Georgia **Childhood Cancer Report** 2016

Georgia Department of Public Health

Acknowledgments

The authors of this report would like to thank the following for their contribution and assistance in planning and review:

Georgia Department of Public Health…….……..……Brenda Fitzgerald, M.D., Commissioner
Division of Health Protection……...……Pat O'Neal, M.D., Director
Epidemiology Program…….…….……...…...Cherie Drenzek, D.V.M., M.S., Director/State Epidemiologist
Chronic Disease, Healthy Behavior, and Injury Epidemiology Section…..…….....A. Rana Bayakly, M.P.H., Chief
Georgia Comprehensive Cancer Registry……...…...…A. Rana Bayakly, M.P.H., Program Director
Chrissy McNamara, M.S.P.H., Epidemiologist

Georgia Center for Cancer Statistics…….……...…..... Kevin C. Ward, Ph.D., M.P.H, C.T.R., Director

We would also like to thank all of the facilities in Georgia that contributed data for this report. Without their hard work, this report would not have been possible.

Funding for this research was made possible (in part) by cooperative agreement award number 5/NU58/DP003875-04 from the Centers for Disease Control and Prevention and through contract HHSN261201300015I with the National Cancer Institute. The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the National Cancer Institute.

Suggested Citation: McNamara C, Bayakly AR, Ward KC. Georgia Childhood Cancer Report, 2016. Georgia Department of Public Health, Georgia Comprehensive Cancer Registry, August 2016.

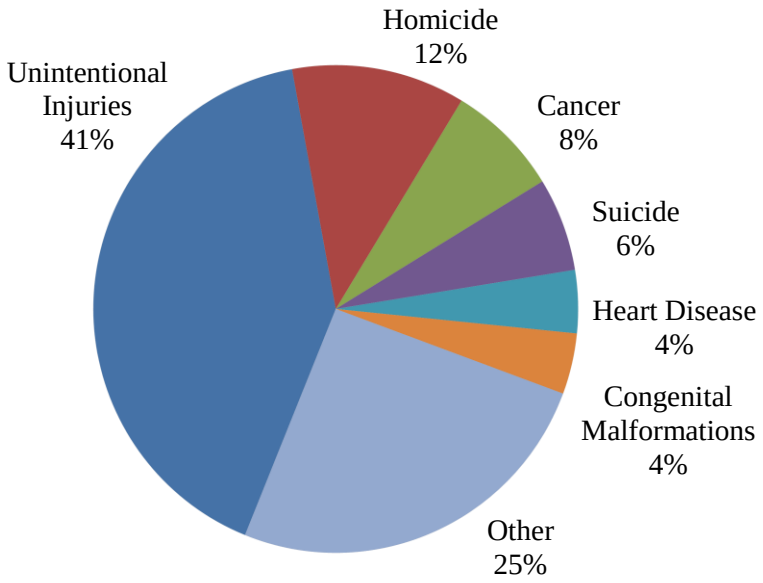
Introduction

Cancer is the third most common cause of death among children between 1 and 19 years of age, following unintentional injuries and homicide. It accounted for 8% of all childhood mortality in Georgia from 2003-2013* *(Figure 1)*. The most common forms of childhood cancer are central nervous system (CNS) tumors, leukemias, and lymphomas, accounting for nearly two-thirds of all childhood cancer diagnoses and cancer deaths *(Table 1)*.

This report was written to assist health professionals, volunteers, cancer control organizations, community groups, and others who are working to reduce the burden of cancer throughout Georgia.

The report describes the burden of childhood cancer in Georgia and includes current incidence, mortality, and survival data, along with disease specific summaries for the most common childhood cancer types.

Figure 1. Childhood Mortality by Cause, Ages 1 to 19 Years, Georgia, 2003-2013*



* Because of data quality issues, 2009 cancer death data are not used for analysis. This report includes data for 2003-2008 and 2010-2013 combined.

Table 1. Incidence and Mortality for the Top Three Cancer Types in Children Ages 0 to 19 Years, Georgia

	Cancer Incidence		Cancer Mortality	
	Cases*	% of Cases	Deaths*	% of Deaths
CNS Tumors	126	25%	16	24%
Leukemias	113	23%	19	30%
Lymphomas	71	14%	3	5%

*Average number of cases (2004-2013) or deaths (2003-2008 & 2010-2013) per year in Georgia

Basic Cancer Information

What is Cancer?

Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. Cells with the ability to spread to other locations in the body are called invasive or malignant cancers. If the growth is not controlled, it can result in death. Cancer is caused by both internal and external factors. Fortunately, many cancers can be cured if detected and treated promptly. Different types of cancer can behave very differently, growing at different rates and responding to different therapies. That is why people with cancer need treatment that is aimed at their specific disease.

Who is at Risk for Developing Cancer?

Everyone is at risk for developing cancer, but the risk increases as individuals age. Most cancers affect adults who are middle-aged or older. Approximately 75% of all cancers in Georgia are diagnosed at age 55 years or older, while only about 1% occur among children under 20 years of age. In the United States, males have a 1 in 2 lifetime risk of cancer, and females have a 1 in 3 lifetime risk. Lifetime risk refers to the probability that an individual, over the course of a lifetime, will develop the disease.

Cancer in Children

Approximately 450 new cancer cases and 60 cancer deaths are expected to occur each year in Georgia among children aged 0-19 years. Despite its rarity, cancer is still the third leading cause of death among children between the ages of 1 and 19 years. In Georgia (as well as in the U.S.), mortality rates from childhood cancer have declined by about 65% since 1970.

Early detection of childhood cancer is challenging because initial symptoms are usually non-specific.[1] Parents should make sure their children have regular medical checkups and should be alert to any unusual symptoms that persist. These may include an unusual mass or swelling; unexplained paleness and loss of energy; sudden tendency to bruise; a persistent, localized pain; limping; prolonged, unexplained fever or illness; frequent headaches, often with vomiting; sudden vision changes; and excessive, rapid weight loss.

The types of cancers that develop in children are very different from those that develop in adults. Many childhood cancers occur very early in life and while parents want to know why, the cause of most childhood cancers is, unfortunately, not known. Childhood cancers are often the result of DNA changes in cells that take place very early in life, sometimes even before birth. Unlike cancers in adults, childhood cancers are not significantly related to lifestyle-related risk factors of the individual such as tobacco or alcohol use, poor diet, or lack of physical activity *(Table 2)*.

Childhood cancers can be treated by a combination of therapies (surgery, radiation, chemotherapy) chosen based on the specific type, location, and stage of the disease. Treatment is optimally coordinated by a team of experts including pediatric oncologists, pediatric nurses, social workers, psychologists, and others who assist children and their families.

For all childhood cancers combined, 5-year relative survival rates have improved markedly over the past four decades, from about 60% in the mid-1970s to the present rate of more than 80%, largely due to new and improved treatments. Rates vary considerably, however, depending on the specific cancer type. Survivors of childhood cancer may experience treatment-related side effects several months or years after their diagnosis. Late treatment effects can include organ malfunction, secondary cancers, and cognitive impairment. It is important that children's primary care providers throughout life are informed of prior cancer treatments so they can monitor for late effects.

Table 2. Comparison of Childhood Cancers Versus Adult Cancers

	Children	Adults
Top 5 Cancers	Central Nervous System Tumors Leukemias Lymphomas Soft Tissue Sarcomas Germ Cell Neoplasms	Prostate Female Breast Lung and Bronchus Colon and Rectum Melanoma
Prevention	Because the cause of most childhood cancer is unknown, there is no known way to prevent it.	Nearly two-thirds of cancer deaths can be linked to modifiable risk factors such as tobacco use, diet, obesity, and lack of exercise. In addition, many skin cancers could be prevented by protection from the sun's rays.
Survival	The Georgia 5-year relative survival rate for all cancers from 2006-2012 among children age 0 to 19 years is 83%.	The Georgia 5-year relative survival rate for all cancers from 2006-2012 among all ages is 65%.

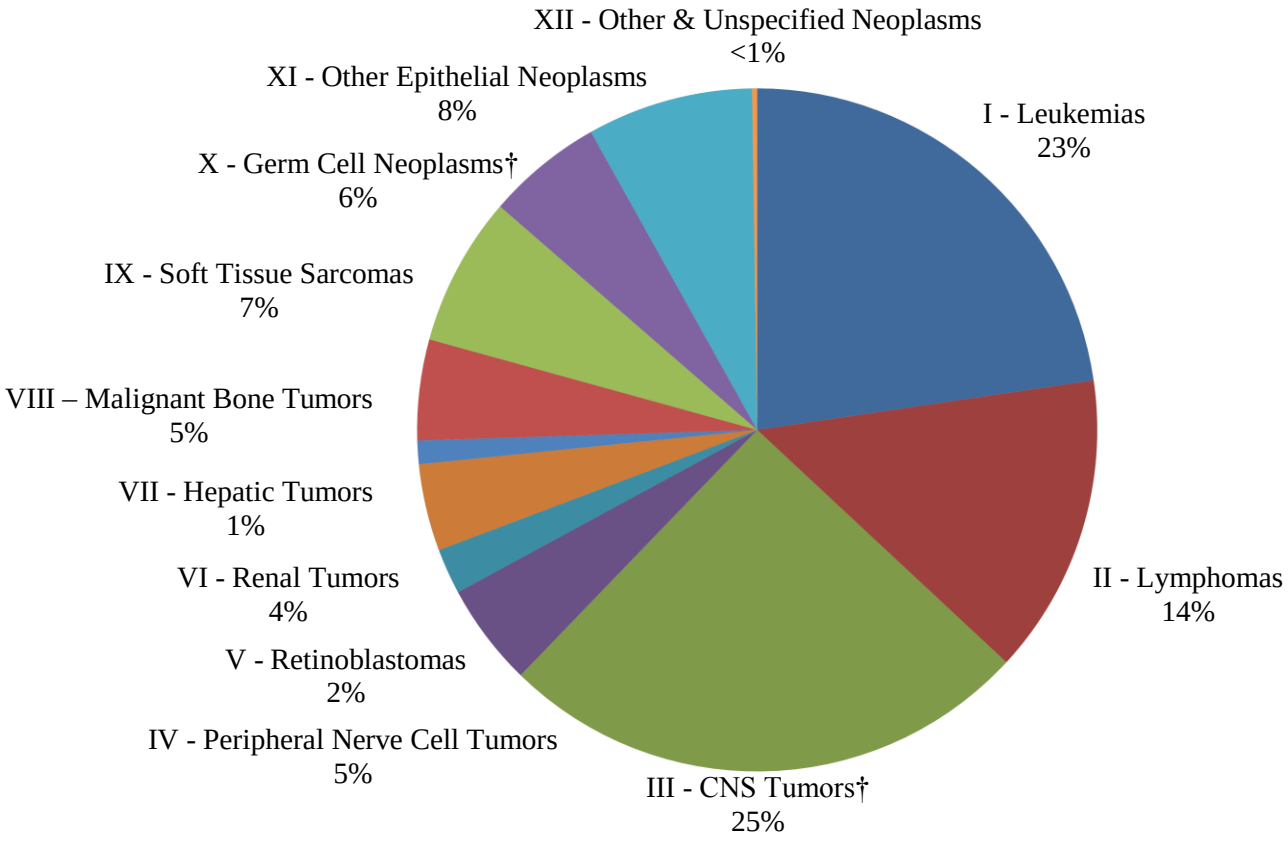
[1] *Cancer in Children*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/cancerinchildren/detailedguide/index

