELOPMENT DISTRICT

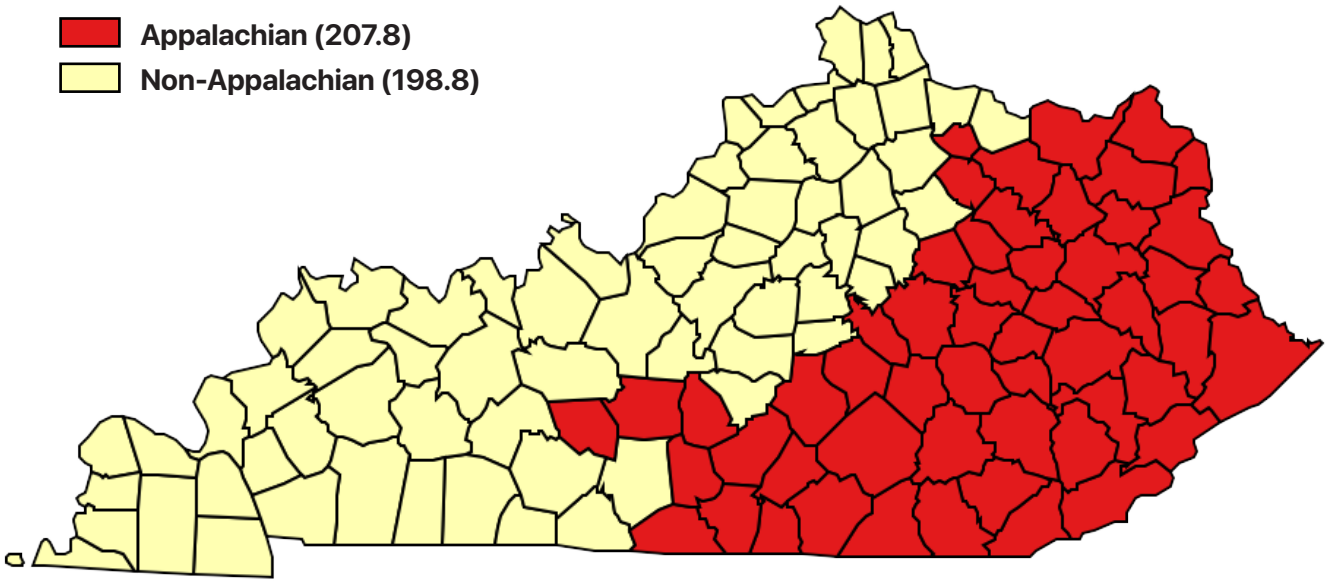




Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Million Population.

