Prepared by:
Chaney Blu
Joseph Hurt-Mueller, MBA
Ellen Lycan, DrPH
Bin Huang, DrPH
Eric B. Durbin, DrPH, MS

For more information contact:
Kentucky Cancer Registry
Markey Cancer Center
University of Kentucky
2365 Harrodsburg Road, Suite A230
Lexington, KY 40504-3381

Telephone: 859-218-6227

http://www.kcr.uky.edu

Suggested citation:
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 the 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 outside of Kentucky. Their efforts are essential to complete, timely, and accurate reporting of all childhood cases occurring in Kentucky.

Beginning in 1994, the 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, the 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. Since 2011, KCR has also obtained a competitive award from the CDC for the Early Case Capture (ECC) of Pediatric and Young Adult Cancers. ECC participation permits KCR to identify and collect basic information about pediatric cancer cases much sooner following a diagnosis than is normally reported to the KCR. KCR has been successful in re-competing and sustaining all of these funding sources since the initial awards. Most recently, KCR was awarded contract renewals to continue through 2023 as an NPCR registry and through 2028 as a SEER Program registry.

Finally, special recognition is given to the professional staff of the 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.

This project has been funded in whole or in part with Federal funds from the Centers for Disease Control and Prevention and the National Cancer Institute, National Institutes of Health, Department of Health and Human Services, under Cooperative Agreement Nos. 5NU58DP005400 (ECC) and 5NU58DP006313 (NPCR), and Contract No. HHSN261201800013I (SEER).
# Table of Contents

## Childhood Cancer Incidence in Kentucky, 2007-2016

1. Introduction and Overview
2. Proportion of Cases by Sex, All Sites
3. Cases by Sex and Age at Diagnosis, All Sites
4. Cases by Site Group and Sex, All Sites
5. Proportion of Cases by Site Group
6. Proportion of Cases by Site Group and Age Group
7. Incidence Rates by Site Group, Male and Female
8. Incidence Rates and Trend, All Sites, Both Sexes
9. Incidence Rates, All Sites, Male
10. Incidence Rates, All Sites, Female
11. Incidence Rates by Area Development District, All Sites
12. Incidence Rate Comparisons by Area Development Districts, All Sites
13. Incidence Rate Comparisons by Appalachian Region, All Sites
14. Kentucky Cases Seen in Children's Oncology Group (COG) Facilities, All Sites

## Childhood Cancer Incidence Rates in Kentucky Compared to U.S., 2006-2015

15. Kentucky Incidence Rates Compared to U.S. by Sex
16. Kentucky Incidence Rates Compared to U.S. by Site Group
17. Kentucky Rankings Compared to U.S. States by Site Group

## Supplemental Information

18. Definitions
19. Staff of the Kentucky Cancer Registry
20. Additional Resources
Introduction

This report of population-based childhood cancer incidence for the Commonwealth of Kentucky represents the most accurate data available at the time of publication. KCR collects uniform, high quality data on approximately 215 new primary cases of childhood cancer occurring in Kentucky residents each year. Childhood cancer is defined as all newly diagnosed malignant 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 are not included in this report.

This report provides information that permits regional comparisons among Kentucky’s Area Development Districts (ADD) and the Appalachian and non-Appalachian 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. The available U.S. data are not as current as KCR data, therefore the national comparisons utilize data from an earlier period of time.

Overview

Childhood cancer is relatively rare, with less than 1% (2,152 / 260,351) of all cancers diagnosed in Kentucky occurring among children under the age of 20 during the years 2007-2016. 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 2007 through 2016, the most recent ten years of complete data presented in this report, 2,152 children in Kentucky were diagnosed. Cancer occurred more frequently among males (54%) than females (46%).
The frequency of cancer diagnoses varied by age, with cancers occurring most frequently among children ages 0-4, followed by children ages 15-19, 10-14 and 5-9, respectively. Males were diagnosed with more cancers across all site groups except for epithelial tumors & melanoma and renal tumors. Among all Kentucky children, leukemia occurred most frequently, followed by brain and CNS tumors, lymphoma, epithelial tumors and melanoma and the other remaining site groups.