Childhood Cancer Incidence

Childhood Cancer Incidence in Georgia

- Central nervous system (CNS) tumors and leukemias are the most common forms of childhood cancer in Georgia, accounting for nearly half of all diagnoses between 2004 and 2013 *(Figure 2).*
- Between 2004 and 2013, there were 4,969 cancer diagnoses among children aged 0 to 19 years living in Georgia. The age-adjusted rate for this time period was 181.6 per million *(Table 3).*
- The highest cancer incidence rate among children aged 0 to 19 years was for CNS tumors (46.2 per million), followed by leukemias with a rate of 41.1 per million.
- Overall, male children had a higher cancer incidence rate than females. This difference was most apparent in lymphomas (especially non-Hodgkin and Burkitt lymphomas) and intracranial and intraspinal germ cell tumors. Female children were more likely to be diagnosed with retinoblastomas and thyroid carcinomas.
- Cancer incidence was highest in the youngest and oldest age categories *(Table 4).*
- Children aged 0 to 4 years were most likely to be diagnosed with leukemias, CNS neoplasms, or peripheral nerve cell tumors.
- Children aged 15 to 19 years were most likely to be diagnosed with CNS tumors, lymphomas, and other malignant neoplasms such as melanomas or thyroid carcinomas.

Figure 2. Childhood Cancer Incidence*, Ages 0 to 19 Years, Georgia, 2004-2013



* Grouped according to the International Classification of Childhood Cancer (ICCC) based on ICD-O-3/WHO 2008.
† Group III, Group III subgroups, and subgroup Xa include benign brain/CNS tumors.

Table 3. Age-Adjusted Childhood Cancer Incidence Rates*, Ages 0 to 19 Years, Georgia, 2004-2013

	Both Sexes		Males		Females	
	Cases	Rate	Cases	Rate	Cases	Rate
All ICCC† Groups Combined Excluding Benign Brain/CNS Tumors	4534	165.6	2402	171.7	2132	159.3
All ICCC Groups Combined Including Benign Brain/CNS Tumors‡	4969	181.6	2592	185.3	2376	177.7
I – Leukemias, Myeloproliferative & Myelodysplastic Diseases	1127	41.1	619	44.3	508	37.8
ia – Lymphoid leukemias	740	27.0	413	29.5	327	24.3
ib – Acute myeloid leukemias	244	8.9	116	8.3	128	9.5
ic – Chronic myeloproliferative diseases	67	2.5	34	2.4	33	2.5
id – Myelodysplastic syndrome and other myeloproliferative diseases	32	1.2	22	1.6	10	~
ie – Unspecified and other specified leukemias	44	1.6	34	2.4	10	~
II – Lymphomas & Reticuloendothelial Neoplasms	707	26.0	442	31.8	265	19.9
iia – Hodgkin lymphomas	322	11.8	185	13.3	137	10.3
iib – Non-Hodgkin lymphomas (except Burkitt)	267	9.8	179	12.9	88	6.6
iic – Burkitt lymphoma	59	2.2	43	3.1	16	1.2
iid – Miscellaneous lymphoreticular neoplasms	50	1.8	***	~	***	~
iie – Unspecified lymphomas	9	~	***	~	<5	~
III – Central Nervous System & Miscellaneous Intracranial & Intraspinal Neoplasms‡	1259	46.2	600	43.1	658	49.4
iiia – Ependymomas and choroid plexus tumor‡	100	3.6	49	3.5	51	3.8
iiib - Astrocytomas‡	448	16.4	221	15.8	227	17.1
iiic – Intracranial and intraspinal embryonal tumors‡	162	5.9	88	6.3	74	5.5
iiid – Other gliomas‡	139	5.1	65	4.7	74	5.6
iiie – Other specified intracranial and intraspinal neoplasms‡	352	12.9	145	10.4	206	15.5
iiif – Unspecified intracranial and intraspinal neoplasms‡	58	2.1	32	2.3	26	2.0
IV – Neuroblastoma & Other Peripheral Nervous Cell Tumors	242	8.7	144	10.1	98	7.2
V – Retinoblastomas	107	3.8	44	3.1	63	4.6
VI – Renal Tumors	205	7.4	100	7.1	105	7.8
via – Nephroblastoma and other nonepithelial renal tumors	177	6.4	87	6.1	90	6.6
vib – Renal carcinomas	***	~	***	~	***	~
vic – Unspecified malignant renal tumors	<5	~	<5	~	<5	~
VII – Hepatic tumors	55	2.0	31	2.2	24	1.8
viia – Hepatoblastoma	42	1.5	25	1.7	17	1.2
viib – Hepatic carcinomas	***	~	***	~	***	~
viic – Unspecified malignant hepatic tumors	<5	~	<5	~	<5	~
VIII – Malignant Bone Tumors	237	8.7	132	9.5	105	7.9
viiia – Osteosarcomas	132	4.9	70	5.0	62	4.7
viiib – Chondrosarcomas	7	~	<5	~	<5	~
viiic – Ewing tumor and related sarcomas of bone	79	2.9	46	3.3	33	2.5
viiid – Other specified malignant bone tumors	7	~	***	~	<5	~
viiie – Unspecified malignant bone tumors	12	~	7	~	5	~
IX – Soft Tissue & Other Extraosseous Sarcomas	352	12.9	196	14.0	156	11.7
ixa – Rhabdomyosarcomas	130	4.8	76	5.4	54	4.1
ixb – Fibrosarcomas, peripheral nerve sheath, and other fibromatous neoplasms	35	1.3	18	1.3	17	1.3
ixc – Kaposi sarcoma	5	~	<5	~	<5	~
ixd – Other specified soft tissue sarcomas	129	4.7	69	5.0	60	4.5
ixe – Unspecified soft tissue sarcomas	53	1.9	***	~	***	~
X – Germ Cell & Trophoblastic Tumors & Neoplasms of Gonads‡	274	10.0	144	10.2	130	9.8
xa – Intracranial and intraspinal germ cell tumors‡	51	1.9	33	2.4	18	1.3
xb – Malignant extracranial and extragonadal germ cell tumors	37	1.3	12	~	25	1.8
xc – Malignant gonadal germ cell tumors	168	6.2	98	6.9	70	5.3
xd – Gonadal carcinomas	11	~	<5	~	***	~
xe – Other and unspecified malignant gonadal tumors	7	~	<5	~	***	~
XI – Other Malignant Epithelial Neoplasms & Malignant Melanoma	392	14.4	138	9.9	254	19.1
xia – Adrenocortical carcinomas	***	~	<5	~	<5	~
xib – Thyroid carcinomas	173	6.3	36	2.6	137	10.3
xic – Nasopharyngeal carcinomas	16	0.6	11	~	5	~
xid – Malignant melanomas	97	3.6	44	3.1	53	4.0
xie – Skin carcinomas	<5	~	<5	~	<5	~
xif – Other and unspecified carcinomas	98	3.6	42	3.0	56	4.2
XII – Other & Unspecified Malignant Neoplasms	12	~	<5	~	***	~

* Average annual rate per million, age-adjusted to the 2000 US standard population.

† Grouped according to the International Classification of Childhood Cancer (ICCC) based on ICD-O-3/WHO 2008.

‡ Group III, Group III subgroups, and subgroup Xa include benign brain/CNS tumors.

~ Rates are not calculated where the count is less than sixteen, due to reliability of the rate.

*** Counts less than five and those that allow calculation of counts less than five are concealed for confidentiality purposes.

Table 4. Age-Specific Childhood Cancer Incidence Rates*, Ages 0 to 19 Years, Georgia, 2004-2013