CHILDHOOD CANCER INCIDENCE IN KENTUCKY
ALL SITES, 2013-2022

AGE-ADJUSTED RATES BY APPALACHIAN REGION

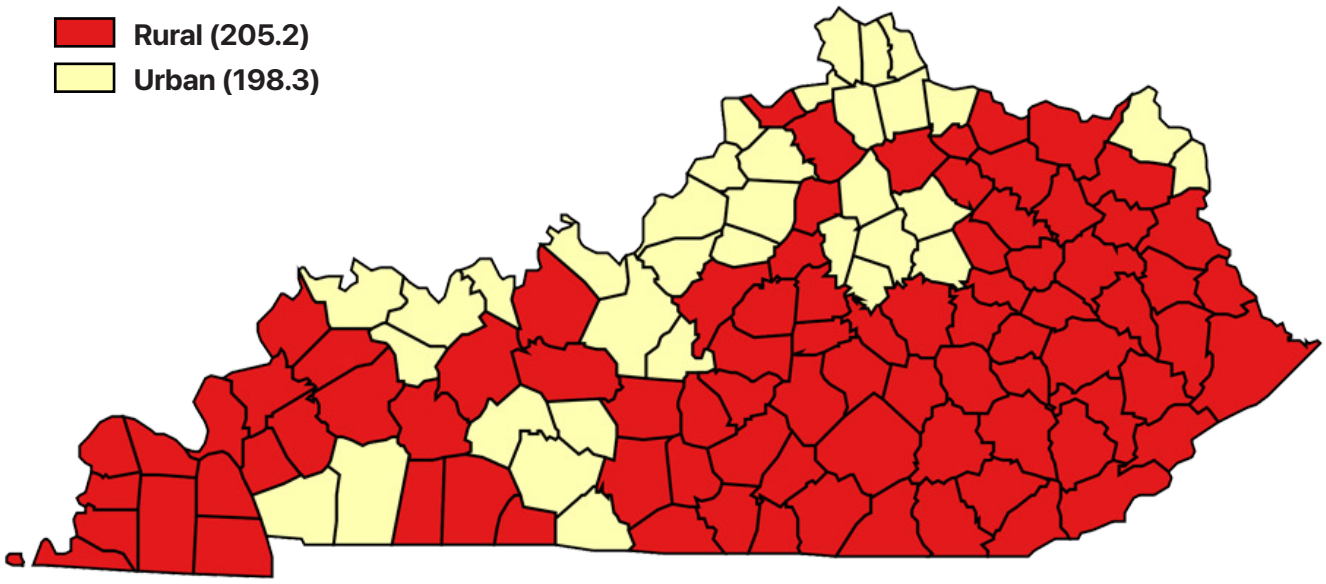


Region	Population at Risk	Cases	Crude Rate	Age-Adjusted Rate	95% CI Lower	95% CI Upper
Appalachia	2,881,782	602	208.9	207.8	191.6	225.1
Non-Appalachia	8,435,886	1681	199.3	198.8	189.4	208.6
Kentucky	**11,317,668**	**2,283**	**201.7**	**201.2**	**193.0**	**209.6**

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

CHILDHOOD CANCER INCIDENCE IN KENTUCKY
ALL SITES, 2013-2022

AGE-ADJUSTED RATES BY URBAN/RURAL REGION



Region	Population at Risk	Cases	Crude Rate	Age-Adjusted Rate	95% CI Lower	95% CI Upper
Rural	4,558,674	939	206.0	205.2	192.3	218.8
Urban	6,758,994	1344	198.8	198.3	187.8	209.2
Kentucky	**11,317,668**	**2,283**	**201.7**	**201.2**	**193.0**	**209.6**

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

Childhood Cancer Survival Rates in Kentucky

2013-2022

SURVIVAL ANALYSIS FOR CHILDHOOD CANCER IN KENTUCKY AGES 0-19, 2013-2022

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 are from the Kentucky Cancer Registry (KCR) 2013-2022. Data from non-Kentucky SEER data were obtained from the Cancer Incidence-SEER Research Plus Limited-Field Data, 22 Registries (Excluding IL and MA), Nov 2023 Sub (2011-2021).

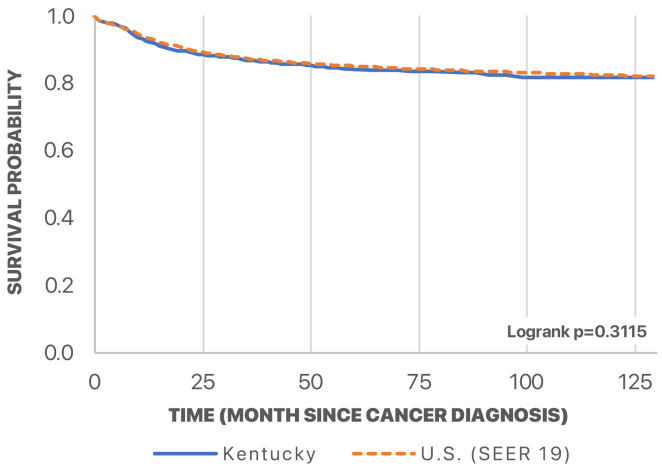
The Kaplan-Meier (KM) plots were used to perform the survival analysis. The KM method is commonly used in health science studies to understand how long patients survive after a diagnosis. The graphs, called the KM survival curve, show how survival rates change over time. This report presents survival curves for all children diagnosed with invasive cancer in Kentucky. 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 illustrate survival trends for childhood cancers in Kentucky between 2013 and 2022, revealing 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 84.3%, closely matching the SEER national average of 85.1%. This is true for leukemia and lymphoma as well. For leukemia, Kentucky's 5-year survival rate is 83.7% vs. 84.8% from SEER; for lymphoma, Kentucky's 5-year survival rate is 95.4% vs. 94.2% from SEER; however, Kentucky had significantly better survival for brain and CNS tumors (p-value=0.0356). For brain and CNS tumors, Kentucky's 5-year survival rate is 78.4% vs. 74.6% 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 84.8% while 85.9% for female, and 86.9% for children from Appalachian counties compared to 84.7% 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.