The frequency of diagnoses by cancer site group also varied by age group. Of note, a greater proportion of 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 & melanoma, and germ cell & gonadal tumors increased proportionally with age, while sympathetic nervous system tumors, renal tumors, retinoblastoma, and hepatic tumors decreased proportionally with age. The greatest proportion of soft tissue sarcomas occurred among children ages 10-14. The age-adjusted incidence rates of childhood cancer have increased by over 1.8% annually among both males and females over this ten-year time period. While of concern, this trend is consistent with observations in the U.S. as a whole [2].

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. However, the differences are not statistically significant. According to the most recent national data available (2006-2015), Kentucky’s age-adjusted childhood cancer incidence rate for all cancer sites is approximately the same as in the U.S. [4]. However, rates in Appalachian Kentucky are higher than in the U.S. for both males and females. Comparisons to U.S. rates by site group indicate that Appalachian children in Kentucky have higher rates across all major site groups except for soft tissue sarcomas, bone tumors, and renal tumors. Of particular concern, rates of brain and CNS tumors are significantly higher in Kentucky compared to the U.S. and even higher among Appalachian children in Kentucky. Compared to other states, Kentucky was ranked 22nd for all invasive cancer sites combined. However, Kentucky had the 5th highest rate for both retinoblastoma and hepatic tumors and the 6th highest rate for brain and CNS tumors.

Children’s Oncology Group (COG) affiliated facilities are likely to be in a position to offer the most current recommended treatment regimens for Kentucky children as well as opportunities to participate in life saving clinical trials. However, KCR data indicate that 18.7% of Kentucky children were treated outside of COG facilities in Kentucky during this reporting period.


CHILDHOOD CANCER INCIDENCE IN KENTUCKY
ALL SITES, 2007-2016

PROPORTION OF CASES BY SEX

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of Cases (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1,169 (54%)</td>
</tr>
<tr>
<td>Female</td>
<td>983 (46%)</td>
</tr>
<tr>
<td>Total</td>
<td>2,152</td>
</tr>
</tbody>
</table>

Male

Female
CHILDHOOD CANCER INCIDENCE IN KENTUCKY
ALL SITES, 2007-2016

CASES BY SEX AND AGE AT DIAGNOSIS

NUMBER OF CASES

<table>
<thead>
<tr>
<th>Ages 0-4</th>
<th>Ages 5-9</th>
<th>Ages 10-14</th>
<th>Ages 15-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>385</td>
<td>226</td>
<td>234</td>
<td>324</td>
</tr>
<tr>
<td>297</td>
<td>164</td>
<td>207</td>
<td>315</td>
</tr>
</tbody>
</table>

Male | Female
CHILDHOOD CANCER INCIDENCE IN KENTUCKY
BY SITE GROUP, 2007-2016

CASES BY SITE GROUP AND SEX

<table>
<thead>
<tr>
<th>Site Group</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukemia</td>
<td>285</td>
<td>187</td>
</tr>
<tr>
<td>Brain and CNS Tumors</td>
<td>224</td>
<td>156</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>197</td>
<td>140</td>
</tr>
<tr>
<td>Epithelial Tumors and Melanoma</td>
<td>143</td>
<td>106</td>
</tr>
<tr>
<td>Germ Cell and Gonadal Tumors</td>
<td>88</td>
<td>66</td>
</tr>
<tr>
<td>Soft Tissue Sarcomas</td>
<td>88</td>
<td>66</td>
</tr>
<tr>
<td>Sympathetic Nervous System Tumors</td>
<td>60</td>
<td>48</td>
</tr>
<tr>
<td>Bone Tumors</td>
<td>50</td>
<td>38</td>
</tr>
<tr>
<td>Renal Tumors</td>
<td>50</td>
<td>38</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>42</td>
<td>32</td>
</tr>
<tr>
<td>Hepatic Tumors</td>
<td>34</td>
<td>26</td>
</tr>
<tr>
<td>Other and Unspecified</td>
<td>24</td>
<td>18</td>
</tr>
</tbody>
</table>

