Georgia Childhood Cancer Report 2005

Georgia Department of Human Resources
Division of Public Health

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Introduction

Cancer is the third most common cause of death among children between 1 and 19 years of age, following unintentional injuries and homicide, and accounting for 6% of childhood mortality in Georgia in 1999-2003 *(Figure 1)*. The most common forms of childhood cancer, leukemias, central nervous system (CNS) neoplasms, and lymphomas account for about 60% of all childhood cancer diagnoses and deaths *(Table 1)*.

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

This report describes the burden of childhood cancer in Georgia and includes: 1) the number of cancer cases and incidence rates for Georgia children; and 2) the number of cancer deaths and mortality rates for Georgia children.

Figure 1. Childhood Mortality by Cause, Ages 1 to 19, Georgia, 1999-2003

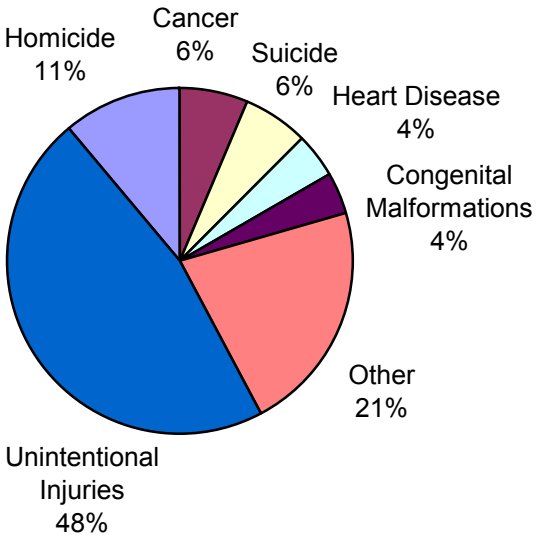


Table 1. Incidence vs Mortality for the Top Three Cancer Types in Children Ages 0 to 19 Years, Georgia

	Incidence		Mortality	
	Cases*	% of Cases	Deaths*	% of Deaths
Leukemia	90	25%	16	27%
CNS Cancer	69	19%	14	24%
Lymphoma	55	15%	5	9%

*Average number of cases or deaths 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. If the growth is not controlled, it can result in death. Cancer is caused by both internal and external factors. Many cancers can be cured if detected and treated promptly. Different types of cancer can behave very differently. They grow at different rates and respond to different therapies. That is why people with cancer need treatment that is aimed at their particular kind of cancer.

Who is at Risk for Developing Cancer?

Everyone, but children are less likely to develop cancer than adults. Since the risk of cancer increases as individuals age, most cancers affect adults who are middle-aged or older. About 73% of all cancers in Georgia are diagnosed at age 55 or older and about 1% occurs among children under 20 years of age. In the U.S., males have a 1 in 2 lifetime risk, 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 cancer.

Cancer in Children

According to the American Cancer Society, an estimated 9,510 new cancer cases and 1,585 cancer deaths are expected to occur in the U.S. among children aged 0-14 in 2005. Despite its rarity, cancer is the chief cause of death by disease in children between the ages of 1 and 14. Mortality rates from childhood cancer have declined by about 49% since 1975.

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

Many childhood cancers occur very early in life and many parents want to know why. The cause of most childhood cancers is not known. Radiation exposure contributes to a few types of childhood cancers. Some are the result of a familial predisposition. Unlike cancers of adults, childhood cancers are not significantly related to lifestyle-related risk factors of the patient such as tobacco or alcohol use, poor diet, or lack of physical activity *(Table2)*.

Childhood cancers can be treated by a combination of therapies (surgery, radiation, chemotherapy) chosen based on the specific type, location, and stage of the cancer. Treatment is 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 30 years, from less than 60% in the mid-1970s to nearly 80% in the late 1990s, largely due to new and improved treatments. Rates vary considerably, however depending on the specific type. Survivors of childhood cancer may experience treatment-related side effects several months or years after their childhood cancer. Late treatment effects include organ malfunction, secondary cancers, and cognitive impairments.

Table 2. Comparison of Childhood Cancers Versus Adult Cancers

	Children	Adults
Top 5 Cancers	Leukemias Central Nervous System Neoplasms Lymphomas Soft Tissue Sarcomas Peripheral Nervous System Tumors	Prostate Female Breast Lung and Bronchus Colon and Rectum Lymphomas
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	5-year relative survival rate for all cancers from 1995-2001 for children age 0 to 19 is 79%.	5-year relative survival rate for all cancers from 1995-2001 for all ages is 66%.

Childhood Cancer Incidence

Childhood Cancer Incidence in Georgia

- Leukemia is the most common form of childhood cancer, accounting for 25% of all childhood cancer diagnoses between 1999 and 2002 in Georgia *(Figure 2)*.
- Central nervous system (CNS) tumors and lymphomas combined account for over one third of all childhood cancer diagnoses.
- Between 1999 and 2002, there were 1447 cancer diagnoses among children aged 0 to 19 years living in Georgia. The age-adjusted rate for this time period was 145.5 per million *(Table 3)*. This rate is lower than the U.S. rate of 162.6 per million.
- The highest cancer incidence rate among children aged 0 to 19 years was for leukemia (35.6 per million), followed by CNS neoplasms with a rate of 27.9 per million.
- Overall, males had a higher cancer incidence rate than females. This difference was most apparent in lymphomas (especially Burkitt lymphoma), CNS neoplasms, and germ cell tumors. Females were more likely to be diagnosed with renal tumors 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, peripheral nerve cell tumors, renal tumors, or retinoblastomas.
- Children aged 15 to 19 years were most likely to be diagnosed with lymphomas (especially Hodgkin lymphoma), bone tumors, gonadal germ cell tumors, thyroid carcinomas, or melanoma.

Figure 2. Childhood Cancer Incidence, Ages 0 to 19, Georgia, 1999-2002

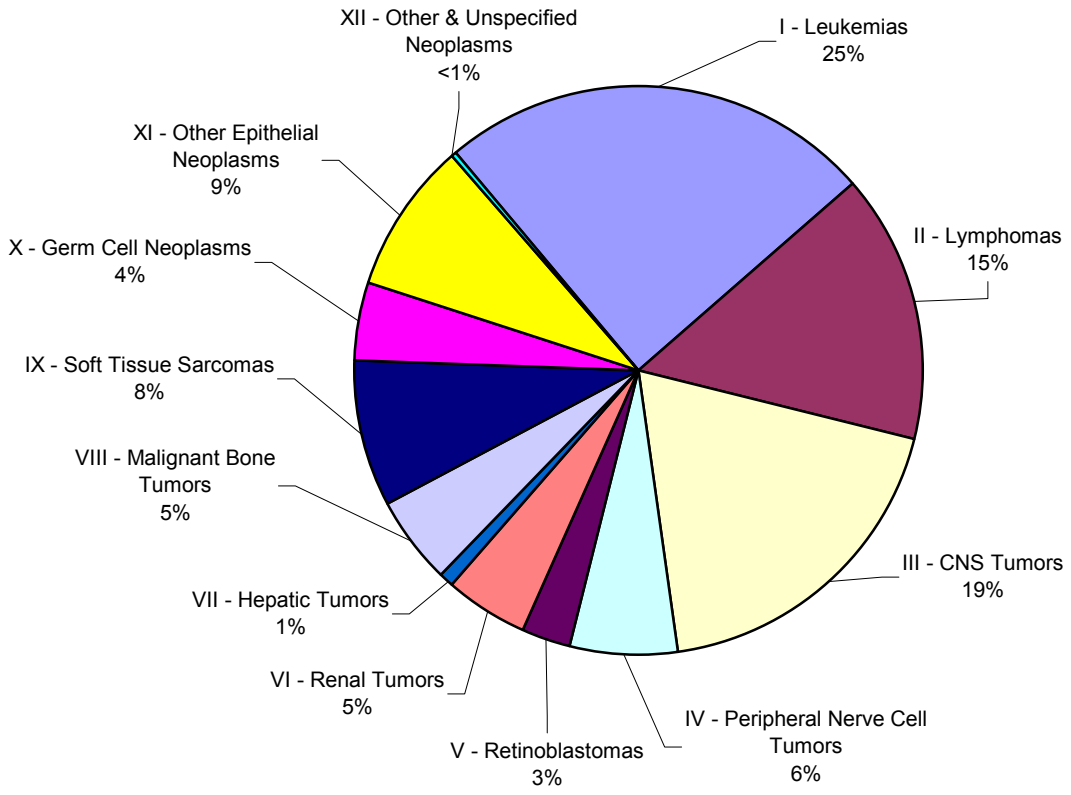


Table 3. Age-Adjusted Childhood Cancer Incidence Rates*, Ages 0 to 19, Georgia, 1999-2002

International Classification of Childhood Cancer (ICCC-3) Grouping	Both Sexes		Males		Females	
	Cases	Rate*	Cases	Rate*	Cases	Rate*
All Types	1447	145.5	805	157.3	642	133.0
I - Leukemias, Myeloproliferative & Myelodysplastic Diseases	359	35.6	194	37.6	165	33.4
ia - Lymphoid leukemia	266	26.2	150	29.0	116	23.2
ib - Acute myeloid leukemia	67	6.8	34	6.7	33	6.9
ic - Chronic myeloproliferative diseases	10	~	<5	~	***	~
id - Myelodysplastic syndrome & other myeloproliferative diseases	5	~	<5	~	<5	~
ie - Unspecified and other specified leukemias	11	~	<5	~	***	~
II - Lymphomas & Reticuloendothelial Neoplasms	219	22.8	136	27.5	83	17.9
iia - Hodgkin lymphoma	104	10.9	57	11.7	47	10.2
iib - Non-Hodgkin lymphoma (except Burkitt)	80	8.3	49	9.8	31	6.6
iic - Burkitt lymphoma	31	3.2	26	5.2	5	~
iid - Miscellaneous lymphoreticular neoplasms	<5	~	<5	~	<5	~
iie - Unspecified lymphomas	<5	~	<5	~	<5	~
III - Central Nervous System & Miscellaneous Intracranial & Intraspinal Neoplasms	276	27.9	167	32.9	109	22.6
iiia - Ependymomas and choroid plexus tumor	23	2.2	12	~	11	~
iiib - Astrocytomas	138	14.1	84	16.7	54	11.3
iiic - Intracranial and intraspinal embryonal tumors	67	6.7	42	8.2	25	5.1
iiid - Other gliomas	43	4.4	27	5.4	16	~
iiie - Other specified intracranial and intraspinal neoplasms	<5	~	<5	~	<5	~
iiif - Unspecified intracranial and intraspinal neoplasms	<5	~	<5	~	<5	~
IV - Neuroblastoma & Other Peripheral Nervous Cell Tumors	87	8.1	46	8.2	41	7.9
V - Retinoblastomas	41	3.7	25	4.4	16	~
VI - Renal Tumors	67	6.2	33	5.9	34	6.6
VII - Hepatic Tumors	11	~	***	~	<5	~
VIII - Malignant Bone Tumors	73	7.6	41	8.4	32	6.9
viiia - Osteosarcomas	39	4.1	19	~	20	4.3
viiib - Chondrosarcomas	<5	~	<5	~	<5	~
viiic - Ewing tumor and related sarcomas of bone	28	2.9	18	~	10	~
viiid - Other specified malignant bone tumors	<5	~	<5	~	<5	~
viiie - Unspecified malignant bone tumors	<5	~	<5	~	<5	~
IX - Soft Tissue & Other Extraosseous Sarcomas	121	12.4	69	13.6	52	11.0
ixa - Rhabdomyosarcomas	56	5.6	33	6.4	23	4.8
ixb - Fibrosarcomas, peripheral nerve sheath & other fibromatous neoplasms	11	~	6	~	5	~
ixc - Kaposi sarcoma	<5	~	<5	~	<5	~
ixd - Other specified soft tissue sarcomas	41	4.3	24	4.8	17	~
ixe - Unspecified soft tissue sarcomas	12	~	5	~	7	~
X - Germ Cell & Trophoblastic Tumors & Neoplasms of Gonads	64	6.6	39	7.7	25	5.4
xa - Intracranial and intraspinal germ cell tumors	7	~	***	~	<5	~
xb - Malignant extracranial and extragonadal germ cell tumors	15	~	<5	~	***	~
xc - Malignant gonadal germ cell tumors	37	3.8	30	6.0	7	~
xd - Gonadal carcinomas	<5	~	<5	~	<5	~
xe - Other and unspecified malignant gonadal tumors	<5	~	<5	~	<5	~
XI - Other Malignant Epithelial Neoplasms & Malignant Melanomas	124	13.0	46	9.3	78	17.0
xia - Adrenocortical carcinomas	<5	~	<5	~	<5	~
xib - Thyroid carcinomas	39	4.1	6	~	33	7.2
xic - Nasopharyngeal carcinomas	8	~	<5	~	***	~
xid - Malignant melanomas	42	4.4	20	4.1	22	4.8
xie - Skin carcinomas	<5	~	<5	~	<5	~
xif - Other and unspecified carcinomas	31	3.3	14	~	17	~
XII - Other & Unspecified Malignant Neoplasms	5	~	<5	~	<5	~

* Average annual rate per million, age-adjusted to the 2000 US standard million population
~ Rates are not calculated where the count is less than twenty
*** 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, Georgia, 1999-2002

ICCC-3 Grouping	Ages 0 to 4		Ages 5-9		Ages 10-14		Ages 15-19	
	Cases	Rate*	Cases	Rate*	Cases	Rate*	Cases	Rate*
All Types	487	197.8	269	109.3	273	110.0	418	174.7
I - Leukemias, Myeloproliferative & Myelodysplastic Diseases	154	62.5	91	37.0	52	21.0	62	25.9
II - Lymphomas & Reticuloendothelial Neoplasms	21	8.5	41	16.7	56	22.6	101	42.2
III - CNS & Miscellaneous Intracranial & Intraspinal Neoplasms	87	35.3	80	32.5	63	25.4	46	19.2
IV - Neuroblastoma & Other Peripheral Nervous Cell Tumors	73	29.6	8	~	<5	~	<5	~
V - Retinoblastomas	41	16.7	<5	~	<5	~	<5	~
VI - Renal Tumors	55	22.3	9	~	<5	~	<5	~
VII - Hepatic Tumors	9	~	<5	~	<5	~	<5	~
VIII - Malignant Bone Tumors	6	~	12	~	25	10.1	30	12.5
IX - Soft Tissue & Other Extraosseous Sarcomas	30	12.2	20	8.1	31	12.5	40	16.7
X - Germ Cell & Trophoblastic Tumors & Neoplasms of Gonads	9	~	<5	~	11	~	42	17.6
XI - Other Malignant Epithelial Neoplasms & Malignant Melanomas	<5	~	5	~	27	10.9	91	38.0
XII - Other & Unspecified Malignant Neoplasms	<5	~	<5	~	<5	~	<5	~

* Average annual rate per million
~ Rates are not calculated where the count is less than twenty

Childhood Cancer Incidence Rates by Health District in Georgia

- Among the health districts, childhood cancer incidence rates ranged from 99.8 per million to 182.4 per million *(Table 5)*.
- Clayton (3-3) and Athens (10) Health Districts had significantly lower rates than the state average, while East Metro (3-4) had a significantly higher rate.
- A rate was not calculated for South Central (5-1) Health District because there were fewer than twenty cases.

Table 5. Age-Adjusted Childhood Cancer Incidence Rates* by Health District, Ages 0 to 19, Georgia, 1999-2002

Georgia Rate* = 145.5

Health District	Rate*	Health District	Rate*
1.1 Northwest	156.9	5.1 South Central	~
1.2 Dalton	130.1	5.2 North Central	135.7
2.0 Gainesville	159.4	6.0 Augusta	140.7
3.1 Cobb-Douglas	171.2	7.0 West Central	135.0
3.2 Fulton	134.9	8.1 Valdosta	115.3
3.3 Clayton	99.8†	8.2 Southwest	122.2
3.4 East Metro	182.4†	9.1 Coastal	133.1
3.5 DeKalb	160.6	9.2 Southeast	158.1
4.0 LaGrange	149.8	10.0 Athens	112.0†

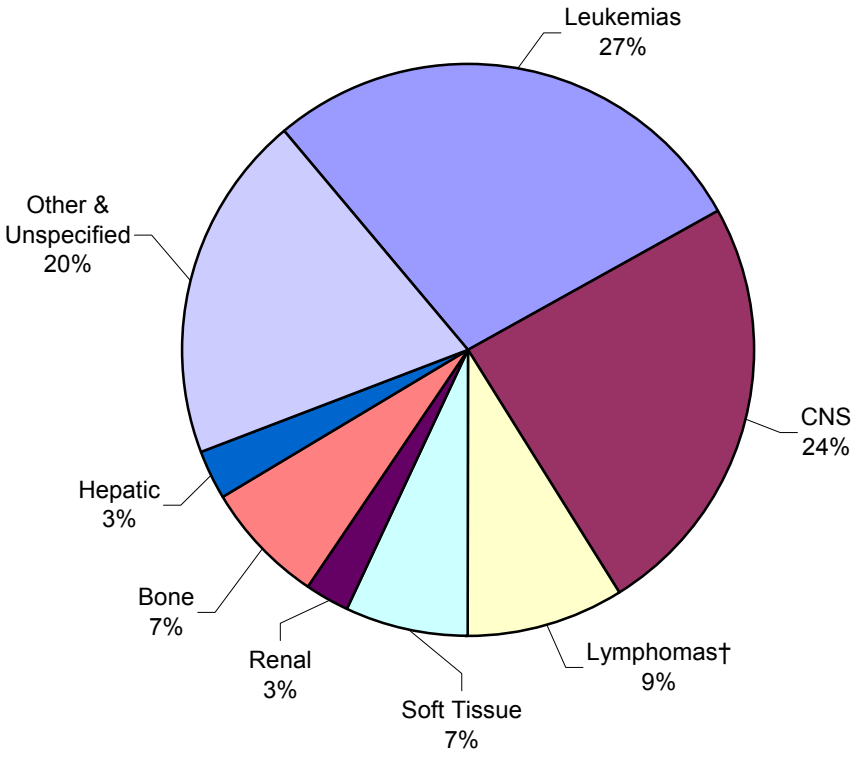
* Average annual rate per million, age-adjusted to the 2000 US standard million population
† Rate is significantly higher or lower than the state rate (p<.05)
~ Rates are not calculated where the count is less than twenty

Childhood Cancer Mortality

Childhood Cancer Mortality in Georgia

- Leukemia is the most common cause of childhood cancer deaths, accounting for 27% of all childhood cancer deaths in Georgia between 1994 and 2003 *(Figure 3)*.
- Central nervous system (CNS) neoplasms are second, responsible for nearly a quarter of all childhood cancer deaths. Lymphomas account for about a tenth of all childhood cancer deaths.
- Between 1994 and 2003, there were 566 cancer deaths among Georgia's children aged 0 to 19 years. The age-adjusted rate for this time period was 24.3 per million *(Table 6)*.
- The highest cancer mortality rate among children aged 0 to 19 years was for leukemia (6.8 per million), followed by CNS neoplasms with a rate of 5.9 per million.
- Overall, males had a higher cancer mortality rate than females. This difference was most apparent for CNS neoplasms.
- Cancer mortality was highest among children in the 15 to 19 year old age group *(Table 7)*.
- Children aged 15 to 19 years were most likely to die from leukemias and lymphomas.
- Children aged 5 to 9 years were most likely to die from CNS neoplasms.

Figure 3. Childhood Cancer Mortality, Ages 0 to 19, Georgia, 1994-2003



† Including Other Reticuloendothelial Neoplasms

Table 6. Age-Adjusted Childhood Cancer Mortality Rates*, Ages 0 to 19, Georgia, 1994-2003

	Both Sexes		Males		Females	
	Deaths	Rate*	Deaths	Rate*	Deaths	Rate*
All Types	566	24.3	322	27.0	244	21.4
Leukemias	159	6.8	81	6.8	78	6.9
CNS	137	5.9	85	7.2	52	4.6
Lymphomas	50	2.2	31	2.6	19	~
Soft Tissue, including heart	39	1.7	23	1.9	16	~
Renal Tumors	15	~	8	~	7	~
Bone Tumors	39	1.7	24	2.1	15	~
Hepatic Tumors	16	~	9	~	7	~
Other & Unspecified	111	4.7	61	5.0	50	4.3

* Average annual rate per million, age-adjusted to the 2000 US standard million population
~ Rates are not calculated where the count is less than twenty

Table 7. Age-Specific Childhood Cancer Mortality Rates*, Ages 0 to 19, Georgia, 1994-2003

	Ages 0 to 4		Ages 5-9		Ages 10-14		Ages 15-19	
	Deaths	Rate*	Deaths	Rate*	Deaths	Rate*	Deaths	Rate*
All Types	118	20.1	144	24.4	126	21.5	178	31.1
Leukemias	34	5.8	45	7.6	33	5.6	47	8.2
CNS	27	4.6	49	8.3	34	5.8	27	4.7
Lymphomas	<5	~	6	~	12	~	28	4.9
Soft Tissue, including heart	5	~	10	~	5	~	19	~
Renal Tumors	<5	~	<5	~	6	~	<5	~
Bone Tumors	<5	~	<5	~	16	~	19	~
Hepatic Tumors	8	~	<5	~	<5	~	6	~
Other & Unspecified	37	6.3	25	4.2	19	~	30	5.2

* Average annual rate per million
~ Rates are not calculated where the count is less than twenty

Childhood Cancer Mortality Rates by Health District in Georgia

- Among the health districts, childhood cancer mortality rates ranged from 14.6 per million to 35.1 per million *(Table 8)*.
- Fulton (3-2) and Coastal (9-1) Health Districts had significantly lower rates than the state average.
- A rate was not calculated for South Central (5-1) Health District because there were fewer than twenty deaths.