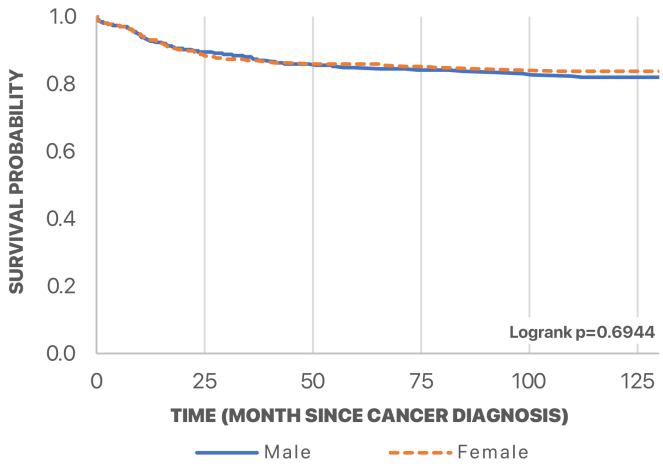
SURVIVAL RATES FOR INVASIVE CHILDHOOD CANCER IN KENTUCKY DIAGNOSED 2013-2022, ALL SITES

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



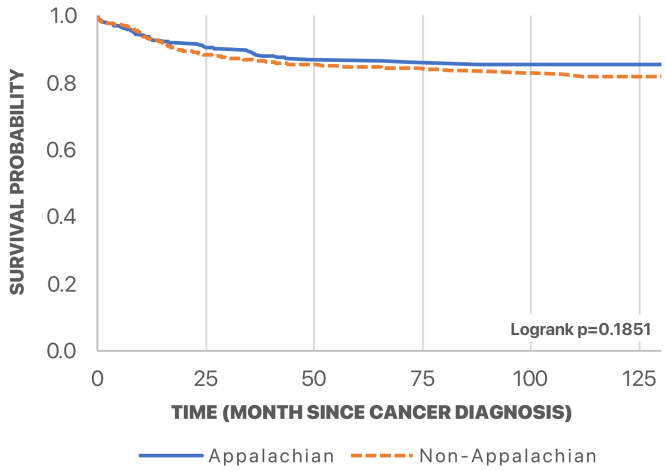
Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	92.4	93.5
5-year	84.3	85.1
10-year	81.8	82.4

SURVIVAL PLOTS BY SEX



Survival Rate %	Male	Female
1-year	93.0	93.2
5-year	84.8	85.9
10-year	81.8	83.8

SURVIVAL PLOTS BY APPALACHIAN REGION

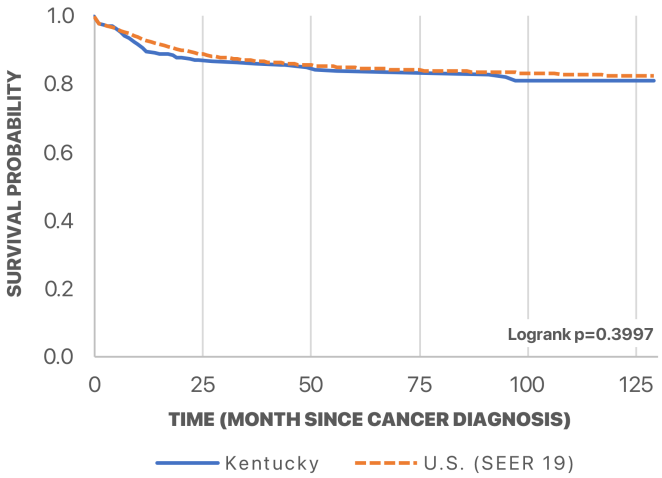


Survival Rate %	Appalachian	Non-Appalachian
1-year	93.4	93.0
5-year	86.9	84.7
10-year	85.4	81.7

The patients compared between Kentucky and non-Kentucky SEER data were from the years 2011–2021 to align with the latest available SEER data (2021) 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.