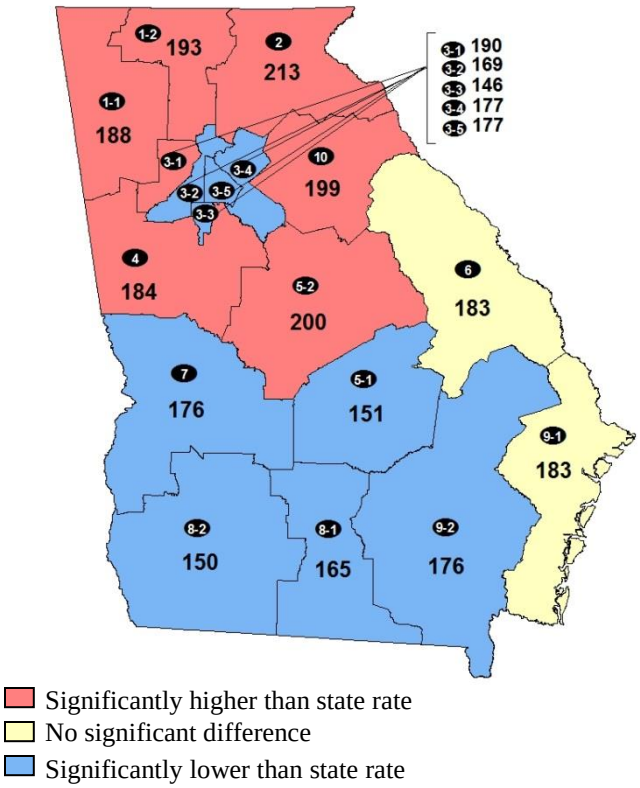
	Ages 0-4		Ages 5-9		Ages 10-14		Ages 15-19	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
All ICCC† Groups Combined Excluding Benign Brain/CNS Tumors	1432	210.7	818	122.1	887	129.9	1397	202.5
All ICCC Groups Combined Including Benign Brain/CNS Tumors‡	1493	219.6	878	131.1	1000	146.5	1598	231.6
I – Leukemias, Myeloproliferative & Myelodysplastic Diseases	452	66.5	240	35.8	207	30.3	228	33.0
II – Lymphomas & Reticuloendothelial Neoplasms	80	11.8	127	19.0	162	23.7	338	49.0
III – Central Nervous System & Misc. Intracranial & Intraspinal Neoplasms‡	333	49.0	290	43.3	290	42.5	346	50.1
IV – Neuroblastoma & Other Peripheral Nervous Cell Tumors	195	28.7	28	4.2	12	1.8	7	~
V – Retinoblastomas	103	15.2	<5	~	<5	~	<5	~
VI – Renal Tumors	134	19.7	45	6.7	6	~	20	2.9
VII – Hepatic tumors	37	5.4	7	~	6	~	5	~
VIII – Malignant Bone Tumors	12	1.8	35	5.2	89	13.0	101	14.6
IX – Soft Tissue & Other Extraosseous Sarcomas	86	12.7	52	7.8	104	15.2	110	15.9
X – Germ Cell & Trophoblastic Tumors & Neoplasms of Gonads‡	49	7.2	21	3.1	47	6.9	157	22.8
XI – Other Malignant Epithelial Neoplasms & Malignant Melanoma	9	1.3	29	4.3	74	10.8	280	40.6
XII – Other & Unspecified Malignant Neoplasms	<5	~	<5	~	<5	~	6	~

* Average annual rate per million.
† Grouped according to the International Classification of Childhood Cancer (ICCC) based on ICD-O-3/WHO 2008.
‡ Group III, Group III subgroups, and subgroup Xa include benign brain/CNS tumors.
~ Rates are not calculated where the count is less than sixteen, due to reliability of the rate.

Childhood Cancer Incidence Rates by Georgia Public Health District

- Among the Georgia Public Health Districts, childhood cancer incidence rates ranged from 146 per million to 213 per million *(Figure 3)*.
- Public Health Districts 1-1, 1-2, 2, 3-1, 4, 5-2, and 10 had significantly higher rates than the overall state average, while Districts 3-2, 3-3, 3-4, 3-5, 5-1, 7, 8-1, 8-2, and 9-2 had significantly lower rates.
- See Appendix C for a list of counties included in each Public Health District.

Figure 3. Age-Adjusted Childhood Cancer Incidence Rates*† by Georgia Public Health District, Ages 0 to 19 Years, Georgia, 2004-2013

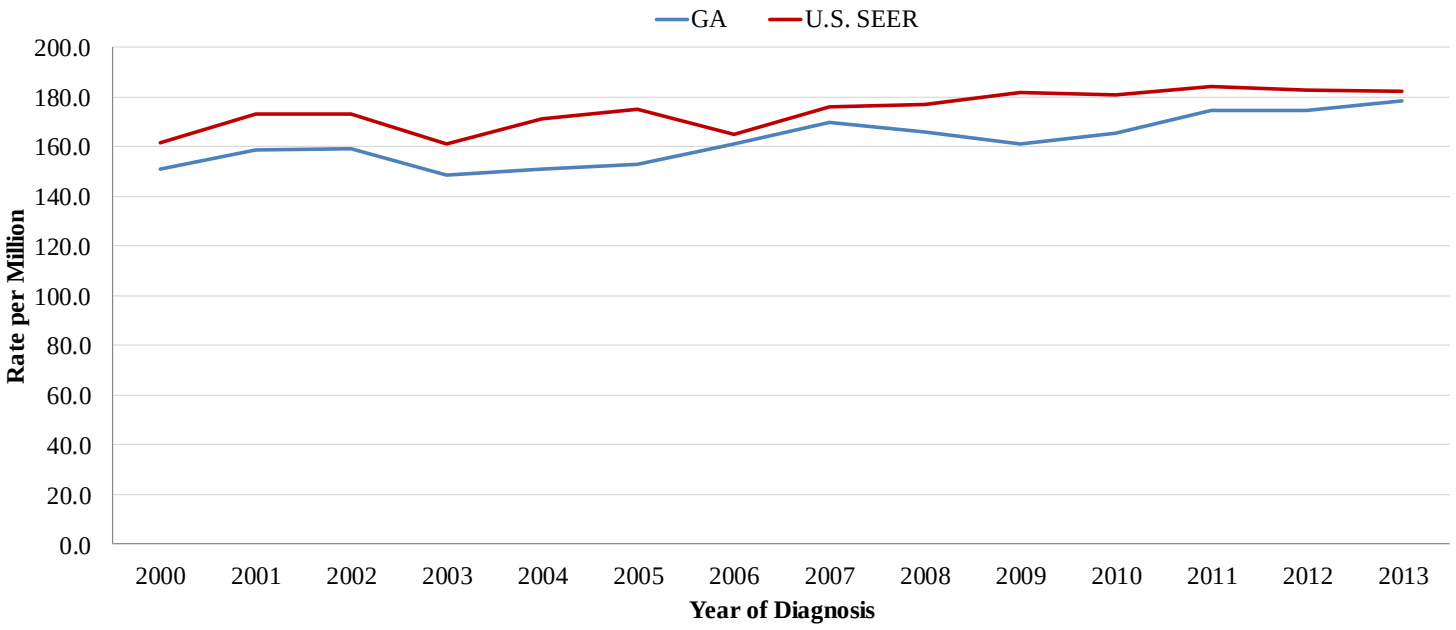


* Average annual rate per million, age-adjusted to the 2000 US standard population.
† All ICCC groups combined including benign brain/CNS tumors.
‡ Rate is significantly higher or lower than the state rate (p<.05).

Trends in Childhood Cancer Incidence in Georgia

In Georgia, incidence rates for all childhood cancers combined increased at an average rate of about 1.2% per year from 2000 to 2013 (*Figure 4*). This increase mimics national trends, but the reasons behind it are unclear.

Figure 4. Childhood Cancer Incidence Rates*†, All Types, Ages 0 to 19 Years, Georgia vs U.S. SEER‡, 2000-2013



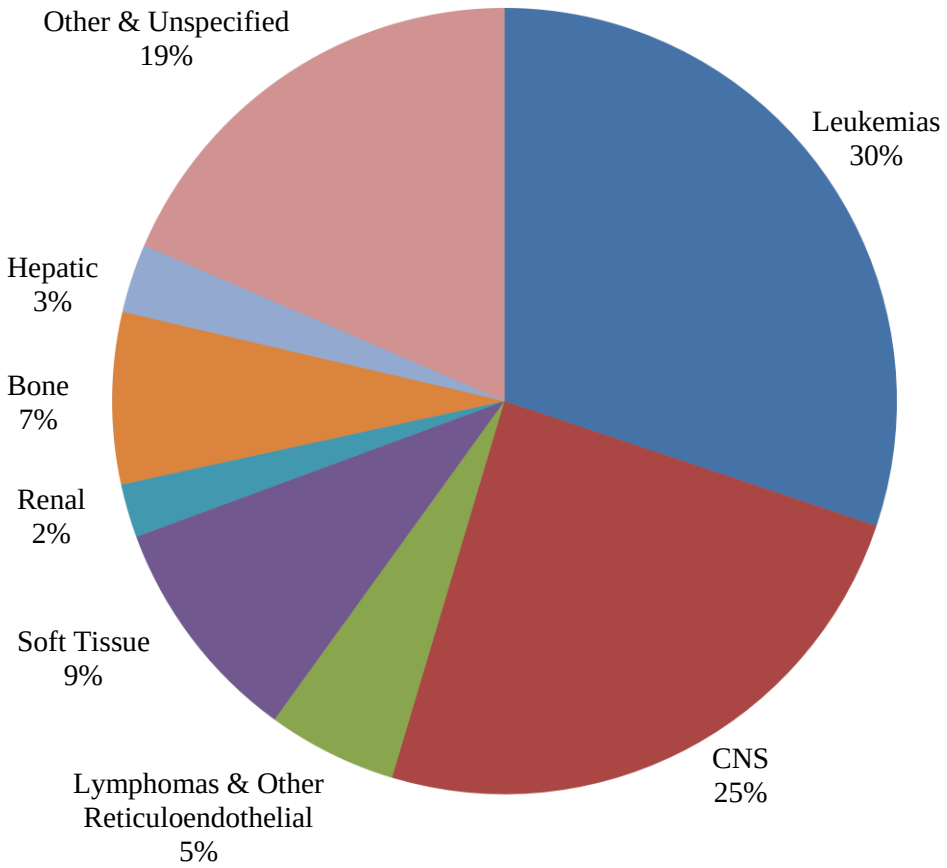
* Annual rate per million, age-adjusted to the 2000 US standard population.
† All ICCC groups combined excluding benign brain/CNS tumors.
‡ United States Surveillance, Epidemiology, and End Results Program

Childhood Cancer Mortality

Childhood Cancer Mortality in Georgia

- Leukemias are the most common cause of childhood cancer deaths, accounting for 30% of all childhood cancer deaths in Georgia between 2003 and 2013* *(Figure 5).*
- Central nervous system (CNS) cancers are the second most common cause, responsible for 25% of all childhood cancer deaths.
- Between 2003 and 2013*, there were 637 cancer deaths among Georgia's children aged 0 to 19 years. The age-adjusted rate for this time period was 23.5 per million *(Table 5).*
- The highest cancer mortality rate among children aged 0 to 19 years was for leukemias (7.1 per million), followed by CNS cancers with a rate of 5.8 per million.
- Overall, male children had a higher cancer mortality rate than females. This difference was most apparent for lymphomas and bone cancers.
- Cancer mortality was highest among children in the 15 to 19 year old age group *(Table 6).*
- In the younger age groups, leukemias and CNS cancers account for the majority of childhood cancer deaths. As age progresses, other types of cancers begin to claim more children's lives, but leukemias and CNS cancers remain the most common causes of cancer death throughout childhood.