Table 8. Age-Adjusted Childhood Cancer Mortality Rates* by Health District, Ages 0 to 19, Georgia, 1994-2003

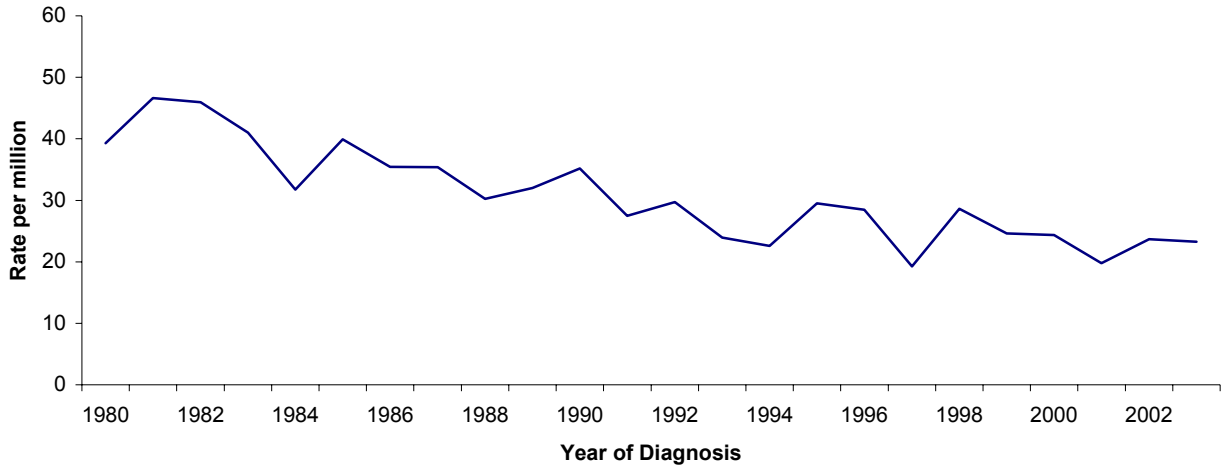
Health District	Rate*	Health District	Rate*
1.1 Northwest	24.7	5.1 South Central	~
1.2 Dalton	22.5	5.2 North Central	25.4
2.0 Gainesville	30.4	6.0 Augusta	18.5
3.1 Cobb-Douglas	26.7	7.0 West Central	20.5
3.2 Fulton	14.6†	8.1 Valdosta	23.4
3.3 Clayton	32.0	8.2 Southwest	26.6
3.4 East Metro	26.0	9.1 Coastal	14.8†
3.5 DeKalb	32.9	9.2 Southeast	35.1
4.0 LaGrange	24.7	10.0 Athens	21.8

* Average annual rate per million, age-adjusted to the 2000 US standard million population
† Rate is significantly higher or lower than the state rate (p<.05)
~ Rates are not calculated where the count is less than twenty

Trends in Childhood Cancer Mortality in Georgia

Mortality rates for all childhood cancers combined decreased from 1980 to 2003 in Georgia *(Figure 4)*. This decrease resulted from improvements in survival for most childhood cancers, especially leukemia and lymphoma. The availability of newer, more effective chemotherapy treatments is the principal reason for improved survival among childhood cancer patients.

Figure 4. Childhood Cancer Mortality Rates*, All Types, Ages 0 to 19, Georgia, 1980-2003



* Rate per million, age-adjusted to the 2000 US standard million population

Childhood Cancer Survival in the U.S.

- Overall, U.S. cancer survival rates were greatest among older children *(Table 9)*; females fared better than males.
- Children with retinoblastoma had the highest survival rate (95.5 percent), while children with hepatic tumors had the lowest (52.0 percent).
- After the first year of life, leukemia survival decreases with age, although infants have the lowest survival rate (45.3 percent).

Table 9. Five-Year Relative Survival Rates for Childhood Cancer, Ages 0 to 19, U.S. SEER, 1985-2001

	Ages 0-19 by Sex			Both Sexes by Age				
	Total	Male	Female	<1	1-4	5-9	10-14	15-19
All Types	76.4	74.5	78.6	72.6	76.6	75.6	75.5	78.1
Leukemias	71.7	70.0	73.8	45.3	82.6	77.7	62.4	48.0
Lymphomas & Reticuloendothelial Neoplasms	85.3	83.6	87.5	~	78.2	85.2	86.4	85.7
CNS Neoplasms	69.1	69.5	68.6	52.2	64.0	68.5	74.7	76.6
Sympathetic Nervous System Tumors	66.3	65.2	67.5	85.9	55.3	57.5	63.2	52.3
Retinoblastoma	95.5	95.6	95.4	95.7	94.7	~	~	~
Renal Tumors	89.9	88.7	91.0	89.5	92.6	88.4	80.6	71.4
Hepatic Tumors	52.0	50.2	53.9	69.7	56.1	~	~	15.0
Malignant Bone Tumors	65.4	63.7	67.9	~	~	71.4	67.5	62.0
Soft-Tissue Sarcomas	71.2	70.8	71.6	58.3	77.7	73.6	74.5	66.2
Germ Cell & Other Gonadal Neoplasms	89.0	88.1	90.3	80.9	93.0	85.0	87.8	90.1

~ Statistic could not be calculated due to fewer than 25 cases during the time period.

Childhood Leukemia

What is it?
Leukemia is a cancer of the blood-forming cells. Most of time, 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, and other organs.

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

Types of Childhood Leukemia
Leukemia can be 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) represents about 75% of all childhood leukemias. Five-year relative survival for children with ALL is about 80%.

Acute myelogenous leukemia (AML) represents most of the remaining leukemias in children. Five-year relative survival for children with AML is about 42%.

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 Klinefelter syndrome carry an increased risk of leukemia.

Having an identical twin who developed leukemia before 6 years of age increases the risk for the other twin to 20% to 25%. Twins who are not identical and other brothers and sisters have a slightly increased risk.

Exposure to very high doses of radiation is a major risk factor for leukemia. Children and adults who were treated with radiation therapy and 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 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 first among cancer diagnoses for children ages 0 to 19 in Georgia, accounting for 25% of all childhood cancer morbidity.
- Between 1999 and 2002, there were 359 cases of leukemia in children. The age-adjusted rate was 35.6 per million.
- Males were 13% more likely than females to be diagnosed with leukemia.
- The highest rates were among children under age five.

Leukemia Mortality in Georgia Children
- Leukemia ranks first among cancer deaths for children ages 0 to 19 in Georgia, accounting for 27% of all childhood cancer mortality.
- Between 1994 and 2003, there were 159 deaths from leukemia among children. The age-adjusted rate was 6.8 per million.
- Males and females were equally affected.
- The highest rates were among children over age 15.

Central Nervous System Cancer in Children

What is it?
The central nervous system (CNS) includes the brain and spinal cord. Both malignant and benign tumors may occur in the central nervous system and both are capable of causing damage that is often disabling and sometimes fatal. The major distinction is how readily they spread through the rest of the central nervous system and whether they can be removed and not come back. About 75% of childhood CNS tumors are malignant. GCCR has recently begun collection of data on benign CNS tumors, but the current report discusses only malignant tumors.

CNS tumors are the second largest category of cancer in children, constituting about 17% of all cancers diagnosed in U.S. children under the age of twenty. Survival for children with CNS cancer is poorest among infants but improves with increasing age. Five-year relative survival rates have improved over time to 69%.

Types of CNS Cancer
The brain consists of different kinds of tissues and cells. Different types of tumors can start in these different cell and tissue types. These different types of tumors have varying outlooks for survival and may be treated differently.

Astrocytomas account for about half of all childhood brain cancers. Many astrocytomas cannot be cured because they spread widely throughout the normal brain tissue. These astrocytomas are called infiltrating astrocytomas.

Oligodendrogliomas spread or infiltrate in a manner similar to astrocytomas and, in most cases, cannot be completely removed by surgery. A small number of these tumors are associated with long-term survivals of 30 or 40 years.

Ependymomas usually do not spread or infiltrate into normal brain tissue. As a result, some but not all ependymomas can be removed and cured by surgery. Almost 10% of brain tumors in children are ependymomas.

Medulloblastomas are fast-growing tumors that can spread along the spinal cord and meninges but can be treated. Up to 50% of cases are cured by surgery and radiation therapy, sometimes with added chemotherapy. About 15% of childhood brain tumors are medulloblastomas.

Risk Factors and Prevention
Most brain tumors are not associated with known risk factors and occur for no apparent reason. As a result, most brain tumors cannot be prevented.

The only established environmental risk factor for brain tumors is ionizing radiation, 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 neurofibromatosis, tuberous sclerosis, Von Hippel-Lindau disease, and Li-Fraumeni syndrome.

CNS Cancer Incidence in Georgia Children
- CNS cancer ranks second among cancer diagnoses for children ages 0 to 19 in Georgia, accounting for 19% of all childhood cancer morbidity.
- Between 1999 and 2002, there were 276 cases of CNS cancer in children. The age-adjusted rate was 27.9 per million.
- Males were about 46% more likely than females to be diagnosed with CNS cancer.
- The highest rates were among children under age 5.

CNS Cancer Mortality in Georgia Children
- CNS cancer ranks second among cancer deaths for children ages 0 to 19 in Georgia, accounting for 24% of all childhood cancer mortality.
- Between 1994 and 2003, there were 137 deaths from CNS cancer among children. The age-adjusted rate was 5.9 per million.
- Males were about 57% more likely than females to die from CNS cancer.
- The highest rates were among children between ages 5 and 9.

Childhood Lymphoma

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

Hodgkin lymphoma accounts for over half of all lymphomas in U.S. children under the age of 20. It is rare among young children and becomes more common among teens and young adults. The five-year relative survival rate is 93%.

NHL represents about 30% of all lymphomas in U.S. children. About 70% of NHL occurs in boys. It is also about 40% more common in white children than in black children. The five-year relative survival rate is about 76%.

Types of Childhood NHL
Lymphoblastic lymphomas account for just under one third of the cases of childhood NHL. This type of lymphoma tends to spread very quickly to the bone marrow, other lymph nodes, the brain, and membranes around the heart.

Small non-cleaved cell lymphoma accounts for about half of the cases of childhood NHL in the U.S. This type of lymphoma is divided into two groups: Burkitt type and non-Burkitt type. Burkitt lymphoma is one of the fastest growing cancers known. It may spread to many organs including the brain.

Large cell lymphoma accounts for one fourth of all NHL in children. Unlike the other types, it seldom spreads to the bone marrow or brain. Nor does it grow as quickly as the other types.

Risk Factors and Prevention
Scientists have found few risk factors to be associated with Hodgkin lymphoma. Since most cases are not associated with any known risk factors, it is impossible to prevent.

Epstein-Barr virus (EBV) infection is associated with an increased risk for Hodgkin lymphoma, but its role is unclear. Immunodeficiency has also been associated with an increased risk.

The exact cause of NHL is not known. Scientists have found that this cancer is associated with a number of other conditions, but most children with NHL do not have any known risk factors.

Many of the risk factors for non-Hodgkin lymphoma appear to be linked to problems with the immune system. These problems may be present at birth or they may be caused by infections or drugs used to treat other diseases. Organ transplant, HIV infection, and congenital immunodeficiency syndromes have all been linked to an increased risk for developing NHL.

Lymphoma Incidence in Georgia Children
- Lymphoma ranks third among cancer diagnoses for children ages 0 to 19 in Georgia, accounting for 15% of all childhood cancer morbidity.
- Between 1999 and 2002, there were 219 cases of lymphoma in children. The age-adjusted rate was 22.8 per million.
- Males were 54% more likely then females to be diagnosed with lymphoma.
- The highest rates were among children between ages 15 and 19.

Lymphoma Mortality in Georgia Children
- Lymphoma ranks third among cancer deaths for children ages 0 to 19 in Georgia, accounting for 9% of all childhood cancer mortality.
- Between 1994 and 2003, there were 50 deaths from lymphoma among children. The age-adjusted rate was 2.2 per million.
- Males were more likely than females to die from lymphoma.
- The greatest number of deaths was among children between ages 15 and 19.

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. 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.

Over 85% of rhabdomyosarcomas occur in infants, children, and teenagers. The most common site is in the head and neck (30%-40%) where it can grow near the eye, inside the mouth or even near the spine in the neck. The next most common sites are the urinary and reproductive organs (20%-25%). The least common sites are the arms and legs (18%-20%), and trunk (7%).

The exact prognosis for each person with rhabdomyosarcoma depends on many factors, including the location of the tumor, type of tumor, size of the tumor, the results of surgery, and whether the cancer has metastasized. Overall, about two thirds of children with rhabdomyosarcoma will be cured. Younger children (but not infants) have a better outlook than older ones.

Types of Rhabdomyosarcoma
The most common type, embryonal rhabdomyosarcoma tends to occur in the head and neck area, bladder, vagina, and in or around the prostate and testes. These usually affect infants and young children.

The second main type, alveolar rhabdomyosarcoma, occurs more often in large muscles of the trunk, arms, and legs and typically affects older children or teenagers.

Risk Factors and Prevention
Rhabdomyosarcoma is unlike most adult 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, and neurofibromatosis.

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 fifth among cancer diagnoses for children ages 0 to 19 in Georgia, accounting for 8% of all childhood cancer morbidity.
- Between 1999 and 2002, there were 121 cases of soft tissue sarcoma in children. The age-adjusted rate was 12.4 per million.
- Males were 24% more likely than females to be diagnosed with soft tissue sarcoma.
- The highest rates were among children between ages 15 and 19.

Soft Tissue Sarcoma Mortality in Georgia Children

- Soft tissue sarcoma ranks fourth among cancer deaths for children ages 0 to 19 in Georgia, accounting for 7% of all childhood cancer mortality.
- Between 1994 and 2003, there were 39 deaths from soft tissue sarcoma among children. The age-adjusted rate was 1.7 per million.
- Males were more likely than females to die from soft tissue sarcoma.
- The greatest number of deaths was among children between ages 15 and 19.

Neuroblastoma in Children

What is it?
Neuroblastoma is a form of cancer that occurs in infants and young children. It is rarely found in children older than 10 years. The cells of this cancer usually resemble primitive developing embryonic or fetal nerve cells called neuroblasts. About one third of neuroblastomas start in the adrenal glands and another third begin in the sympathetic nervous system ganglia of the abdomen. The rest start in sympathetic ganglia of the chest, neck, pelvis, or (rarely) in the spinal cord.

Overall, about 5% of all childhood cancers are neuroblastomas. The average age at the time of diagnosis is about 17 months. Around one third of cases are diagnosed by the first year. Nearly 90% of cases are diagnosed by age 5. Overall, about two thirds of children with neuroblastoma will be cured. Prognosis depends on how far the tumor has spread, the age of the child, tumor grade (how it looks under a microscope), and other lab 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. There is evidence suggesting that rarely, certain people may inherit an increased risk of developing neuroblastoma. 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 in Georgia, accounting for 6% of all childhood cancer morbidity.
- Between 1999 and 2002, there were 87 cases of peripheral nerve call cancer in children. The age-adjusted rate was 8.1 per million.
- Males and females were equally affected.
- Nearly all cases occurred among children under age five.

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.

Bone Cancer in Children

What is it?
Osteosarcoma is the most common type of cancer that starts in the bone. More than half of all childhood bone cancers are osteosarcomas. It often starts near the ends of the long bones, especially around the knee and sometimes the shoulder. Osteosarcoma is most common in teenagers. Overall, the five-year relative survival rate is about 64%, depending on whether the tumor has spread and how it responds to treatment.

Ewing's family of tumors (EFT) accounts for about a third of all childhood bone cancers. EFT is most common in early teenage years. The majority of these tumors occur in the trunk, and the most common site is the pelvis. About one third of EFT tumors occur in the legs, mainly in the middle of the long bones. Overall five-year survival is about 62%.

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 bone and multiple hereditary osteochondromas, increase the risk for developing osteosarcoma. Also at an increased risk are children with Li-Fraumeni syndrome or retinoblastoma.

Studies of children with EFT have not found risk factors linked to radiation, chemicals, or any other environmental exposures. Scientists have found few factors related to the risk of developing EFT. EFT occurs most often in the white population and is extremely 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 in Georgia, accounting for 5% of all childhood cancer morbidity.
- Between 1999 and 2002, there were 73 cases of bone cancer in children. The age-adjusted rate was 7.6 per million.
- Males were 22% more likely than females to be diagnosed with bone cancer.
- The highest rates were among children between ages 15 and 19.

Bone Cancer Mortality in Georgia Children

- Bone cancer ranks fourth among cancer deaths for children ages 0 to 19 in Georgia, accounting for 7% of all childhood cancer mortality.
- Between 1994 and 2003, there were 39 deaths from bone cancer among children. The age-adjusted rate was 1.7 per million.
- Males were more likely than females to die from bone cancer.
- The greatest number of deaths was among children between ages 15 and 19.

Renal Cancer in Children

What is it?
Wilms tumor (also called nephroblastoma) is the most common type of renal (kidney) cancer in children. About 90% of renal cancers in children are Wilms tumors. Wilms tumor occurs most often in very young children and is not common in children after age 6. The overall five-year relative survival rate for children with Wilms tumor is about 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 is found, the worse 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. About 95% of Wilms tumors have a favorable appearance.

Risk Factors and Prevention
Research has not shown a connection between Wilms tumor and environmental factors, either before 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 in Georgia, accounting for 5% of all childhood cancer morbidity.
- Between 1999 and 2002, there were 67 cases of renal cancer in children. The age-adjusted rate was 6.2 per million.
- Females were 12% more likely than males to be diagnosed with renal cancer.
- Nearly all cases occurred among children under age five.

Renal Cancer Mortality in Georgia Children
- Renal cancer ranks seventh among cancer deaths for children ages 0 to 19 in Georgia, accounting for 3% of all childhood cancer mortality.
- Between 1994 and 2003, there were 15 deaths from renal cancer among children.
- Males and females were equally affected.

Conclusions

Childhood cancers are uncommon but they remain an important public health issue. The information in this report summarizes current incidence and mortality 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. Efforts are underway to pool information from states with high quality cancer registries for the purpose of research. Georgia will participate in these group research projects.

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 75% 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 Comprehensive 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 will 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 Comprehensive 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 rate: The number of new cancer cases occurring in a population during a specified period of time. For childhood cancer, this is expressed per million population.
Cancer mortality rate: The number of cancer deaths occurring in a population during a specified period of time. For childhood cancer, this is expressed 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 were obtained from the Georgia Department of Human Resources, Division of Public Health, Vital Records Branch. Mortality data were coded using ICD-9 (1980-1998) and ICD-10 codes (1999-2003). A list of the cancer groupings used for this publication is in Appendix B.

The number of new cases and incidence rates for the state of Georgia were obtained from the Georgia Department of Human Resources, Division of Public Health, Georgia Comprehensive Cancer Registry. Incidence data were coded using ICD-O-3 codes. The International Classification of Childhood Cancer (ICCC-3) groupings were used. For more information on this classification scheme, please visit the International Association of Cancer Registries on the web at http://www.iacr.com.fr/.

Childhood cancer survival data for the United States were obtained from SEER Cancer Statistics Review, 1975-2002, available at http://seer.cancer.gov/csr/1975_2002/. Survival data were categorized using the International Classification of Childhood Cancer (ICCC-2).

Population estimates for 1980-2003 and the 2000 US standard million 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 million population. The incidence rates are four-year average annual rates for the period 1999 through 2002, as these are the years in which Georgia Comprehensive Cancer Registry data are greater than 95% complete.

Mortality rates were calculated per million population and age-adjusted by the direct method to the 2000 US standard million population. Except where calculated to show trends, the mortality rates are five-year average annual rates for 1999-2003.

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 Department of Human Resources, Division 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 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). NPCR provides 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 morbidity 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://health.state.ga.us/programs/gccr/.

Appendix B

ICD-9 Codes for Childhood Cancer Mortality (1980-1998)*

All Sites	140-208
Leukemias	202.4, 203.1, 204-208
CNS	191-192
Lymphomas & Other Reticuloendothelial Neoplasms	200.0-202.3, 202.5-203.0, 203.2-203.8
Soft Tissue, including heart	171, 164.1
Renal Tumors	189.0, 189.1
Bone Tumors	170
Hepatic Tumors	155.0-155.2
Other & Unspecified	179, 185, 193, 140.0-154.8, 156.0-164.0 164.2-165.9, 172.0-188.9, 189.2-190.9, 194.0-199.1

ICD-10 Codes for Childhood Cancer Mortality (1999-2003)*

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-3) groupings were used.
For more information, please contact the International Association of Cancer Registries.

* The comparability ratio for malignant neoplasms is 1.0068. No adjustments were made to the data to take this into account.

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
2.0 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
4.0 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
6.0 East Central	Burke, Columbia, Emanuel, Glascock, Jefferson, Jenkins, Lincoln, McDuffie, Richmond, Screven, Taliaferro, Warren, Wilkes
7.0 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
10.0 Northeast	Barrow, Clarke, Elbert, Greene, Jackson, Madison, Morgan, Oconee, Oglethorpe, Walton