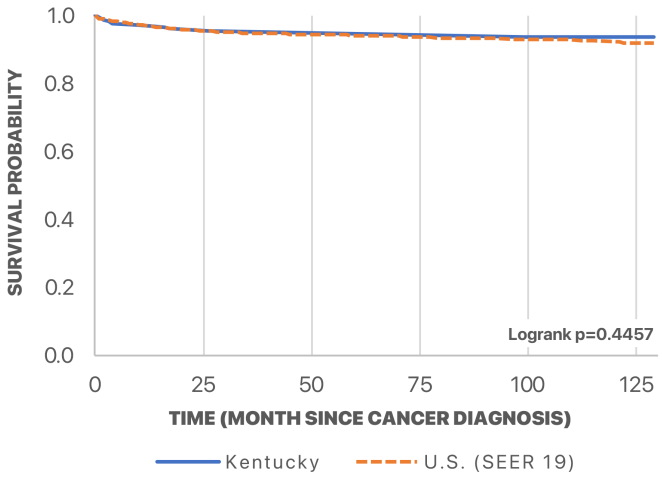
SURVIVAL RATES FOR INVASIVE CHILDHOOD CANCER IN KENTUCKY DIAGNOSED 2013-2022, LEUKEMIA, LYMPHOMA, BRAIN AND CNS

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



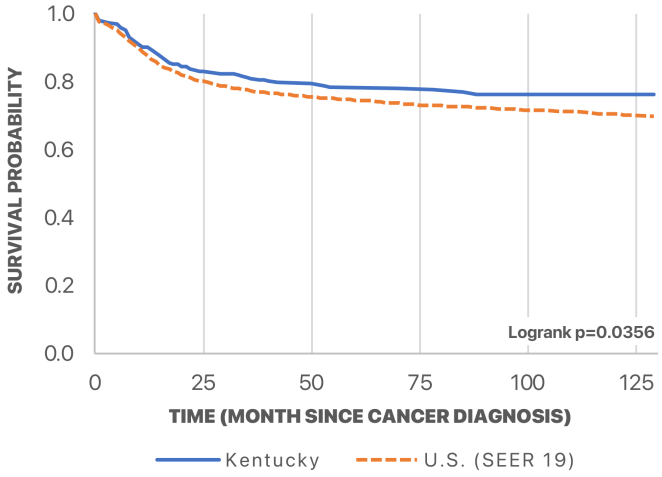
Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	89.4	92.8
5-year	83.7	84.8
10-year	81.0	82.4

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



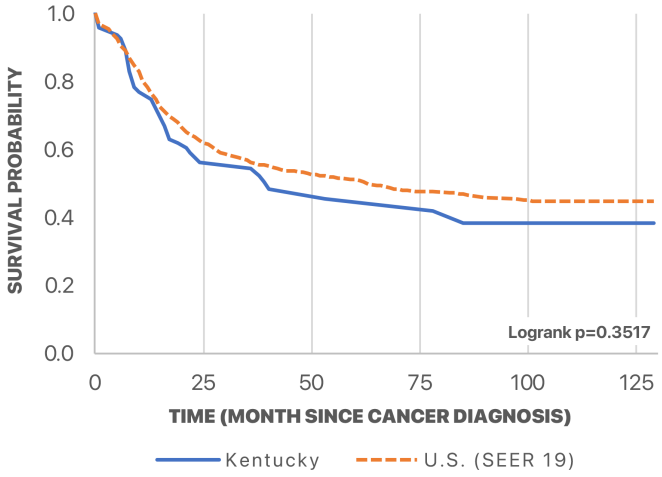
Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	97.3	97.0
5-year	95.4	94.2
10-year	93.8	92.6

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



Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	90.0	87.5
5-year	78.4	74.6
10-year	76.4	70.5