Figure 5. Childhood Cancer Mortality, Ages 0 to 19 Years, Georgia, 2003-2013*



* Because of data quality issues, 2009 cancer death data are not used for analysis. This report includes data for 2003-2008 and 2010-2013 combined.

Table 5. Age-Adjusted Childhood Cancer Mortality Rates*, Ages 0 to 19 Years, Georgia, 2003-2013†

	Both Sexes		Males		Females	
	Deaths	Rate	Deaths	Rate	Deaths	Rate
All Types	637	23.5	352	25.5	285	21.4
Leukemias	192	7.1	103	7.5	89	6.7
CNS	156	5.8	84	6.1	72	5.4
Lymphomas & Other Reticuloendothelial	34	1.3	22	1.6	12	~
Soft Tissue	60	2.2	33	2.3	27	2.0
Renal	14	~	5	~	9	~
Bone	45	1.7	32	2.3	13	~
Hepatic	18	0.6	9	~	9	~
Other & Unspecified	118	4.3	64	4.6	54	4.0

* Average annual rate per million, age-adjusted to the 2000 US standard population.
† Because of data quality issues, 2009 cancer death data are not used for analysis. This report includes data for 2003-2008 and 2010-2013 combined.
~ Rates are not calculated where the count is less than sixteen, due to reliability of the rate.

Table 6. Age-Specific Childhood Cancer Mortality Rates*, Ages 0 to 19 Years, Georgia, 2003-2013†

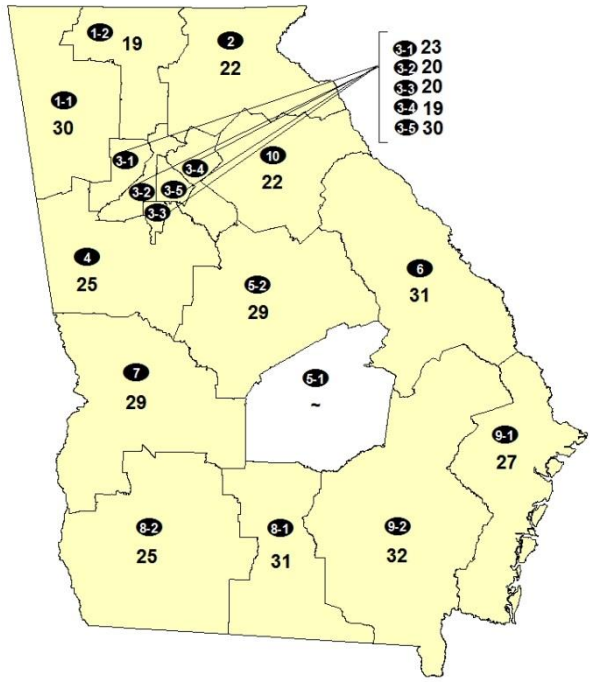
	Ages 0-4		Ages 5-9		Ages 10-14		Ages 15-19	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
All Types	152	22.5	138	20.9	134	19.7	213	31.3
Leukemias	45	6.7	34	5.1	49	7.2	64	9.4
CNS	41	6.1	48	7.3	32	4.7	35	5.1
Lymphomas & Other Reticuloendothelial	<5	~	<5	~	9	~	22	3.2
Soft Tissue	12	~	11	~	6	~	31	4.6
Renal	<5	~	7	~	<5	~	<5	~
Bone	<5	~	<5	~	11	~	31	4.6
Hepatic	9	~	<5	~	<5	~	<5	~
Other & Unspecified	41	6.1	31	4.7	21	3.1	25	3.7

* Average annual rate per million.
† Because of data quality issues, 2009 cancer death data are not used for analysis. This report includes data for 2003-2008 and 2010-2013 combined.
~ Rates are not calculated where the count is less than sixteen, due to reliability of the rate.

Childhood Cancer Mortality Rates by Georgia Public Health District

- Among the Georgia Public Health Districts, childhood cancer mortality rates ranged from 19 per million to 32 per million *(Figure 6).*
- No Public Health District had a mortality rate significantly higher or lower than the state rate.
- A rate was not calculated for Public Health District 5-1 because there were fewer than sixteen deaths.
- See Appendix C for a list of counties included in each Public Health District.

Figure 6. Age-Adjusted Childhood Cancer Mortality Rates* by Georgia Public Health District, Ages 0 to 19 Years, Georgia, 2003-2013†

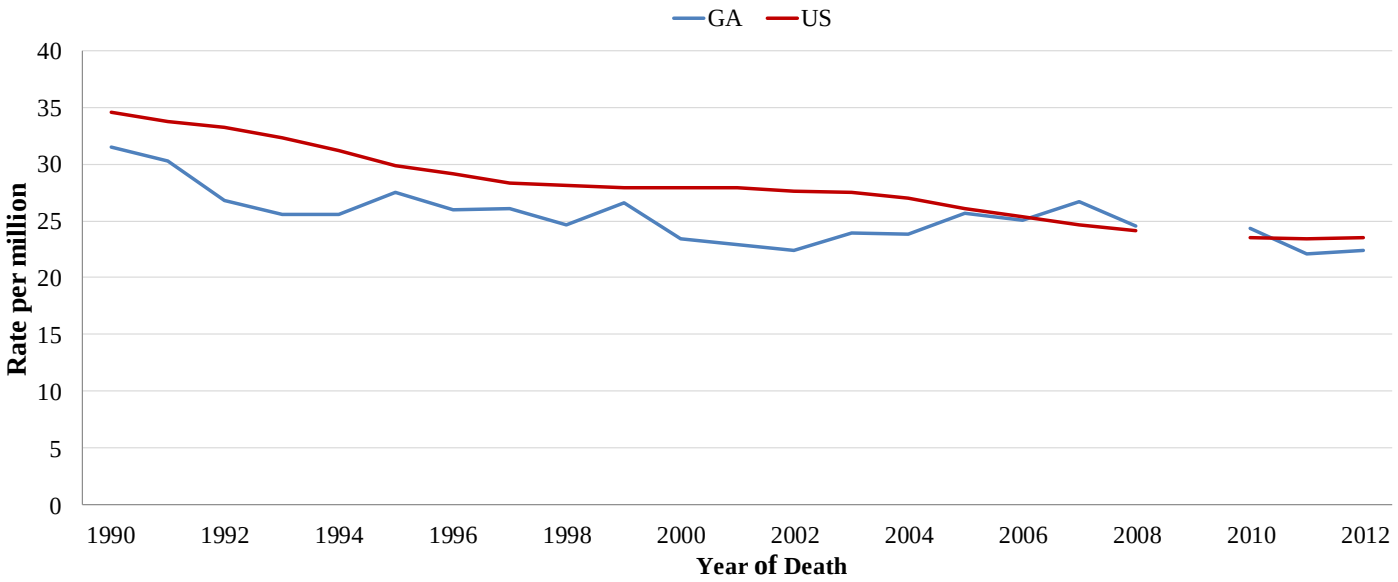


* Average annual rate per million, age-adjusted to the 2000 US standard population.
† Because of data quality issues, 2009 cancer death data are not used for analysis. This report includes data for 2003-2008 and 2010-2013 combined.
~ Rates are not calculated where the count is less than sixteen, due to reliability of the rate.

Trends in Childhood Cancer Mortality in Georgia

In Georgia, mortality rates for all childhood cancers combined decreased at an average rate of about 2.8% per year from 1970 to 1990. Since 1990, cancer mortality rates have decreased at a more modest pace of 1.0% per year among Georgia children *(Figure 7)*. Nationally, childhood cancer mortality rates decreased by about 3.1% per year from 1970 to 1990, followed by a decrease of 1.7% per year. This decrease results from improvements in survival for most childhood cancers, especially leukemia and lymphoma. The availability of newer, more effective chemotherapy is the principal reason for improved survival among childhood cancer patients.

Figure 7. Childhood Cancer Mortality Rates*, All Types, Ages 0 to 19 Years, Georgia, 1990-2012†



* Rolling 3-year average rate per million, age-adjusted to the 2000 US standard population
† Because of data quality issues, 2009 cancer death data are not used for analysis. This report includes data for 2003-2008 and 2010-2013 combined.
Please note: Implementation of ICD-10 occurred in 1999. The comparability ratio for malignant neoplasms is 1.0068. No adjustments were made to the data to take this into account.

Childhood Cancer Survival

- Overall, Georgia childhood cancer survival rates were similar to U.S. SEER survival rates for cancers diagnosed between 2006 and 2012 *(Table 7)*.
- Among Georgia's male children, those diagnosed with renal tumors fared 12 percent better than U.S. males; those with soft tissue sarcomas fared 7 percent better; and those with germ cell tumors fared 5 percent worse than U.S. males.
- Among Georgia's female children, those diagnosed with bone tumors fared 12 percent better than U.S. females; those with peripheral nervous system tumors fared 6 percent better; and those with hepatic tumors fared 39 percent worse than U.S. females.
- Overall survival among females was slightly better than that for males, but this varied by cancer type.
- In Georgia, children with retinoblastoma had the highest survival rate (94.8 percent), while children with hepatic tumors had the lowest (63.3 percent).

Table 7. Five-Year Relative Childhood Cancer Survival Rates, Ages 0 to 19 Years, Georgia and U.S. SEER*, 2006-2012

	State of Georgia			U.S. SEER		
	Total	Males	Females	Total	Males	Females
All ICCC† Groups Combined Excluding Benign Brain/CNS Tumors	83.0	82.1	84.1	83.3	82.1	84.7
All ICCC Groups Combined Including Benign Brain/CNS Tumors‡	83.0	82.0	84.1	83.3	82.2	84.7
I – Leukemias, Myeloproliferative & Myelodysplastic Diseases	82.0	81.4	82.6	83.0	82.7	83.4
II – Lymphomas & Reticuloendothelial Neoplasms	92.3	93.1	90.6	93.2	93.0	93.4
III – Central Nervous System & Misc. Intracranial & Intraspinal Neoplasms‡	72.3	68.2	76.5	73.8	73.0	74.8
IV – Neuroblastoma & Other Peripheral Nervous Cell Tumors	82.9	80.9	86.4	79.5	78.0	81.2
V – Retinoblastomas	94.8	97.4	92.5	95.3	94.2	96.5
VI – Renal Tumors	92.4	97.4	87.5	89.2	87.2	91.1
VII – Hepatic tumors	63.3	75.1	45.7	72.4	71.3	74.6
VIII – Malignant Bone Tumors	75.8	71.4	81.8	70.7	69.1	73.0
IX – Soft Tissue & Other Extraosseous Sarcomas	76.8	75.7	78.0	72.3	70.5	74.5
X – Germ Cell & Trophoblastic Tumors & Neoplasms of Gonads‡	87.2	87.7	86.8	92.4	92.8	91.6

* United States Surveillance, Epidemiology, and End Results (SEER) Program.
† Grouped according to the International Classification of Childhood Cancer (ICCC) based on ICD-O-3/WHO 2008.
‡ Group III, Group III subgroups, and subgroup Xa include benign brain/CNS tumors.

Central Nervous System Tumors in Children

What is it?

The central nervous system (CNS) includes the brain and spinal cord.[2] Both malignant and benign CNS tumors are capable of causing damage that is often disabling and sometimes fatal. The major distinction is how readily they spread and whether they can be removed and not come back. In Georgia, about two-thirds of childhood CNS tumors are malignant; the rest are benign. The Georgia Comprehensive Cancer Registry has been collecting data on benign CNS tumors since 2004 and the current report discusses both malignant and benign tumors.

CNS tumors constitute about 24% of all cancers in U.S. children under the age of twenty. Survival for children with CNS tumors is poorest among infants but improves with age. U.S. five-year relative survival rates have improved over time to 74%.

Types of CNS Tumors

The brain consists of various kinds of tissues and cells. Different types of tumors can start in these diverse tissue and cell types. All of these tumors have varying outlooks for survival and may be treated differently.

About 36% of all CNS tumors among Georgia's children start in cells called astrocytes and are called astrocytomas. Most can spread widely throughout normal brain tissue, making them very hard to remove by surgery. Some special types of low-grade tumors called non-infiltrating astrocytomas have a good prognosis.

About 6% of CNS tumors in Georgia's children are ependymomas. These tumors start in the cells that line the ventricles and spinal canal. Ependymomas do not spread outside the brain or spinal cord, nor do they infiltrate normal brain tissue. As a result, some (but not all) of these tumors can be removed and cured by surgery.

Medulloblastomas tend to grow quickly and spread throughout the spinal canal and meninges. They account for about 8% of Georgia's childhood CNS tumors and can often be treated effectively.

Risk Factors and Prevention

Few risk factors for CNS tumors have been found and there is no clear cause for most CNS tumors. The only established environmental risk factor for brain tumors is ionizing radiation to the head, usually given for the treatment of other cancers.

Rare cases of brain and spinal cord tumors run in families. In general, persons with familial tumor syndromes have multiple tumors that occur when they are young. These syndromes include Von Hippel-Lindau disease, neurofibromatosis, tuberous sclerosis, and Li-Fraumeni syndrome.

CNS Tumor Incidence in Georgia Children

- CNS tumors rank first among cancer diagnoses for children ages 0 to 19 years in Georgia, accounting for 25% of all childhood cancer incidence *(Figure 2)*.
- Between 2004 and 2013, there was an average of 126 cases per year of CNS tumors in children. The age-adjusted rate was 46.2 per million. This is similar to the U.S. SEER rate of 45.8 per million *(Appendix D)*.
- Females were about 15% more likely than males to be diagnosed with malignant CNS cancer *(Table 3)*.
- The highest rates were among children in the youngest and oldest age groups *(Table 4)*.
- The five-year relative survival rate for children diagnosed with CNS tumors between 2006 and 2012 was 72.3% *(Table 7)*.

CNS Cancer Mortality in Georgia Children

- CNS cancer ranks second among cancer deaths for children ages 0 to 19 years in Georgia, accounting for 25% of all childhood cancer mortality *(Figure 5)*.
- Between 2003 and 2013*, there was an average of 16 deaths per year from CNS cancer among children. The age-adjusted rate was 5.8 per million *(Table 5)*.
- Males were about 13% more likely than females to die from CNS cancer *(Table 5)*.
- The highest rates were among children between ages 5 and 9 years *(Table 6)*.

[2] *Brain and Spinal Cord Tumors in Children*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/braincnstumorsinchildren/detailedguide/index

* Death data are for 2003-2008 and 2010-2013 combined.

Childhood Leukemia

What is it?
Leukemia is a cancer of the blood-forming cells.[3] Most often, it involves the white blood cells, but it can involve other blood cell types as well. Leukemia starts in the bone marrow and then spreads to the blood. From there it can go to the lymph nodes, spleen, liver, central nervous system, or other organs.

In the United States, leukemia is the most common cancer in children and adolescents, accounting for about 1 in 4 cancers in children under age twenty. Thanks to advances in therapy, five-year survival rates have greatly increased over time. Prognosis depends on the specific type of leukemia and other factors such as age, white blood cell count, sex, race, genetics, and response to treatment.

Types of Childhood Leukemia
Leukemia can be classified as either fast growing (acute), or slower growing (chronic). Almost all leukemia in children is acute. Acute leukemia is divided into 2 types – acute lymphocytic leukemia (ALL) and acute myelogenous leukemia (AML).

Nearly 3 out of 4 childhood leukemias are ALL. U.S. five-year relative survival for children with ALL is 88%. AML represents most of the remaining leukemias in children. U.S. five-year relative survival for children with AML is 63%.

Risk Factors and Prevention
The exact cause of most cases of leukemia is not known, but doctors have found that this cancer is linked to a number of risk factors.

Certain genetic diseases that cause children to be born with an abnormal immune system and other genetic conditions such as Li-Fraumeni syndrome, Down syndrome, and neurofibromatosis carry an increased risk of leukemia.

If an identical twin develops childhood leukemia, the other twin has about a 1 in 5 chance of getting leukemia as well. This risk is even higher if the leukemia develops in the first year of life. Twins who are not identical and other brothers and sisters have a slightly increased risk.

Exposure to high levels of radiation is another known risk factor for childhood leukemia. Children and adults who were treated with radiation therapy or chemotherapy for other cancers are at slightly increased risk for developing a second cancer, usually AML, later in life. Patients who are taking drugs to suppress their immune systems (mainly organ transplant patients) are also at increased risk for leukemia.

It is important to remember that most children with leukemia do not have any known risk factors, and there is no known way to prevent most cases.

Leukemia Incidence in Georgia Children

- Leukemia ranks second among cancer diagnoses for children ages 0 to 19 years in Georgia, accounting for 23% of all childhood cancer incidence *(Figure 2)*.
- Between 2004 and 2013, there was an average of 113 cases per year of leukemia in children. The age-adjusted rate was 41.1 per million. This is significantly lower than the U.S. SEER rate of 48.8 per million *(Appendix D)*.
- Males were 17% more likely than females to be diagnosed with leukemia *(Table 3)*.
- The highest rates were among children under age five years *(Table 4)*.
- The five-year relative survival rate for children diagnosed with leukemia between 2006 and 2012 was 82.0% *(Table 7)*.

Leukemia Mortality in Georgia Children

- Leukemia ranks first among cancer deaths for children ages 0 to 19 years in Georgia, accounting for 30% of all childhood cancer mortality *(Figure 5)*.
- Between 2003 and 2013*, there was an average of 19 deaths per year from leukemia among children. The age-adjusted rate was 7.1 per million *(Table 5)*.
- Males were 12% more likely than females to die from leukemia *(Table 5)*.
- The highest rates were among children between ages 15 and 19 years *(Table 6)*.

[3] *Childhood Leukemia*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/leukemiainchildren/detailedguide/index

* Death data are for 2003-2008 and 2010-2013 combined.

Childhood Lymphoma

What is it?
Lymphoma is a cancer that starts in lymph tissue and is divided into two main types: Hodgkin lymphoma and non-Hodgkin lymphoma (NHL).[4] Non-Hodgkin lymphoma differs significantly from Hodgkin lymphoma in behavior, pathology, spread, and responsiveness to treatment.

Hodgkin lymphoma accounts for about 6% of childhood cancers. It is rare among young children and becomes more common among teens and young adults. The U.S. five-year relative survival rate is 97%.

NHL makes up about 5% of childhood cancers. It is more likely to occur in younger children than is Hodgkin lymphoma, but it is still rare in children younger than 3. The U.S. five-year relative survival rate is 88%.

Types of Childhood NHL
Precursor cell lymphomas (also called lymphoblastic lymphomas) account for 34% of NHL among Georgia's children. It is most common among children ages 5 to 9 years old, and boys are affected twice as often as girls. It can grow very rapidly and often interferes with breathing, so it needs to be diagnosed and treated quickly.

Burkitt lymphoma accounts for 18% of childhood NHL in Georgia. It is most often seen in boys around the age of 5 to 10 years old. Burkitt lymphoma nearly always starts in the abdomen and is one of the fastest growing cancers known. It may spread to other organs including the brain and must be treated quickly.

Mature cell lymphomas (also called large cell lymphomas) account for 40% of all NHL in Georgia's children. It occurs most often among children between ages 15 and 19 years, and boys are about 57% more likely than girls to be diagnosed. Unlike the other types, it seldom spreads to the bone marrow or brain, nor does it grow as quickly.

Risk Factors and Prevention
The exact cause of lymphoma is not known. Researchers have found that this cancer is associated with a number of other conditions, but most children with lymphoma do not have any known risk factors.

Epstein-Barr virus (EBV) infection is associated with an increased risk for some lymphomas, but its role is unclear. Immunodeficiency due to HIV infection, organ transplant, or congenital syndromes has also been associated with an increased risk. Boys are affected more often than girls.

Lymphoma Incidence in Georgia Children
- Lymphoma ranks third among cancer diagnoses for children ages 0 to 19 years in Georgia, accounting for 14% of all childhood cancer incidence *(Figure 2)*.
- Between 2004 and 2013, there was an average of 71 cases per year of lymphoma in children. The age-adjusted rate was 26.0 per million. This is similar to the U.S. SEER rate of 26.4 per million *(Appendix D)*.
- Males were 60% more likely than females to be diagnosed with lymphoma *(Table 3)*.
- The highest rates were among children between ages 15 and 19 years *(Table 4)*.
- The five-year relative survival rate for children diagnosed with lymphoma between 2006 and 2012 was 92.3% *(Table 7)*.

Lymphoma Mortality in Georgia Children
- Lymphoma ranks fifth among cancer deaths for children ages 0 to 19 years in Georgia, accounting for 5% of all childhood cancer mortality *(Figure 5)*.
- Between 2003 and 2013*, there was an average of 3 deaths per year from lymphoma among children. The age-adjusted rate was 1.3 per million *(Table 5)*.
- Males were more likely than females to die from lymphoma *(Table 5)*.
- The greatest number of deaths was among children between ages 15 and 19 years *(Table 6)*.

[4] *Non-Hodgkin Lymphoma in Children*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/non-hodgkinlymphomainchildren/detailedguide/index

* Death data are for 2003-2008 and 2010-2013 combined.

Soft Tissue Sarcoma in Children

What is it?
Sarcomas are cancers that develop from connective tissues in the body, such as muscles, fat, membranes that line the joints, or blood vessels.[5] Rhabdomyosarcoma, the most common soft tissue sarcoma in children, is a cancer made up of cells that normally develop into skeletal muscles of the body.

Most rhabdomyosarcomas are diagnosed in children and teens. More than half of all rhabdomyosarcomas are diagnosed in children younger than 10 years old.

The exact prognosis for each child with rhabdomyosarcoma depends on many factors. The U.S. five-year survival rate is 66%. The rate varies somewhat based on tumor location, stage, and the age of the child (with children aged 1 to 9 years tending to do better than older or younger children).

Types of Rhabdomyosarcoma
The most common type of rhabdomyosarcoma is embryonal rhabdomyosarcomas (ERMS). These cancers generally occur in the head and neck area or in the genital and urinary tracts. They usually affect infants and young children.

The second main type, alveolar rhabdomyosarcoma (ARMS), affects all age groups and is found more often in the large muscles of the arms, legs, or trunk.

Risk Factors and Prevention
Rhabdomyosarcoma is like most other childhood cancers in that there are no known environmental or lifestyle risk factors associated with it. However, there is evidence of an increased risk for rhabdomyosarcoma from genetic disorders including Li-Fraumeni syndrome, Beckwith-Wiedemann syndrome, neurofibromatosis, Costello syndrome, and Noonan syndrome.

Because no avoidable or modifiable risk factors have yet been found, there is no known way to prevent rhabdomyosarcoma.

Soft Tissue Sarcoma Incidence in Georgia Children

- Soft tissue sarcoma ranks fourth among cancer diagnoses for children ages 0 to 19 years in Georgia, accounting for 7% of all childhood cancer incidence *(Figure 2)*.
- Between 2004 and 2013, there was an average of 35 cases per year of soft tissue sarcoma in children. The age-adjusted rate was 12.9 per million. This is higher than the U.S. SEER rate of 12.2 per million, but this difference is not significant *(Appendix D)*.
- Males were 20% more likely than females to be diagnosed with soft tissue sarcoma *(Table 3)*.
- The highest rates were among children between ages 15 and 19 years *(Table 4)*.
- The five-year relative survival rate for children diagnosed with soft tissue sarcoma between 2006 and 2012 was 76.8% *(Table 7)*.

Soft Tissue Sarcoma Mortality in Georgia Children

- Soft tissue sarcoma ranks third among cancer deaths for children ages 0 to 19 years in Georgia, accounting for 9% of all childhood cancer mortality *(Figure 5)*.
- Between 2003 and 2013*, there was an average of 6 deaths per year from soft tissue sarcoma among children. The age-adjusted rate was 2.2 per million *(Table 5)*.
- Males were 15% more likely than females to die from soft tissue sarcoma *(Table 5)*.
- The greatest number of deaths was among children between ages 15 and 19 years *(Table 6)*.

[5] *Rhabdomyosarcoma*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/rhabdomyosarcoma/detailedguide/index

* Death data are for 2003-2008 and 2010-2013 combined.

Neuroblastoma in Children

What is it?
Neuroblastoma is a form of cancer that occurs in infants and young children.[6] It is rarely found in children older than 10 years. These tumors start in early nerve cells (neuroblasts) of the sympathetic nervous system, so they can be found anywhere along this system.

A little more than a third of neuroblastomas start in the adrenal glands. About one fourth begin in sympathetic nerve ganglia in the abdomen. Most of the rest start in sympathetic ganglia near the spine in the chest or neck, or in the pelvis.

Neuroblastoma accounts for about 4% of all cancers in U.S. children. It is the most common cancer in infants less than one year old. Nearly 90% of cases are diagnosed by age five and it is extremely rare in people over the age of ten. The U.S. five-year survival rate is 79%. Prognosis depends on how far the tumor has spread, the age of the child, tumor grade (how it looks under a microscope), and other laboratory tests.

Ganglioneuromas and Ganglioneuroblastomas
Ganglioneuromas are benign tumors composed of mature ganglion and nerve sheaths that do not continue to grow. They are usually removed by surgery and carefully examined under a microscope to be certain they do not have areas of malignancy.

Ganglioneuroblastoma is a tumor that has both malignant and benign parts. It contains neuroblasts that can grow and spread abnormally, as well as areas of benign tissue that are similar to ganglioneuroma.

Risk Factors and Prevention
Neuroblastomas have not been associated with any environmental or lifestyle risk factors. In about 1% to 2% of cases, children inherit an increased risk of developing neuroblastoma. This rare form of the disease, called familial neuroblastoma, may occur among families with one or more members who had neuroblastoma as infants. Familial cases differ from sporadic cases in age of onset and patterns of spread.

Because there are no avoidable risk factors for neuroblastoma, there is no proven way to prevent this cancer. If there is a family history of neuroblastoma, genetic counseling may be considered.

Peripheral Nerve Cell Cancer Incidence in Georgia Children

- Peripheral nerve cell cancer ranks sixth among cancer diagnoses for children ages 0 to 19 years in Georgia, accounting for 5% of all childhood cancer incidence *(Figure 2)*.
- Between 2004 and 2013, there was an average of 24 cases per year of peripheral nerve cell cancer in children. The age-adjusted rate was 8.7 per million. This is higher than the U.S. SEER rate of 8.2 per million, but this difference is not significant *(Appendix D)*.
- Males were 40% more likely than females to be diagnosed with peripheral nerve cell cancer *(Table 3)*.
- The majority of cases occurred among children under age five years *(Table 4)*.
- The five-year relative survival rate for children diagnosed with peripheral nerve cell cancer between 2006 and 2012 was 82.9% *(Table 7)*.

Peripheral Nerve Cell Cancer Mortality in Georgia Children

- Due to ICD coding limitations, we were unable to produce mortality rates for peripheral nerve cell cancer.

[6] *Neuroblastoma*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/neuroblastoma/detailedguide/index

Bone Cancer in Children

What is it?
Osteosarcoma is the most common type of cancer that starts in the bone.[7] Most osteosarcomas occur in children and young adults. Teenagers are the most commonly affected age group, but osteosarcoma can occur at any age. It usually develops in areas where the bone is growing quickly, such as near the ends of the long bones, especially around the knee and sometimes the shoulder. The U.S. five-year relative survival rate is about 67%, depending on whether the tumor has spread and how it responds to treatment.

The Ewing family of tumors (EFT) accounts for about 2% of all childhood cancers.[8] EFT is a group of cancers that start in the bones or nearby soft tissue that share some common features. They can occur at any age, but these tumors are most common in early teenage years. U.S. five-year survival is 72%.

Risk Factors and Prevention
The exact cause of most osteosarcomas is not known. The risk of osteosarcoma is highest during the teenage "growth spurt", suggesting a relationship between rapid bone growth and risk of tumor formation. People who were treated with radiation, especially at a young age, for another cancer have a higher risk of later developing osteosarcoma. Certain non-cancerous bone diseases, such as Paget disease of the bone and hereditary multiple osteochondromas, increase the risk for developing osteosarcoma. Also at an increased risk are children with retinoblastoma, Li-Fraumeni syndrome, or Rothmund-Thomson syndrome.

Studies of children with EFT have not found risk factors linked to radiation, chemicals, or any other environmental exposures. Nor is EFT passed along within families. Scientists have found few factors related to the risk of developing EFT. EFT occurs most often in the white population and is rare among African Americans and Asian Americans. The reason is not known.

Bone Cancer Incidence in Georgia Children

- Bone cancer ranks seventh among cancer diagnoses for children ages 0 to 19 years in Georgia, accounting for 5% of all childhood cancer incidence *(Figure 2)*.
- Between 2004 and 2013, there was an average of 24 cases per year of bone cancer in children. The age-adjusted rate was 8.7 per million. This is lower than the U.S. SEER rate of 9.0 per million, but this difference is not significant *(Appendix D)*.
- Males were 20% more likely than females to be diagnosed with bone cancer *(Table 3)*.
- The highest rates were among children between ages 15 and 19 years *(Table 4)*.
- The five-year relative survival rate for children diagnosed with bone cancer between 2006 and 2012 was 75.8% *(Table 7)*.

Bone Cancer Mortality in Georgia Children

- Bone cancer ranks fourth among cancer deaths for children ages 0 to 19 years in Georgia, accounting for 7% of all childhood cancer mortality *(Figure 5)*.
- Between 2003 and 2013*, there was an average of 5 deaths per year from bone cancer among children. The age-adjusted rate was 1.7 per million *(Table 5)*.
- Males were more likely than females to die from bone cancer *(Table 5)*.
- The greatest number of deaths was among children between ages 15 and 19 years *(Table 6)*.

[7] *Osteosarcoma*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/osteosarcoma/detailedguide/index
[8] *Ewing Family of Tumors*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/ewingfamilyoftumors/detailedguide/index

* Death data are for 2003-2008 and 2010-2013 combined.

Renal Cancer in Children

What is it?
Wilms tumor (also called nephroblastoma) is the most common type of renal (kidney) cancer in children.[9] About 9 of 10 kidney tumors that occur in children are Wilms tumors. The average age at diagnosis is about 3 to 4 years. It becomes less common as children grow older and is uncommon after age 6. The U.S. five-year relative survival rate for children with Wilms tumor is 91%.

Types of Wilms Tumor
Wilms tumors are classified into two major types depending on how they look under the microscope. These two categories differ in prognosis and treatment.

Wilms tumors of unfavorable appearance contain anaplasia, characterized by the presence of large, irregular nuclei in the tumor's cells. The more anaplasia, the less the chance for a cure.

Wilms tumors of favorable appearance do not contain anaplasia. Patients with these tumors usually have a much better outlook for cure. More than nine of ten Wilms tumors have a favorable appearance.

Risk Factors and Prevention
So far, research has not found any strong links between Wilms tumor and environmental factors, either during a mother's pregnancy or after a child's birth. A small number of children with Wilms tumor have a relative with the same cancer. There is a strong link between Wilms tumors and certain kinds of birth defects. But most children with Wilms tumors do not have any known gene changes or birth defects.

Renal Cancer Incidence in Georgia Children

- Renal cancer ranks eighth among cancer diagnoses for children ages 0 to 19 years in Georgia, accounting for 4% of all childhood cancer incidence *(Figure 2)*.
- Between 2004 and 2013, there was an average of 21 cases per year of renal cancer in children. The age-adjusted rate was 7.4 per million. This is higher than the U.S. SEER rate of 6.5 per million, but this difference is not significant *(Appendix D)*.
- Females were 10% more likely than males to be diagnosed with renal cancer *(Table 3)*.
- The highest rates were among children under age five years *(Table 4)*.
- The five-year relative survival rate for children diagnosed with renal cancer between 2006 and 2012 was 92.4% *(Table 7)*.

Renal Cancer Mortality in Georgia Children

- Renal cancer ranks eighth among cancer deaths for children ages 0 to 19 years in Georgia, accounting for 2% of all childhood cancer mortality *(Figure 5)*.
- Between 2003 and 2013*, there was an average of 1 death per year from renal cancer among children *(Table 5)*.
- Females were more likely than males to die from renal cancer *(Table 5)*.
- The greatest number of deaths was among children between ages 5 and 9 years *(Table 6)*.

[9] *Wilms Tumor*. (2016). Retrieved February 16, 2016 from http://www.cancer.org/cancer/wilmstumor/detailedguide/index

* Death data are for 2003-2008 and 2010-2013 combined.

Conclusions

Childhood cancers are uncommon but they remain an important public health issue. The information in this report summarizes current incidence, mortality, and survival rates for childhood cancers in Georgia. It also provides short summaries about what is known about the more common types of childhood cancers. The information will be useful to many individuals concerned about cancer such as public health workers, health care providers, volunteer workers and groups, and families and friends of children with cancer. The report also calls attention to needed actions.

To reduce the incidence and mortality from childhood cancers, several steps are being taken:

Search for causes so that childhood cancer can be prevented. The cause or causes of most childhood cancers are unknown, making preventive actions impossible. The search for causes is difficult because the cancers are rare. However, more research needs to be conducted on childhood cancers in Georgia so that we may shed light on the causes of childhood cancer.

Assure that every child with cancer in Georgia has access to the best treatment. In recent decades, the treatment of childhood cancers has improved markedly. Presently more than 80% of children with cancer survive 5 years or more. Much of this dramatic improvement is due to the development of improved therapies at children's cancer centers, where the majority of children with cancer have their treatment.

Improve the quality of information about childhood cancer in Georgia. In 2002, when this report was first published, accurate and reliable information about childhood cancer in Georgia was available for only 26 counties. The quality of information reported by hospitals and other cancer care providers to the Georgia Cancer Registry has improved so that we now have accurate and reliable information about childhood cancer for the entire state. Efforts to achieve accurate and reliable information are ongoing and the quantity of available data continues to improve over time.

Thus, by participating in the search for causes, by assuring access to appropriate treatment, and by improving the quality of information contained in the Georgia Cancer Registry, Georgians will be participating in efforts to reduce the burden of childhood cancers, a group of uncommon but devastating illnesses.

Technical Notes

Definitions:
Age-adjusted rate: A rate calculated in a manner that allows for the comparison of rates derived from populations with different age structures.
Cancer incidence: The number of new cancer cases occurring in a population during a specified period of time. For childhood cancer, this is expressed as a rate per million population.
Cancer mortality: The number of cancer deaths occurring in a population during a specified period of time. For childhood cancer, this is expressed as a rate per million population.
Relative survival rate: A net survival measure representing cancer survival in the absence of other causes of death.

Data Sources:
The number of deaths and mortality rates for the state of Georgia for 2003-2008 and 2010-2013 were obtained from the Georgia Department of Public Health, Office of Vital Records. Mortality data were coded using ICD-10 codes. A list of the cancer groupings used for this publication can be found in Appendix B.

The number of new cases and incidence rates for the state of Georgia for 2004-2013 were obtained from the Georgia Department of Public Health, Division of Health Protection, Epidemiology Program, Georgia Comprehensive Cancer Registry. Incidence data were coded using ICD-O-3 codes. The International Classification of Childhood Cancer (ICCC) site recode ICD-O-3/WHO 2008 groupings were used. For more information on this classification scheme, please visit the Surveillance, Epidemiology, and End Results (SEER) Program on the web at http://seer.cancer.gov/iccc/.

Childhood cancer incidence trend and survival data for Georgia and the United States were obtained from the SEER Program (www.seer.cancer.gov) SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2015 Sub (2000-2013) <Katrina/Rita Population Adjustment> - Linked To County Attributes - Total U.S., 1969-2014 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2016, based on the November 2015 submission. Incidence and survival data were categorized using the ICCC site recode ICD-O-3/WHO 2008. At present, SEER*Stat provides the most comprehensive and flexible method for analyzing childhood cancer incidence and survival data at the national level.

Childhood cancer mortality trend data for Georgia and the United States were obtained from the SEER Program (www.seer.cancer.gov) SEER*Stat Database: Mortality - All COD, Aggregated With State, Total U.S. (1969-2013) <Katrina/Rita Population Adjustment>, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2016. Underlying mortality data provided by NCHS (www.cdc.gov/nchs). Cause of death was categorized using the cause of death recode. All malignant cancers were included.

Population estimates for 2003-2013 and the 2000 US standard population were obtained from the US Bureau of the Census, available at http://www.census.gov/.

Methods:
Incidence rates were calculated per million population and age-adjusted by the direct method to the 2000 US standard population. Except where calculated to show trends, the incidence rates are ten-year average annual rates for the period 2004 through 2013.

Mortality rates were calculated per million population and age-adjusted by the direct method to the 2000 US standard population. Because of data quality issues, 2009 cancer death data are not used for analysis. Except where calculated to show trends, the mortality rates are ten-year average annual rates including data for 2003-2008 and 2010-2013 combined.

Mortality trends were calculated using 3 year rolling averages allowing for greater stability in the point estimates produced. For a given calendar year (index year), the rates for the index year, the year prior to, and the following year were averaged together to produce the point estimate for the index year.

Appendix A

The Georgia Comprehensive Cancer Registry

The Georgia Comprehensive Cancer Registry (GCCR) is a statewide population-based cancer registry collecting all cancer cases diagnosed among Georgia residents since January 1, 1995. This information furthers our understanding of cancer and is used to develop strategies and policies for prevention, control, and treatment. The availability of this data at the state level allows health researchers to analyze geographic, racial, and other differences that provide clues that point to risk factors. This data also helps in determining where early detection, educational, or other programs should be directed.

The Georgia Department of Public Health has designated the Georgia Center for Cancer Statistics (GCCS) at the Rollins School of Public Health at Emory University as its agent for the purpose of collecting and editing Georgia cancer data.

GCCR is a participant in the National Program for Cancer Registries (NPCR) that was established by the Centers for Disease Control and Prevention (CDC) in 1992 through the Federal Cancer Registry Amendment Act (Public Law 102-515) and is also a participant in the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute. Both NPCR and SEER provide funding and guidance for the development of cancer registries throughout the United States. GCCR is also a member of the North American Association of Central Cancer Registries (NAACCR), which is a professional society that was established in 1987. NAACCR provides ongoing development of cancer registries and the establishment of registry standards.

GCCR Goals:

- To collect information on all newly diagnosed cancer cases.
- To calculate cancer incidence rates for the state of Georgia.
- To make data available to the public and health care professionals.
- To identify and evaluate cancer incidence and mortality trends and problems on an ongoing basis.
- To provide cancer incidence and mortality data to cancer control programs to assist them in developing strategies and evaluating their effectiveness.
- To stimulate cancer control research.

For more information, please visit us on the web at http://dph.georgia.gov/georgia-comprehensive-cancer-registry.

Appendix B

ICD-10 Codes for Childhood Cancer Mortality

All Sites	C00-C97
Leukemias	C90.1, C91-C95
CNS	C70-C72
Lymphomas & Other Reticuloendothelial Neoplasms	C81.0-C90.0, C90.2, C96
Soft Tissue, including heart	C38.0, C45.2, C46.1, C47, C49
Renal Tumors	C64-C65
Bone Tumors	C40-C41
Hepatic Tumors	C22
Other & Unspecified	C00-C21, C23-C37, C38.1-C39.9, C43.0-C45.1, C45.7-C46.0, C46.2-C46.9, C48, C50-C63 C66-C69, C73-C80, C97

ICD-O-3 Codes for Childhood Cancer Incidence

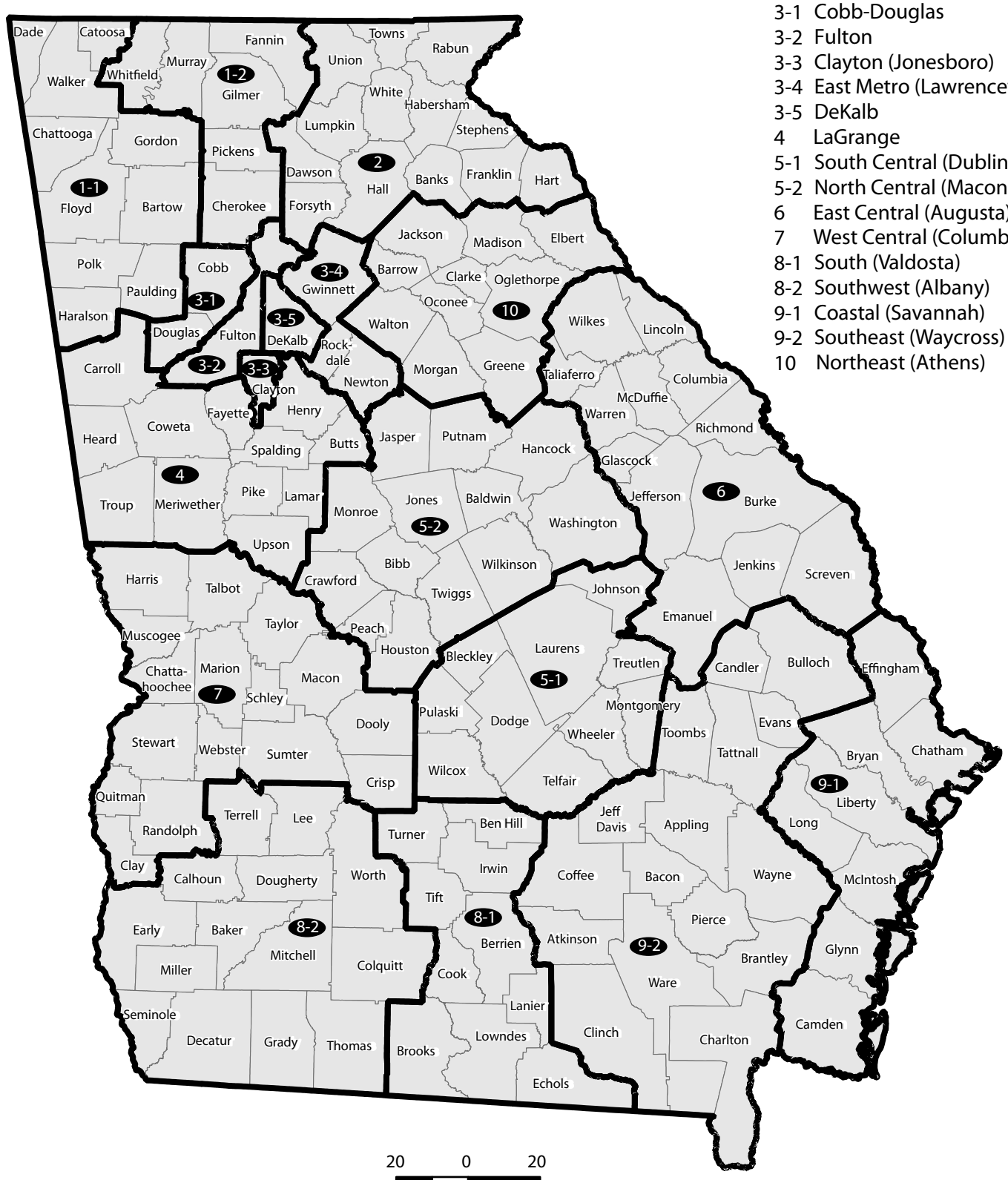
The International Classification of Childhood Cancer (ICCC) site recode ICD-O-3/WHO 2008 groupings were used. For more information on this classification scheme, please visit the Surveillance, Epidemiology, and End Results (SEER) Program on the web at http://seer.cancer.gov/iccc/.

Appendix C

Georgia Public Health Districts

Health District	Counties
1-1 Northwest	Bartow, Catoosa, Chattooga, Dade, Floyd, Gordon, Haralson, Paulding, Polk, Walker
1-2 North Georgia	Cherokee, Fannin, Gilmer, Murray, Pickens, Whitfield
2 North	Banks, Dawson, Forsyth, Franklin, Habersham, Hall, Hart, Lumpkin, Rabun, Stephens, Towns, Union, White
3-1 Cobb-Douglas	Cobb, Douglas
3-2 Fulton	Fulton
3-3 Clayton	Clayton
3-4 East Metro	Gwinnett, Newton, Rockdale
3-5 DeKalb	DeKalb
4 LaGrange	Butts, Carroll, Coweta, Fayette, Heard, Henry, Lamar, Meriwether, Pike, Spalding, Troup, Upson
5-1 South Central	Bleckley, Dodge, Johnson, Laurens, Montgomery, Pulaski, Telfair, Treutlen, Wheeler, Wilcox
5-2 North Central	Baldwin, Bibb, Crawford, Hancock, Houston, Jasper, Jones, Monroe, Peach, Putnam, Twiggs, Washington, Wilkinson
6 East Central	Burke, Columbia, Emanuel, Glascock, Jefferson, Jenkins, Lincoln, McDuffie, Richmond, Screven, Taliaferro, Warren, Wilkes
7 West Central	Chattahoochee, Clay, Crisp, Dooly, Harris, Macon, Marion, Muscogee, Quitman, Randolph, Schley, Stewart, Sumter, Talbot, Taylor, Webster
8-1 South	Ben Hill, Berrien, Brooks, Cook, Echols, Irwin, Lanier, Lowndes, Tift, Turner
8-2 Southwest	Baker, Calhoun, Colquitt, Decatur, Dougherty, Early, Grady, Lee, Miller, Mitchell, Seminole, Terrell, Thomas, Worth
9-1 Coastal	Bryan, Camden, Chatham, Effingham, Glynn, Liberty, Long, McIntosh
9-2 Southeast	Appling, Atkinson, Bacon, Brantley, Bryan, Bulloch, Camden, Candler, Charlton, Clinch, Coffee, Evans, Glynn, Jeff Davis, Liberty, Long, McIntosh, Pierce, Tattnall, Toombs, Ware, Wayne
10 Northeast	Barrow, Clarke, Elbert, Greene, Jackson, Madison, Morgan, Oconee, Oglethorpe, Walton

GEORGIA
Public Health Districts



1-1 Northwest (Rome)
1-2 North Georgia (Dalton)
2 North (Gainesville)
3-1 Cobb-Douglas
3-2 Fulton
3-3 Clayton (Jonesboro)
3-4 East Metro (Lawrenceville)
3-5 DeKalb
4 LaGrange
5-1 South Central (Dublin)
5-2 North Central (Macon)
6 East Central (Augusta)
7 West Central (Columbus)
8-1 South (Valdosta)
8-2 Southwest (Albany)
9-1 Coastal (Savannah)
9-2 Southeast (Waycross)
10 Northeast (Athens)

Appendix D

Age-Adjusted Childhood Malignant Cancer Incidence Rates*†, Ages 0 to 19 Years, Georgia Versus U.S. SEER, 2004-2013

	Georgia	U.S. SEER
All ICCC† Groups Combined Excluding Benign Brain/CNS Tumors	165.6^	177.7
All ICCC Groups Combined Including Benign Brain/CNS Tumors‡	181.6^	193.6
I – Leukemias, Myeloproliferative & Myelodysplastic Diseases	41.1^	48.8
ia – Lymphoid leukemias	27.0^	35.3
ib – Acute myeloid leukemias	8.9	8.6
ic – Chronic myeloproliferative diseases	2.5	2.0
id – Myelodysplastic syndrome and other myeloproliferative diseases	1.2	1.5
ie – Unspecified and other specified leukemias	1.6	1.4
II – Lymphomas & Reticuloendothelial Neoplasms	26.0	26.4
iia – Hodgkin lymphomas	11.8	12.1
iib – Non-Hodgkin lymphomas (except Burkitt)	9.8	9.2
iic – Burkitt lymphoma	2.2	2.4
iid – Miscellaneous lymphoreticular neoplasms	1.8	2.4
iie – Unspecified lymphomas	~	0.3
III – Central Nervous System & Miscellaneous Intracranial & Intraspinal Neoplasms‡	46.2	45.8
iiia – Ependymomas and choroid plexus tumor‡	3.6	4.0
iiib - Astrocytomas‡	16.4	15.9
iiic – Intracranial and intraspinal embryonal tumors‡	5.9	6.1
iiid – Other gliomas‡	5.1	5.5
iiie – Other specified intracranial and intraspinal neoplasms‡	12.9	13.0
iiif – Unspecified intracranial and intraspinal neoplasms‡	2.1	1.4
IV – Neuroblastoma & Other Peripheral Nervous Cell Tumors	8.7	8.2
V – Retinoblastomas	3.8	3.3
VI – Renal Tumors	7.4	6.5
via – Nephroblastoma and other nonepithelial renal tumors	6.4	5.9
vib – Renal carcinomas	~	0.6
vic – Unspecified malignant renal tumors	~	0.0
VII – Hepatic tumors	2.0	2.4
viia – Hepatoblastoma	1.5	1.8
viib – Hepatic carcinomas	~	0.6
viic – Unspecified malignant hepatic tumors	~	0.0
VIII – Malignant Bone Tumors	8.7	9.0
viiia – Osteosarcomas	4.9	5.1
viiib – Chondrosarcomas	~	0.4
viiic – Ewing tumor and related sarcomas of bone	2.9	2.8
viiid – Other specified malignant bone tumors	~	0.4
viiie – Unspecified malignant bone tumors	~	0.2
IX – Soft Tissue & Other Extraosseous Sarcomas	12.9	12.2
ixa – Rhabdomyosarcomas	4.8	4.8
ixb – Fibrosarcomas, peripheral nerve sheath, and other fibromatous neoplasms	1.3	1.2
ixc – Kaposi sarcoma	~	0.0
ixd – Other specified soft tissue sarcomas	4.7	5.0
ixe – Unspecified soft tissue sarcomas	1.9	1.2
X – Germ Cell & Trophoblastic Tumors & Neoplasms of Gonads‡	10.0^	12.4
xa – Intracranial and intraspinal germ cell tumors‡	1.9	2.3
xb – Malignant extracranial and extragonadal germ cell tumors	1.3	1.5
xc – Malignant gonadal germ cell tumors	6.2^	7.9
xd – Gonadal carcinomas	~	0.5
xe – Other and unspecified malignant gonadal tumors	~	0.2
XI – Other Malignant Epithelial Neoplasms & Malignant Melanoma	14.4^	17.9
xia – Adrenocortical carcinomas	~	0.2
xib – Thyroid carcinomas	6.3	8.0
xic – Nasopharyngeal carcinomas	0.6	0.6
xid – Malignant melanomas	3.6	4.7
xie – Skin carcinomas	~	0.1
xif – Other and unspecified carcinomas	3.6	4.3
XII – Other & Unspecified Malignant Neoplasms	~	0.6

* Average annual rate per million, age-adjusted to the 2000 US standard population.
† Grouped according to the International Classification of Childhood Cancer (ICCC) based on ICD-O-3/WHO 2008.
‡ Group III, Group III subgroups, and subgroup Xa include benign brain/CNS tumors.
^ Georgia rate is significantly higher or lower than U.S. SEER rate (p<.05).
~ Rates are not calculated where the count is less than sixteen, due to reliability of the rate.