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |

- | Male | Female |
CHILDHOOD CANCER INCIDENCE IN KENTUCKY
BY SITE GROUP, 2007-2016

PROPORTION OF CASES BY SITE GROUP

- Leukemia: 23%
- Brain and CNS Tumors: 16%
- Lymphoma: 6%
- Epithelial Tumors and Melanoma: 5%
- Germ Cell and Gonadal Tumors: 5%
- Soft Tissue Sarcomas: 6%
- Sympathetic Nervous System Tumors: 3%
- Bone Tumors: 2%
- Renal Tumors: 2%
- Retinoblastoma: <1%
- Hepatic Tumors: 5%
- Other and Unspecified: 0%
CHILDHOOD CANCER INCIDENCE IN KENTUCKY
BY SITE GROUP, 2007-2016

PROPORTION OF CASES BY SITE GROUP AND AGE GROUP

AGE GROUP (YEARS)

0-4

5-9

10-14

15-19

PROPORTION OF ALL CANCERS

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 RATES IN KENTUCKY
### BY SITE GROUP, 2007-2016

### MALE AND FEMALE

<table>
<thead>
<tr>
<th>Site Group</th>
<th>Male Cases</th>
<th>Male Age-Adjusted Rate</th>
<th>Female Cases</th>
<th>Female Age-Adjusted Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Sites</td>
<td>1,169</td>
<td>200.2</td>
<td>983</td>
<td>176.9</td>
</tr>
<tr>
<td>Leukemia</td>
<td>288</td>
<td>49.4</td>
<td>212</td>
<td>38.1</td>
</tr>
<tr>
<td>Brain and CNS Tumors</td>
<td>228</td>
<td>39.2</td>
<td>206</td>
<td>37.2</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>224</td>
<td>38.5</td>
<td>115</td>
<td>20.7</td>
</tr>
<tr>
<td>Epithelial Tumors and Melanoma</td>
<td>68</td>
<td>11.6</td>
<td>190</td>
<td>34.1</td>
</tr>
<tr>
<td>Germ Cell and Gonadal Tumors</td>
<td>80</td>
<td>13.5</td>
<td>49</td>
<td>8.8</td>
</tr>
<tr>
<td>Soft Tissue Sarcomas</td>
<td>67</td>
<td>11.5</td>
<td>53</td>
<td>9.6</td>
</tr>
<tr>
<td>Sympathetic Nervous System Tumors</td>
<td>68</td>
<td>11.5</td>
<td>41</td>
<td>7.3</td>
</tr>
<tr>
<td>Bone Tumors</td>
<td>59</td>
<td>10.2</td>
<td>45</td>
<td>8.2</td>
</tr>
<tr>
<td>Renal Tumors</td>
<td>33</td>
<td>5.7</td>
<td>39</td>
<td>7.0</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>32</td>
<td>5.4</td>
<td>15</td>
<td>2.7</td>
</tr>
<tr>
<td>Hepatic Tumors</td>
<td>20</td>
<td>3.4</td>
<td>15</td>
<td>2.7</td>
</tr>
<tr>
<td>Other and Unspecified</td>
<td>2</td>
<td>0.3</td>
<td>1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population at Risk</td>
<td>1,133,012</td>
<td>1,142,982</td>
<td>1,144,346</td>
<td>1,146,057</td>
<td>1,133,846</td>
<td>1,131,606</td>
<td>1,127,736</td>
<td>1,125,457</td>
<td>1,124,893</td>
<td>11,350,412</td>
<td></td>
</tr>
<tr>
<td>Total Cases</td>
<td>206</td>
<td>188</td>
<td>209</td>
<td>211</td>
<td>229</td>
<td>217</td>
<td>211</td>
<td>214</td>
<td>231</td>
<td>236</td>
<td>2,152</td>
</tr>
<tr>
<td>Crude Rate</td>
<td>181.8</td>
<td>164.5</td>
<td>182.6</td>
<td>184.1</td>
<td>200.8</td>
<td>191.4</td>
<td>186.5</td>
<td>189.8</td>
<td>205.2</td>
<td>209.8</td>
<td>189.6</td>
</tr>
<tr>
<td>Age-Adjusted Rate</td>
<td>180.2</td>
<td>163.6</td>
<td>181.7</td>
<td>183.0</td>
<td>200.1</td>
<td>190.9</td>
<td>186.2</td>
<td>189.3</td>
<td>204.5</td>
<td>209.0</td>
<td>188.8</td>
</tr>
<tr>
<td>95% CI Lower</td>
<td>156.4</td>
<td>141.1</td>
<td>157.9</td>
<td>159.2</td>
<td>175.0</td>
<td>166.3</td>
<td>161.9</td>
<td>164.8</td>
<td>179.0</td>
<td>183.2</td>
<td>180.9</td>
</tr>
<tr>
<td>95% CI Upper</td>
<td>206.5</td>
<td>188.8</td>
<td>208.1</td>
<td>209.5</td>
<td>227.8</td>
<td>218.1</td>
<td>213.0</td>
<td>216.4</td>
<td>232.7</td>
<td>237.4</td>
<td>197.0</td>
</tr>
</tbody>
</table>

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**

Incidence rates have increased approximately 1.8% annually over this ten year time period. The trend line shown in the figure is based on a linear regression. The 1.8% annual percent change (APC) is calculated using the Joinpoint Trend Analysis software package developed by NCI SEER (https://surveillance.cancer.gov/joinpoint/)
## Childhood Cancer Incidence Rates in Kentucky

### MALE

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population at Risk</td>
<td>580,973</td>
<td>585,519</td>
<td>586,178</td>
<td>587,012</td>
<td>584,561</td>
<td>581,193</td>
<td>580,303</td>
<td>578,156</td>
<td>576,795</td>
<td>576,056</td>
<td>5,816,746</td>
</tr>
<tr>
<td>Total Cases</td>
<td>117</td>
<td>95</td>
<td>94</td>
<td>127</td>
<td>129</td>
<td>124</td>
<td>122</td>
<td>110</td>
<td>130</td>
<td>121</td>
<td>1,169</td>
</tr>
<tr>
<td>Crude Rate</td>
<td>201.4</td>
<td>162.2</td>
<td>160.4</td>
<td>216.3</td>
<td>220.7</td>
<td>213.3</td>
<td>210.2</td>
<td>190.3</td>
<td>225.4</td>
<td>210.1</td>
<td>201.0</td>
</tr>
<tr>
<td>Age-Adjusted Rate</td>
<td>200.1</td>
<td>160.7</td>
<td>159.9</td>
<td>214.4</td>
<td>220.3</td>
<td>212.8</td>
<td>209.8</td>
<td>189.9</td>
<td>224.5</td>
<td>209.3</td>
<td>200.2</td>
</tr>
<tr>
<td>95% CI Lower</td>
<td>165.5</td>
<td>130.0</td>
<td>129.2</td>
<td>178.8</td>
<td>183.9</td>
<td>177.0</td>
<td>174.2</td>
<td>156.1</td>
<td>187.6</td>
<td>173.7</td>
<td>188.9</td>
</tr>
<tr>
<td>95% CI Upper</td>
<td>239.8</td>
<td>196.5</td>
<td>195.6</td>
<td>255.2</td>
<td>261.7</td>
<td>253.7</td>
<td>250.5</td>
<td>228.8</td>
<td>266.6</td>
<td>250.2</td>
<td>212.0</td>
</tr>
</tbody>
</table>

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, 2007-2016**

## Female

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population at Risk</td>
<td>552,039</td>
<td>557,463</td>
<td>558,168</td>
<td>559,045</td>
<td>555,916</td>
<td>552,653</td>
<td>551,303</td>
<td>549,580</td>
<td>548,662</td>
<td>548,837</td>
<td>5,533,666</td>
</tr>
<tr>
<td>Total Cases</td>
<td>89</td>
<td>93</td>
<td>115</td>
<td>84</td>
<td>100</td>
<td>93</td>
<td>89</td>
<td>104</td>
<td>101</td>
<td>115</td>
<td>983</td>
</tr>
<tr>
<td>Crude Rate</td>
<td>161.2</td>
<td>166.8</td>
<td>206.0</td>
<td>150.3</td>
<td>179.9</td>
<td>168.3</td>
<td>161.4</td>
<td>189.2</td>
<td>184.1</td>
<td>209.5</td>
<td>177.6</td>
</tr>
<tr>
<td>Age-Adjusted Rate</td>
<td>159.3</td>
<td>166.7</td>
<td>204.7</td>
<td>150.1</td>
<td>178.9</td>
<td>168.0</td>
<td>161.2</td>
<td>188.8</td>
<td>183.5</td>
<td>208.6</td>
<td>176.9</td>
</tr>
<tr>
<td>95% CI Lower</td>
<td>127.9</td>
<td>134.6</td>
<td>168.9</td>
<td>119.7</td>
<td>145.6</td>
<td>135.6</td>
<td>129.5</td>
<td>154.3</td>
<td>149.4</td>
<td>172.2</td>
<td>166.0</td>
</tr>
<tr>
<td>95% CI Upper</td>
<td>196.1</td>
<td>204.3</td>
<td>245.7</td>
<td>185.8</td>
<td>217.6</td>
<td>205.8</td>
<td>198.4</td>
<td>228.8</td>
<td>222.9</td>
<td>250.4</td>
<td>188.3</td>
</tr>
</tbody>
</table>

**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, 2007-2016

#### BY AREA DEVELOPMENT DISTRICT

<table>
<thead>
<tr>
<th>Area Development District</th>
<th>Population at Risk</th>
<th>Cases</th>
<th>Crude Rate</th>
<th>Age-Adjusted Rate</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffalo Trace</td>
<td>147,612</td>
<td>41</td>
<td>277.8</td>
<td>279.8</td>
<td>200.8</td>
<td>379.5</td>
</tr>
<tr>
<td>Big Sandy</td>
<td>371,792</td>
<td>86</td>
<td>231.3</td>
<td>229.8</td>
<td>183.8</td>
<td>283.8</td>
</tr>
<tr>
<td>Cumberland Valley</td>
<td>610,026</td>
<td>129</td>
<td>211.5</td>
<td>210.3</td>
<td>175.6</td>
<td>249.9</td>
</tr>
<tr>
<td>FIVCO</td>
<td>332,436</td>
<td>70</td>
<td>210.6</td>
<td>210.1</td>
<td>163.8</td>
<td>265.5</td>
</tr>
<tr>
<td>Kentucky River</td>
<td>273,198</td>
<td>56</td>
<td>205.0</td>
<td>205.3</td>
<td>155.0</td>
<td>266.5</td>
</tr>
<tr>
<td>Lincoln Trail</td>
<td>740,191</td>
<td>144</td>
<td>194.5</td>
<td>194.6</td>
<td>164.1</td>
<td>229.1</td>
</tr>
<tr>
<td>Green River</td>
<td>568,326</td>
<td>108</td>
<td>190.0</td>
<td>189.3</td>
<td>155.2</td>
<td>228.5</td>
</tr>
<tr>
<td>Purchase</td>
<td>477,088</td>
<td>90</td>
<td>188.6</td>
<td>189.0</td>
<td>152.0</td>
<td>232.4</td>
</tr>
<tr>
<td>KIPDA</td>
<td>2,507,074</td>
<td>465</td>
<td>185.5</td>
<td>185.1</td>
<td>168.6</td>
<td>202.7</td>
</tr>
<tr>
<td>Northern Kentucky</td>
<td>1,225,412</td>
<td>225</td>
<td>183.6</td>
<td>183.7</td>
<td>160.5</td>
<td>209.4</td>
</tr>
<tr>
<td>Bluegrass</td>
<td>2,013,886</td>
<td>371</td>
<td>184.2</td>
<td>182.7</td>
<td>164.5</td>
<td>202.3</td>
</tr>
<tr>
<td>Barren River</td>
<td>767,123</td>
<td>137</td>
<td>178.6</td>
<td>178.0</td>
<td>149.4</td>
<td>210.4</td>
</tr>
<tr>
<td>Gateway</td>
<td>212,766</td>
<td>37</td>
<td>173.9</td>
<td>176.1</td>
<td>123.8</td>
<td>242.9</td>
</tr>
<tr>
<td>Pennyrile</td>
<td>582,571</td>
<td>102</td>
<td>175.1</td>
<td>173.9</td>
<td>141.7</td>
<td>211.2</td>
</tr>
<tr>
<td>Lake Cumberland</td>
<td>520,909</td>
<td>91</td>
<td>174.7</td>
<td>173.6</td>
<td>139.8</td>
<td>213.2</td>
</tr>
<tr>
<td>State</td>
<td>11,350,412</td>
<td>2,152</td>
<td>189.6</td>
<td>188.8</td>
<td>180.9</td>
<td>197.0</td>
</tr>
</tbody>
</table>

**Note:** All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Million Population.
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.
### AGE-ADJUSTED RATES BY APPALACHIAN REGION

<table>
<thead>
<tr>
<th>Region</th>
<th>Population at Risk</th>
<th>Cases</th>
<th>Crude Rate</th>
<th>Age-Adjusted Rate</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appalachian</td>
<td>2,977,907</td>
<td>612</td>
<td>205.5</td>
<td>204.3</td>
<td>188.4</td>
<td>221.1</td>
</tr>
<tr>
<td>Non-Appalachian</td>
<td>8,372,505</td>
<td>1540</td>
<td>183.2</td>
<td>183.2</td>
<td>174.2</td>
<td>192.6</td>
</tr>
<tr>
<td>State</td>
<td>11,350,412</td>
<td>2,152</td>
<td>189.6</td>
<td>188.8</td>
<td>180.9</td>
<td>197.0</td>
</tr>
</tbody>
</table>

Note: All rates are per 1,000,000. Rates are age-adjusted to the 2000 U.S. Standard Million Population.
### KENTUCKY CASES SEEN IN CHILDREN'S ONCOLOGY GROUP (COG) FACILITIES, ALL SITES, 2007-2016

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Number of Cases (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky COG Facilities</td>
<td>1,187 (55.2%)</td>
</tr>
<tr>
<td>Ohio COG Facilities</td>
<td>335 (15.6%)</td>
</tr>
<tr>
<td>Tennessee COG Facilities</td>
<td>228 (10.6%)</td>
</tr>
<tr>
<td>Non-COG Facilities</td>
<td>402 (18.7%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,152</strong></td>
</tr>
</tbody>
</table>
Childhood Cancer Incidence Rates in Kentucky Compared to U.S.

2006 - 2015
AGE-ADJUSTED CHILDHOOD CANCER INCIDENCE RATES
ALL SITES, 2006-2015

KENTUCKY COMPARED TO U.S.

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, 2006-2015

KENTUCKY COMPARED TO U.S.

*P < 0.05 (Kentucky and Appalachian Kentucky rates 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.
## KENTUCKY RANKINGS COMPARED TO ALL U.S. STATES

<table>
<thead>
<tr>
<th>Site Group</th>
<th>Ranking Highest to Lowest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukemia</td>
<td>36th</td>
</tr>
<tr>
<td>Brain and CNS Tumors</td>
<td>6th</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>27th</td>
</tr>
<tr>
<td>Epithelial Tumors and Melanoma</td>
<td>13th</td>
</tr>
<tr>
<td>Germ Cell and Gonadal Tumors</td>
<td>23rd</td>
</tr>
<tr>
<td>Soft Tissue Sarcomas</td>
<td>47th</td>
</tr>
<tr>
<td>Sympathetic Nervous System Tumors</td>
<td>16th</td>
</tr>
<tr>
<td>Bone Tumors</td>
<td>24th</td>
</tr>
<tr>
<td>Renal Tumors</td>
<td>40th</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>5th</td>
</tr>
<tr>
<td>Hepatic Tumors</td>
<td>5th</td>
</tr>
<tr>
<td>Other and Unspecified</td>
<td>30th</td>
</tr>
<tr>
<td><strong>All Sites</strong></td>
<td><strong>22nd</strong></td>
</tr>
</tbody>
</table>
Supplemental Information
## Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age-Adjusted Rate</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Annual Percent Change (APC)</strong></td>
<td>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. <a href="https://surveillance.cancer.gov/joinpoint/">https://surveillance.cancer.gov/joinpoint/</a></td>
</tr>
<tr>
<td><strong>Appalachian Region</strong></td>
<td>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 <a href="https://www.arc.gov/appalachian_region/TheAppalachianRegion.asp">https://www.arc.gov/appalachian_region/TheAppalachianRegion.asp</a></td>
</tr>
<tr>
<td><strong>Area Development Districts</strong></td>
<td>Groups of contiguous counties in Kentucky, comprising 15 area development districts. <a href="https://www.kyatlas.com/kentucky-adds.html">https://www.kyatlas.com/kentucky-adds.html</a></td>
</tr>
<tr>
<td><strong>Cases</strong></td>
<td>Total number of new incident cancer cases diagnosed in a given year or time period.</td>
</tr>
<tr>
<td><strong>Childhood Cancer</strong></td>
<td>A malignant cancer diagnosed in an individual under the age of 20.</td>
</tr>
<tr>
<td><strong>Children's Oncology Group (COG)</strong></td>
<td>A large group of researchers, hospitals, and cancer centers that get support from the National Cancer Institute (NCI) to study childhood cancer. <a href="https://www.childrensoncologygroup.org/index.php/aboutus">https://www.childrensoncologygroup.org/index.php/aboutus</a></td>
</tr>
<tr>
<td><strong>Crude Rate</strong></td>
<td>An unadjusted incidence rate, calculated as the number of newly diagnosed cases divided by the population at risk.</td>
</tr>
<tr>
<td><strong>Diagnosis Year</strong></td>
<td>Year in which a cancer is first diagnosed.</td>
</tr>
<tr>
<td><strong>Incidence Rate</strong></td>
<td>Rate of new cancer diagnoses in a given year or time period.</td>
</tr>
<tr>
<td><strong>P &lt; 0.05</strong></td>
<td>The P value, or calculated probability under the null hypothesis is used to quantify the idea of statistical significance of evidence. P &lt; 0.05 is a convention generally accepted as representing a statistically significant finding.</td>
</tr>
<tr>
<td><strong>Population at Risk</strong></td>
<td>Number of individuals living in a geographical region and at risk of being diagnosed with cancer for a given year or time period.</td>
</tr>
<tr>
<td><strong>Site Group</strong></td>
<td>Type of cancer, grouped by topography and histology, as defined by the International Classification of Childhood Cancer. [1]</td>
</tr>
<tr>
<td><strong>US Standard Million Population</strong></td>
<td>The age distribution of individuals living in the U.S. in a given year, per million residents, as defined by the U.S. Census.</td>
</tr>
<tr>
<td><strong>95% Confidence Interval (CI)</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>

# Staff of the Kentucky Cancer Registry

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Director</strong></td>
<td>Eric B. Durbin, DrPH, MS</td>
</tr>
<tr>
<td><strong>Associate Director</strong></td>
<td>Thomas C. Tucker, PhD, MPH</td>
</tr>
<tr>
<td><strong>Director of Registry Operations</strong></td>
<td>Frances E. Ross, CTR</td>
</tr>
<tr>
<td><strong>Director of Population-based Studies</strong></td>
<td>Bin Huang, DrPH, MS</td>
</tr>
<tr>
<td><strong>Lead Software Architect</strong></td>
<td>Isaac Hands, MPH</td>
</tr>
<tr>
<td><strong>Information Technology Manager</strong></td>
<td>Jennifer Gregory, MS</td>
</tr>
<tr>
<td><strong>Business Operations Manager</strong></td>
<td>Amanda Isaacs</td>
</tr>
<tr>
<td><strong>Epidemiologist/Research Coordinator</strong></td>
<td>Jaclyn K. McDowell, DrPH, MPH</td>
</tr>
<tr>
<td><strong>Early Case Capture Manager</strong></td>
<td>Ellen Lycan, DrPH, MA, CTR</td>
</tr>
<tr>
<td><strong>Quality Assurance Managers</strong></td>
<td>Tonya Brandenburg, MHA, CTR</td>
</tr>
<tr>
<td></td>
<td>Shelly Gray</td>
</tr>
<tr>
<td></td>
<td>Desiree Montgomery, MPH, CTR</td>
</tr>
<tr>
<td><strong>Senior Regional Coordinators</strong></td>
<td>Nicole Catlett, CTR</td>
</tr>
<tr>
<td></td>
<td>Shelly Hodge, CTR</td>
</tr>
<tr>
<td></td>
<td>Marynell Jenkins, CTR</td>
</tr>
<tr>
<td><strong>Regional Abstractors</strong></td>
<td>Leslie Benningfield, CTR</td>
</tr>
<tr>
<td></td>
<td>Becky Bruno, CTR</td>
</tr>
<tr>
<td></td>
<td>Danielle Darcy, CTR</td>
</tr>
<tr>
<td></td>
<td>Jennifer Denham, CTR</td>
</tr>
<tr>
<td><strong>Non-Hospital Abstractors</strong></td>
<td>Lindsey Baker, CTR</td>
</tr>
<tr>
<td></td>
<td>Stephanie Carmack, MS, CTR</td>
</tr>
<tr>
<td></td>
<td>Kim Kimbler, MS, CTR</td>
</tr>
<tr>
<td></td>
<td>Shannon Ladd, MSW, CTR</td>
</tr>
<tr>
<td></td>
<td>Kelly Pictor, CTR</td>
</tr>
<tr>
<td></td>
<td>Pam Shaw, CTR</td>
</tr>
<tr>
<td></td>
<td>Marilyn Wooten, CTR</td>
</tr>
<tr>
<td><strong>Quality Assurance Specialists</strong></td>
<td>Vicki LaRue, CTR</td>
</tr>
<tr>
<td></td>
<td>Paige Lutz, CTR</td>
</tr>
<tr>
<td></td>
<td>Mary Jo Mahoney, CTR</td>
</tr>
<tr>
<td><strong>Informatics Project Manager</strong></td>
<td>Joseph Hurt-Mueller, MBA</td>
</tr>
<tr>
<td><strong>Software and Database Developers</strong></td>
<td>Chaney Blu</td>
</tr>
<tr>
<td></td>
<td>Clay Campbell</td>
</tr>
<tr>
<td></td>
<td>Roger Chui</td>
</tr>
<tr>
<td></td>
<td>Jason Jacob, MS</td>
</tr>
<tr>
<td></td>
<td>Luan Pham</td>
</tr>
<tr>
<td></td>
<td>Pete Ransdell, MS</td>
</tr>
<tr>
<td></td>
<td>David Rust, MS</td>
</tr>
<tr>
<td><strong>Information Technology Support</strong></td>
<td>Joel Wheeler</td>
</tr>
<tr>
<td></td>
<td>John Williams, MA</td>
</tr>
<tr>
<td><strong>Budget Analysts</strong></td>
<td>Sarah Dickerson</td>
</tr>
<tr>
<td></td>
<td>Cindy Pearce</td>
</tr>
<tr>
<td><strong>Administrative Assistants</strong></td>
<td>Paula Cole</td>
</tr>
<tr>
<td></td>
<td>Cheryl Nicholson</td>
</tr>
<tr>
<td></td>
<td>Robin Walls</td>
</tr>
<tr>
<td><strong>Staff Biostatistician</strong></td>
<td>Quan Chen, DrPH</td>
</tr>
</tbody>
</table>
Additional Resources

American Cancer Society

American Childhood Cancer Organization
https://www.acco.org/types-of-childhood-cancer

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/cancer/hematology-oncology-pediatric

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 Program of Cancer Registries (NPCR) Pediatric and Young Adult Early Case Capture Program
https://www.cdc.gov/cancer/npcr/early-case-capture.htm

NIH Kids First Data Resource Center
https://kidsfirstdrc.org

Norton Children’s Cancer Institute
https://nortonchildrens.com/services/cancer

Vanderbilt University Medical Center Pediatric Cancer Program
https://www.childrenshospitalvanderbilt.org/service-line/pediatric-cancer-program

Why Not Kids?
http://whynotkids.com