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

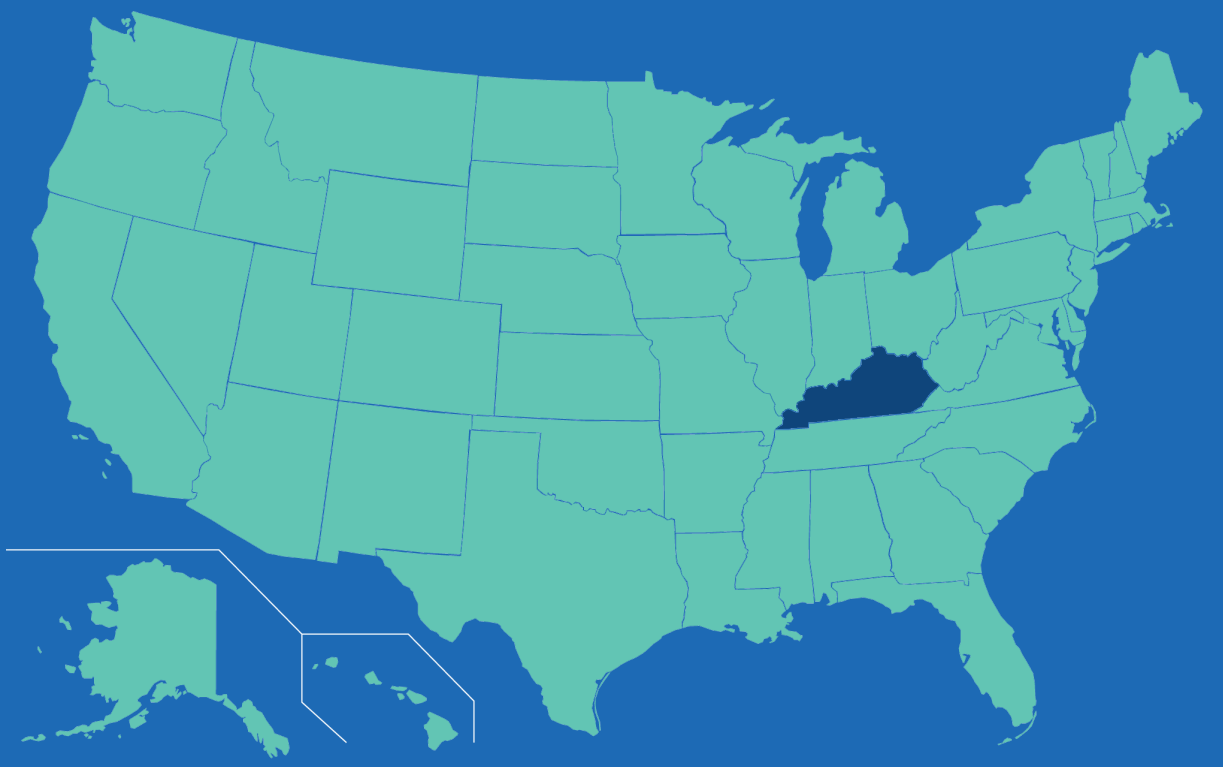


Survival Rate %	Kentucky	U.S. (SEER 19)
1-year	77.1	78.4
5-year	45.6	51.1
10-year	38.6	44.8

The patients compared between Kentucky and non-Kentucky SEER data were from the years 2011–2021 to align with the latest available SEER data (2021) 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.

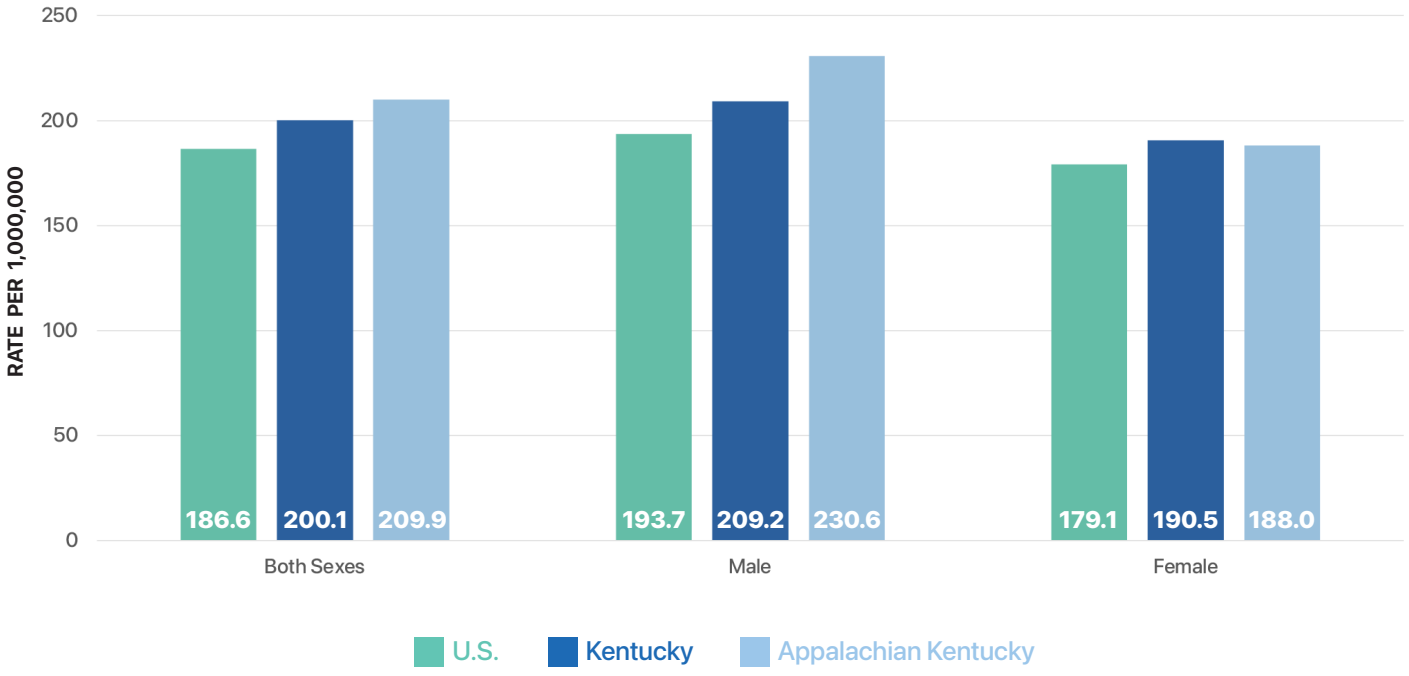
2012-2021



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, 2012-2021

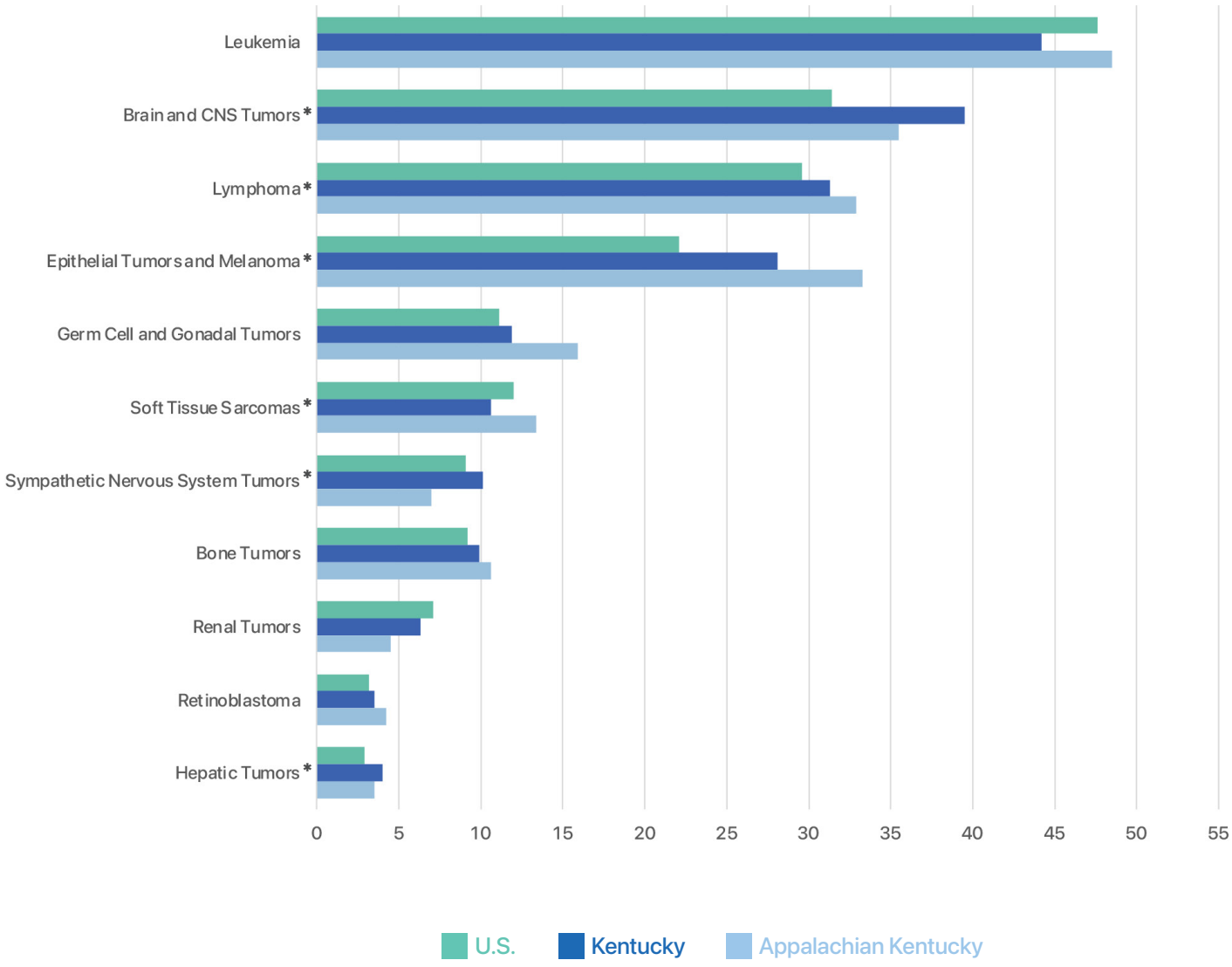
KENTUCKY COMPARED TO U.S. BY SEX



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

AGE-ADJUSTED CHILDHOOD CANCER INCIDENCE RATES BY SITE GROUP, 2012-2021

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)
Soft tissue Sarcomas P < 0.05 (Appalachian 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 Million Population.

AGE-ADJUSTED CHILDHOOD CANCER INCIDENCE RATES BY SITE GROUP, 2012-2021

KENTUCKY RANKINGS COMPARED TO ALL U.S. STATES

Site Group	Highest Ranking
Leukemia	30th
Brain and CNS Tumors	4th
Lymphoma	10th
Epithelial Tumors and Melanoma	6th
Germ Cell and Gonadal Tumors*	13th
Soft Tissue Sarcomas	41st
Sympathetic Nervous System Tumors*	14th
Bone Tumors*	11th
Renal Tumors*	40th
Retinoblastoma*	9th
Hepatic Tumors*	2nd
All Sites	**7th**

***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.

Staff of the Kentucky Cancer Registry

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Director of Population-based Studies	Bin Huang, DrPH, MS
Associate Director of Informatics	Isaac Hands, MPH
Information Technology Manager	Scott Grimes, PhD
Business Operations Manager	Jill Cioci, BBA
Epidemiologist/Research Coordinator	Jaclyn K. McDowell, DrPH, MPH
Virtual Tissue Repository	Lexee Long, MPH
Quality Assurance Managers	Michele Hoskins, BA, ODS Tracy Sumler, BA, ODS Desiree Montgomery, MPH, ODS
Senior Regional Coordinators	Wendy Drechsel, RHIT, ODS Marynell Jenkins, ODS Tracy Sumler, BA, ODS
Regional Abstractors	Leslie Benningfield, RHIT, ODS Amy Brewster, BS
Non-Hospital Abstractors	Stephanie Carmack, MS, ODS Danielle Darsey, RTT, ODS Sherry Gabehart, BS, RHIA, ODS Kim Kimbler, MS, ODS, CCRP Shannon Ladd, MSW, ODS Robin Walls
Quality Assurance Specialists	Jennifer Denham, RHIT, ODS Paige Haydon Lutz, BS, ODS Mary Jo Mahoney, RHIT, ODS
Patient Recruitment Professionals	Stephanie Barber
Software and Database Developers	Chaney Blu Clay Campbell Roger Chui Jason Jacob, MS Luan Pham, MS David Rust, MS Evan Yang
Information Technology Support	Branson Repass Aaron Sword
Budget Analysts	Sarah Dickerson, BS, MPA
Administrative Assistants	Paula Cole Ivelina Todorova
Senior Biostatistician	Feitong Lei, PhD

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/dpqi/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

KENTUCKY
CANCER REGISTRY

Scan for the latest version of the KCR Childhood Cancer Report: