

Leukemia in Ohio 2024

February 2024

Key Findings

- An average of 1,749 cases of leukemia were diagnosed and 970 deaths occurred each year in Ohio during 2016-2020.
- The leukemia incidence rate in Ohio was 12.4 per 100,000 population, compared with the national rate of 14.0 per 100,000 during 2016-2020.
- Leukemia occurs more often in males than in females.
- White people have higher incidence and mortality rates of leukemia than Black people and Asians/Pacific Islanders in Ohio and the United States.
- Leukemia was most frequently diagnosed among people in the 65-74 age group during 2016-2020.
- While there were no clear trends in leukemia incidence rates, mortality rates decreased for males and females in Ohio from 1996 to 2020.
- The incidence of leukemia was highest in Ohio's southern, southeastern, and northern counties during 2016-2020.
- Among adults, the most common types of leukemia are acute myeloid leukemia (AML) and chronic lymphocytic leukemia (CLL).
- Five-year relative survival for leukemia in Ohio was 63.4% for cases diagnosed during the period 2013-2019.
- Acute lymphocytic leukemia (ALL) is the most common type of leukemia among children and adolescents.

New Cases

Leukemia is cancer that originates in the bone marrow and causes the production of abnormal blood cells, particularly white blood cells that help the body to fight infections and other diseases. Leukemia made up 2.5% of newly diagnosed (incidence) cancer cases in Ohio reported to the Ohio Cancer Incidence Surveillance System (OCISS) from 2016 to 2020. An average of 1,749 cases of leukemia were diagnosed annually in Ohio during this time period (Table 1). During 2016-2020, the average annual age-adjusted incidence rate for leukemia in Ohio was 12.4 per 100,000 population, compared with the national incidence rate of 14.0 per 100,000. The leukemia incidence rate among males (15.8 per 100,000) was higher than the rate among females (9.6 per 100,000). The incidence rate among White Ohioans (12.6 per 100,000) was higher than the rate among Black Ohioans (9.1 per 100,000) and Asians/Pacific Islanders (6.6 per 100,000) in Ohio in 2016-2020.

Deaths

Leukemia made up 3.8% of all cancer deaths in Ohio during 2016-2020, with an average of 970 deaths occurring each year (Table 1). The average annual age-adjusted mortality rate for leukemia in Ohio was 6.6 per 100,000 population, compared with the U.S. mortality rate of 6.0 per 100,000. The leukemia mortality rate was higher among males (8.7 per 100,000) than females (5.0 per 100,000). The mortality rate among White Ohioans (6.7 per 100,000) was higher than Black Ohioans (5.5 per 100,000) and Asians/Pacific Islanders (3.1 per 100,000) during 2016-2020.

Table 1. Average Annual Number and Age-Adjusted Rates of Leukemia Cases and Deaths per 100,000 Population by Sex, Race, and Age Group, Ohio and the United States, 2016-2020

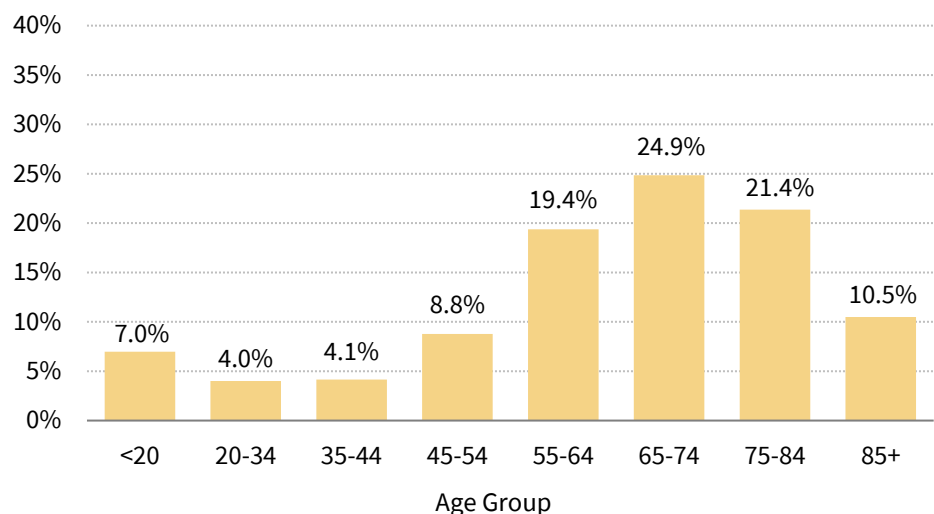
		Incidence			Mortality		
		Ohio Cases	Ohio Rate	U.S. Rate	Ohio Deaths	Ohio Rate	U.S. Rate
Total		1,749	12.4	14.0	970	6.6	6.0
Sex	Male	1,020	15.8	17.8	550	8.7	8.0
	Female	729	9.6	10.9	420	5.0	4.5
Race	White	1,548	12.6	14.9	876	6.7	6.3
	Black	139	9.1	10.8	82	5.5	5.1
	A/PI	19	6.6	8.1	7	3.1	3.4
Age Group	<65	757	6.7	7.2	214	1.8	1.6
	65+	992	51.5	61.0	756	39.7	36.3

Sources: Ohio Cancer Incidence Surveillance System and Bureau of Vital Statistics, Ohio Department of Health, 2023; Surveillance, Epidemiology, and End Results (SEER) Program, National Cancer Institute, 2023.
A/PI = Asian/Pacific Islander.

Incidence by Age Group

In Ohio during 2016-2020, leukemia was most frequently diagnosed among people in the 65-74 age group (24.9%). The incidence of leukemia among children and adolescents (less than 20 years old) made up 7.0% of cases (Figure 1).

Figure 1. Percent of New Leukemia Cases by Age Group, Ohio, 2016-2020

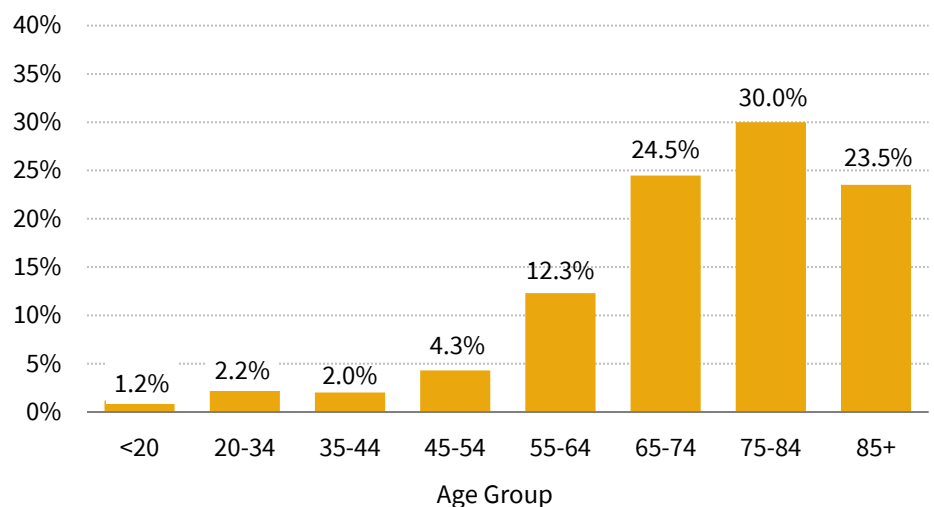


Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Mortality by Age Group

The percentage of leukemia deaths was highest among Ohioans in the 75-84 age group (30.0%) (Figure 2).

Figure 2. Percent of Leukemia Deaths by Age Group, Ohio, 2016-2020

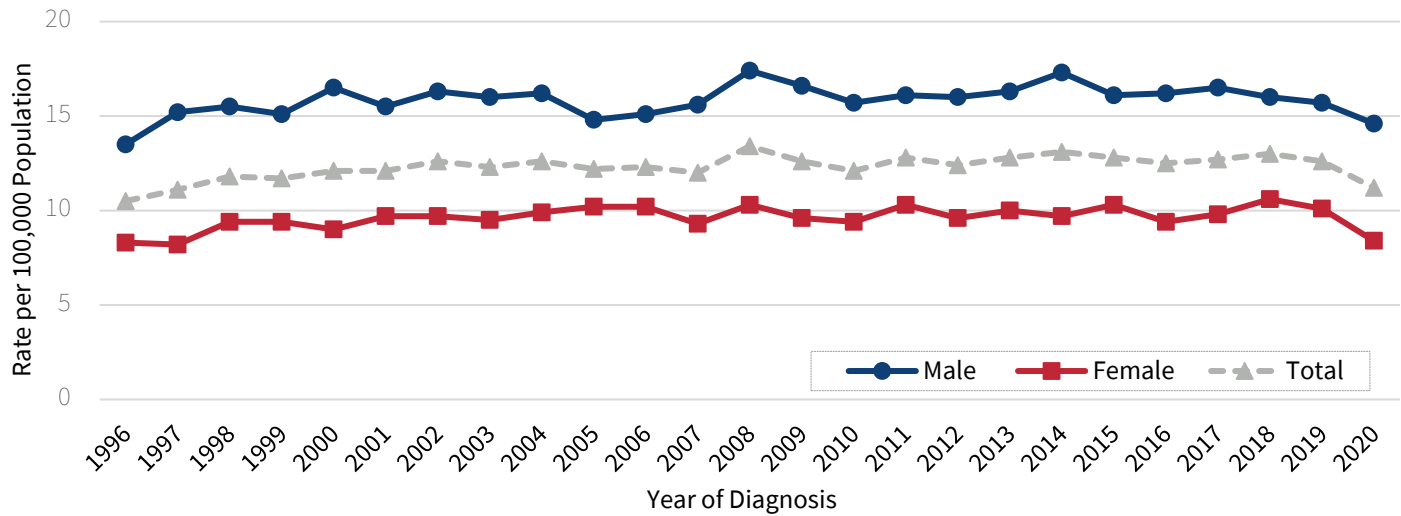


Source: Bureau of Vital Statistics, Ohio Department of Health, 2023.

Trends in Rates

Figure 3 shows incidence rates of leukemia according to year of diagnosis (1996 through 2020) for males and females in Ohio. For each year, the incidence rate was higher among Ohio males, compared with females. From 1996 to 2020, there was no clear trend in leukemia incidence rates in Ohio among men and women.

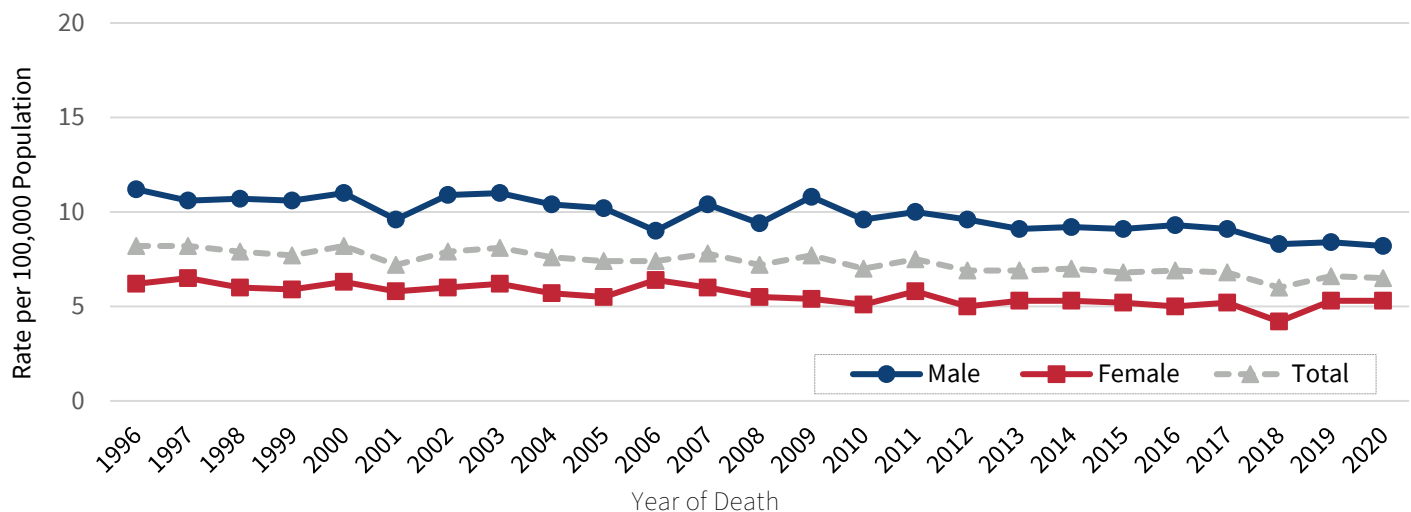
Figure 3. Trends in Age-Adjusted Incidence Rates of Leukemia per 100,000 Population by Sex, Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 4 shows leukemia mortality rates in Ohio according to year of death (1996 through 2020) for males and females. For each year, leukemia mortality rates were higher among males, compared with females in Ohio. From 1996 to 2020, leukemia mortality rates decreased 27% and 15% among Ohio males and females, respectively.

Figure 4. Trends in Age-Adjusted Mortality Rates of Leukemia per 100,000 Population by Sex, Ohio, 1996-2020

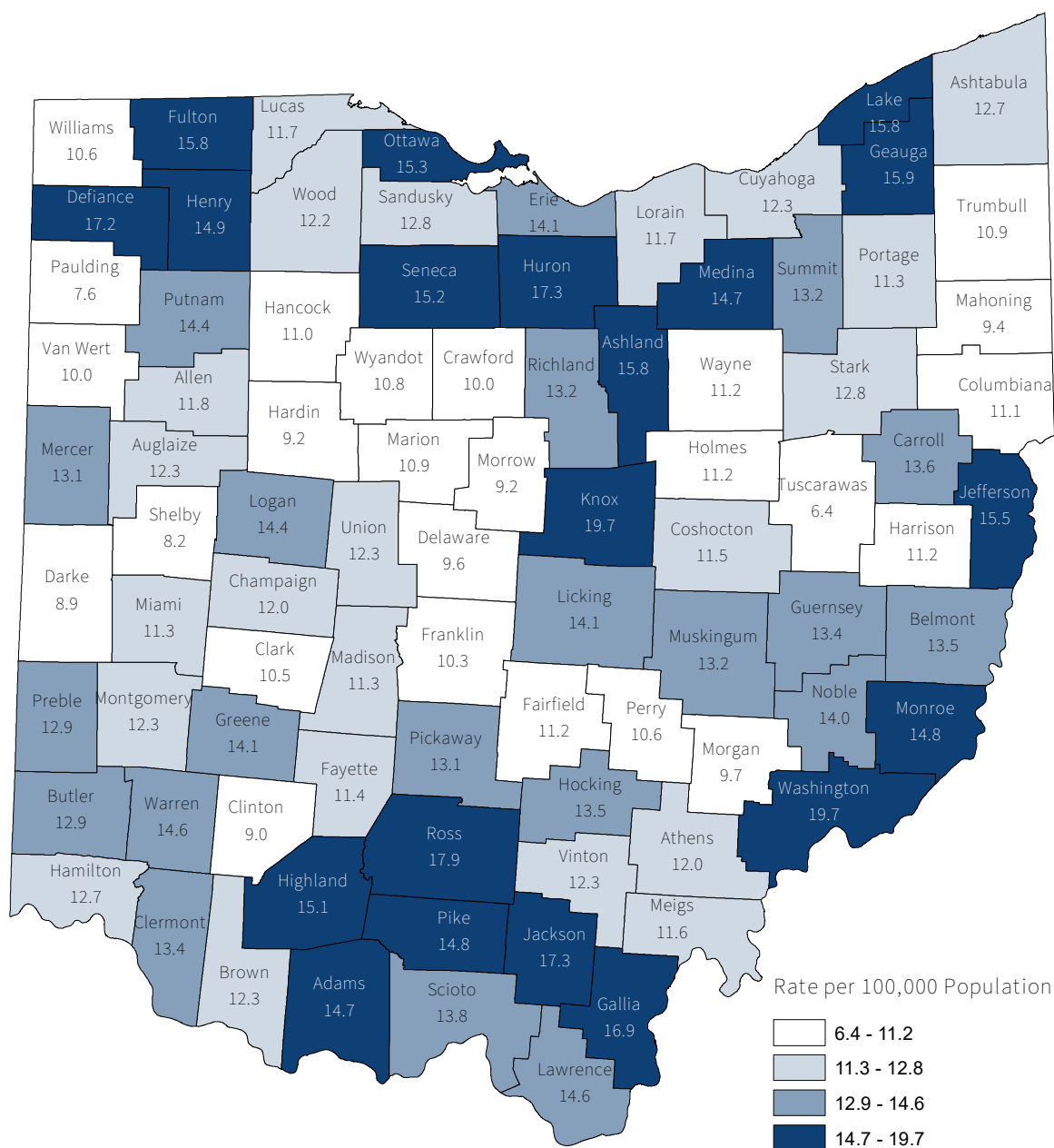


Source: Bureau of Vital Statistics, Ohio Department of Health, 2023.

Incidence by County

Figure 5 shows 2016-2020 average annual age-adjusted leukemia incidence rates by county of residence. County-specific leukemia incidence rates in Ohio ranged from 6.4 to 19.7 per 100,000 population, compared with Ohio's rate of 12.4 per 100,000. The incidence of leukemia was highest in Ohio's southern, southeastern, and northern counties during 2016-2020.

Figure 5. Average Annual Age-Adjusted Incidence Rates of Leukemia per 100,000 Population by County of Residence, Ohio, 2016-2020



Types of Leukemia

Leukemias are named for how quickly the disease develops and gets worse. Leukemia can be either acute or chronic. In acute leukemia, abnormal blood cells are unable to properly mature and cannot carry out normal functions. These abnormal cells accumulate more rapidly, and the disease worsens more quickly. Chronic leukemia usually develops slowly. In chronic leukemia, the cells can mature, but are not completely normal and do not fight infection as well. Leukemias are also named for the type of white blood cell that is affected. Leukemia can arise in either of two main types of white blood cells – lymphoid cells or myeloid cells. The four primary types (histologies) of leukemia are:

Acute Lymphocytic Leukemia (ALL) occurs when a bone marrow cell develops errors in its DNA, which causes the production of immature white blood cells called lymphoblasts. ALL is the most common type in young children, but also affects adults, mainly those 65 years old and older.

Acute Myeloid Leukemia (AML) is caused by damage to the DNA of developing cells in bone marrow. AML occurs in both adults and children, but it is most common in adults 65 years old and older. AML was the most common type, making up 33.7% of all leukemias in Ohio in 2016-2020 (Table 2).

Chronic Lymphocytic Leukemia (CLL) results from a genetic mutation in the DNA of blood-producing cells, leading to progressive accumulation of small, mature-appearing lymphocytes in blood lymph nodes, the spleen and bone marrow. CLL most often affects adults 55 years old and older and is rare in children. CLL was the second most common type (30.9%) in Ohio during 2016-2020 (Table 2).

Chronic Myeloid Leukemia (CML) results from injury to the DNA of a stem cell in the bone marrow leading to uncontrolled growth of white cells. CML occurs mainly in adults.

Table 2. Average Annual Number and Percent of Leukemia Cases by Histology, Ohio, 2016-2020

Histology	Cases	Percent
Acute Lymphocytic Leukemia (ALL)	178	10.2%
Acute Myeloid Leukemia (AML)	589	33.7%
Chronic Lymphocytic Leukemia (CLL)	540	30.9%
Chronic Myeloid Leukemia (CML)	237	13.5%

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.
Other types of leukemia not listed above make up an average of 205 cases per year (not shown).

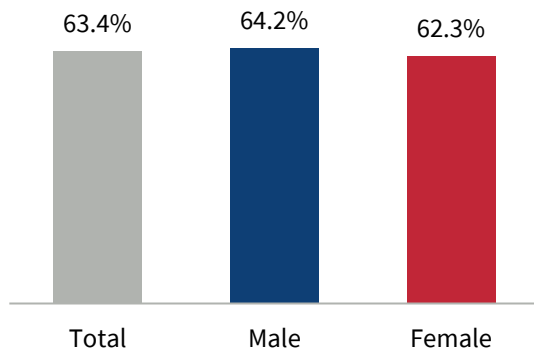
Did You Know?

Although leukemia is often thought of as a childhood cancer, most leukemia cases (93%) in the United States are diagnosed among adults (20 years old and older). Among adults, the most common types are AML and CLL. Among children and adolescents 0 to 19 years old, ALL is the most common type of leukemia.

Survival

Relative survival is the percentage of people who are alive at a designated time period (usually five years) after a diagnosis divided by the percentage expected to be alive in the absence of a diagnosis based on normal life expectancy.

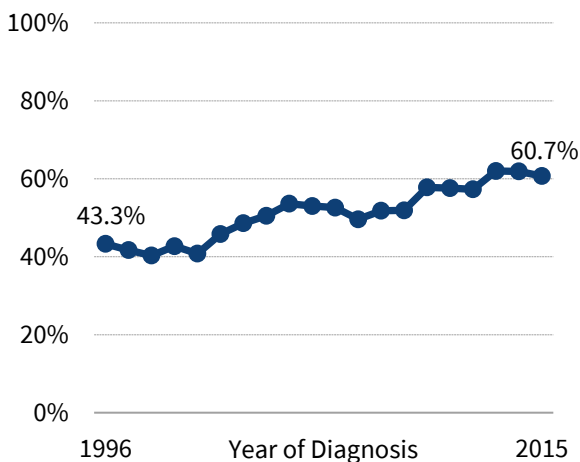
Figure 6. Five-Year Relative Survival (%) for Leukemia by Sex, Ohio, 2013-2019



- The five-year relative survival for leukemia was 63.4%, based on Ohio cases diagnosed during 2013-2019.
- Ohio males had a slightly higher five-year relative survival (64.2%) than Ohio females (62.3%) (Figure 6).

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 7. Trend in Five-Year Relative Survival (%) for Leukemia, Ohio, 1996-2015

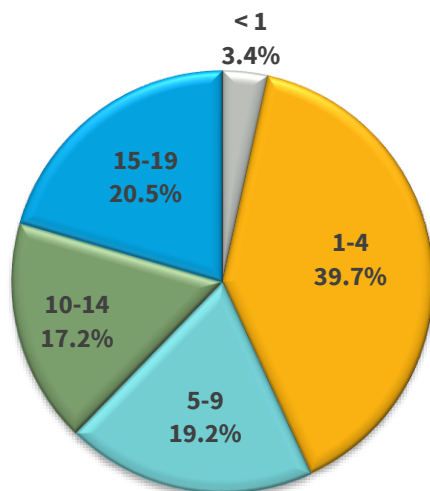


- As shown in Figure 7, there was a substantial improvement in five-year relative survival for leukemia in Ohio from 1996 (43.3%) to 2015 (60.7%).
- Treatment advances such as the development of targeted drugs have resulted in large survival improvements for most types of leukemia, according to the American Cancer Society.

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Leukemia in Children and Adolescents

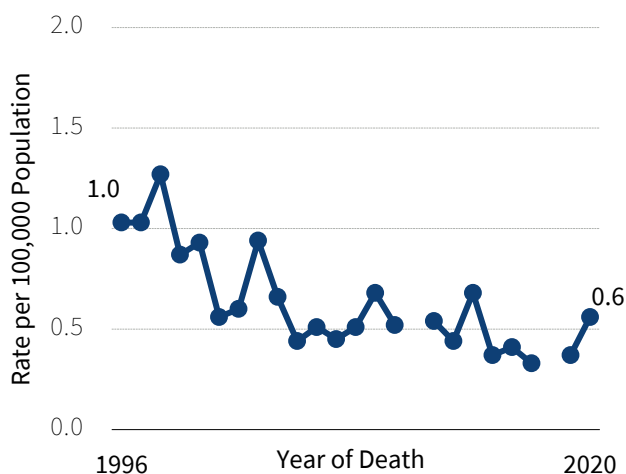
Figure 8. Percent of Leukemia Cases Among Children and Adolescents (Ages 0-19) by Age Group, Ohio, 2016-2020



- Among childhood cancers, leukemia is the most common, representing an average of 122 cases per year and accounting for 22% of all new child and adolescent cancer cases in Ohio during 2016-2020.
- Leukemia occurred most often in the 1-4 age group (39.7%) among children and adolescents in Ohio during 2016-2020 (Figure 8).
- Child and adolescent leukemia incidence rates were variable in Ohio during 1996-2020 (not shown).

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 9. Trend in Leukemia Mortality Rates per 100,000 Population Among Children and Adolescents (Ages 0-19), Ohio, 1996-2020

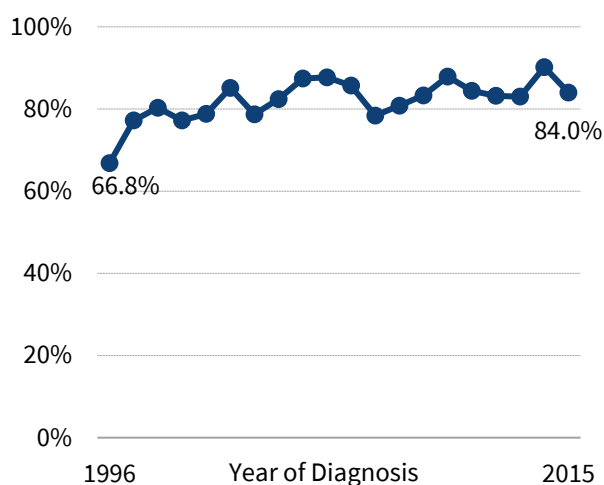


Source: SEER*Stat Mortality Database, All Cause of Death (Ohio), National Cancer Institute, released June 2022.

Rates are not presented when the death count is less than 10 (2011 and 2018).

- Leukemia death rates were variable but declined among Ohio's children and adolescents from 1996 to 2020, decreasing from 1.0 per 100,000 population in 1996 to 0.6 per 100,000 in 2020.

Figure 10. Trend in Five-Year Relative Survival (%) for Leukemia Among Children and Adolescents (Ages 0-19), Ohio, 1996-2015



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

- Correspondingly, five-year relative survival improved for this age group in Ohio, increasing from 66.8% in 1996 to 84.0% in 2015.

Risk Factors

Anything that increases your risk of getting a disease is called a risk factor. Having a risk factor does not mean that you will get cancer; not having risk factors doesn't mean that you will not get cancer. The following is a list of risk factors for leukemia:

Non-Modifiable Risk Factors

Age: ALL is most commonly diagnosed among children, whereas AML, CLL, and CML occur mainly in adults.

Sex: Leukemia is more common among men than women.

Race: White people have higher rates of leukemia compared to Black people.

Family history: While it is rare for more than one person in a family to have leukemia, family history increases the risk of CLL.

Down syndrome and other inherited diseases: Down syndrome and certain other inherited diseases increase the risk of developing acute leukemia (ALL and AML).

Myelodysplastic syndrome and certain other blood disorders: People with certain blood disorders are at increased risk of AML.

Modifiable Risk Factors

Radiation: People exposed to very high levels of radiation are much more likely than others to get AML, CML, or ALL. Radiation exposure resulting from medical treatment for cancer and other conditions can increase risk.

Benzene: Exposure to benzene in the workplace can cause AML. It may also cause CML and ALL. Benzene is found in the chemical industry, cigarette smoke, and gasoline.

Chemotherapy: Certain chemotherapy (chemo) drugs, such as alkylating agents, platinum-based drugs, or topoisomerase II inhibitors, can increase the risk of leukemia, mainly AML. ALL has also been linked to chemo.

Smoking: Smoking cigarettes increases risk of AML.

Human T-cell leukemia virus type I (HTLV-I): People with HTLV-I infection are at increased risk of a rare type of leukemia known as adult T-cell leukemia.

Signs and Symptoms

In acute leukemia, signs may appear suddenly, while chronic leukemia typically progresses slowly with few symptoms and is often diagnosed during routine blood tests. Symptoms may include:

- Fatigue.
- Paleness.
- Weight loss.
- Repeated infections.
- Fever.
- Bleeding or bruising easily.
- Bone or joint pain.
- Swelling in the lymph nodes or abdomen.

Any of these signs/symptoms may be caused by cancer or by other, less serious health problems. If you have any of these signs/symptoms, see your healthcare provider.

Early Detection

There are no recommended screening tests for the detection of leukemia. However, it is sometimes diagnosed early because of abnormal results on blood tests performed for other indications.

Technical Notes

Age-Adjusted Rate: A summary rate that is a weighted average of age-specific rates, where the weights represent the age distribution of a standard population (direct adjustment). The incidence and mortality rates presented in this report were standardized to the age distribution of the 2000 U.S. Standard Population. Under the direct method, the population was first divided into 19 age groups, i.e., <1, 1-4, 5-9, 10-14, 15-19...85+, and the age-specific rate was calculated for each age group. Each age-specific rate was then multiplied by the standard population proportion for the respective age group.

Average Annual Number: The number of cases or deaths diagnosed per year, on average, for the time period of interest (e.g., 2016-2020). Average annual numbers are calculated by summing the number of cases or deaths for a given time period, dividing by the number of years that comprise the time period, and rounding to the nearest whole number.

Census Data: The 1996-2020 rates were calculated using population estimates from the U.S. Census Bureau and National Center for Health Statistics. Population data were compiled from bridged-race intercensal population estimates for July 1, 1990-July 1, 1999; revised bridged-race intercensal population estimates for July 1, 2000-July 1, 2004 (Oct. 26, 2012); revised bridged-race intercensal population estimates for July 1, 2005-July 1, 2009 (released June 26, 2014); and vintage 2020 bridged-race postcensal population estimates for July 1, 2010-July 1, 2020 (released Sept. 22, 2021).

Incidence: The number of cases diagnosed during a specified time period (e.g., 2016-2020). Leukemia cases were defined by the International Classification of Diseases for Oncology, Third Edition (ICD-O-3), and categorized by site and histology codes following the conventions of the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute.

Invasive Cancer: A malignant tumor that has infiltrated the organ in which the tumor originated. Invasive cancers consist of those diagnosed at the local, regional, distant, and unstaged/unknown stages. Only invasive cancers were included in the calculation of incidence rates in this document.

Mortality: The number of deaths during a specified time period (e.g., 2016-2020). Leukemia deaths were defined by the International Statistical Classification of Diseases and Related Health Problems, Ninth Edition (ICD-9) for 1996-1998 and the International Statistical Classification of Diseases and Related Health Problems, Tenth Edition (ICD-10) for 1999-2020, and categorized by site codes following the conventions of the SEER Program of the National Cancer Institute.

Rate: The number of cases or deaths per unit of population (e.g., per 100,000 population) during a specified time period (e.g., 2016-2020). Rates may be unstable and are not presented when the count is less than five (incidence) or 10 (mortality).

Relative Survival: The percentage of people who are alive at a designated time period (usually five years) after a cancer diagnosis divided by the percentage expected to be alive in the absence of cancer based on normal life expectancy. SEER*Stat (version 8.4.2) was used to perform survival calculations for Ohio cases diagnosed during 2013-2019 with follow-up through 2020.

Table 3. Average Annual Number and Age-Adjusted Rates of Leukemia Cases and Deaths per 100,000 Population by County of Residence, Ohio and the United States, 2016-2020

	Incidence		Mortality			Incidence		Mortality	
	Cases	Rate	Deaths	Rate		Cases	Rate	Deaths	Rate
Ohio	1,749	12.4	970	6.6	Lawrence	12	14.6	6	7.4
U.S.		14.0		6.0	Licking	29	14.1	14	6.5
Adams	5	14.7	4	10.8	Logan	9	14.4	4	5.8
Allen	14	11.8	9	6.8	Lorain	45	11.7	25	6.2
Ashland	11	15.8	5	6.7	Lucas	59	11.7	37	7.1
Ashtabula	16	12.7	11	7.8	Madison	6	11.3	3	6.0
Athens	8	12.0	3	4.6	Mahoning	30	9.4	19	5.2
Auglaize	8	12.3	5	7.3	Marion	9	10.9	7	7.4
Belmont	12	13.5	8	7.8	Medina	32	14.7	13	5.8
Brown	7	12.3	5	8.3	Meigs	4	11.6	<2	*
Butler	54	12.9	28	6.8	Mercer	7	13.1	4	7.2
Carroll	5	13.6	2	5.5	Miami	15	11.3	10	6.4
Champaign	6	12.0	4	7.2	Monroe	3	14.8	<2	*
Clark	18	10.5	16	8.4	Montgomery	80	12.3	40	5.8
Clermont	32	13.4	15	6.1	Morgan	2	9.7	<2	*
Clinton	5	9.0	3	6.1	Morrow	4	9.2	<2	*
Columbiana	15	11.1	10	6.7	Muskingum	15	13.2	9	7.9
Coshocton	6	11.5	4	7.0	Noble	3	14.0	<2	*
Crawford	6	10.0	4	5.9	Ottawa	10	15.3	4	6.2
Cuyahoga	192	12.3	113	6.7	Paulding	2	7.6	<2	*
Darke	6	8.9	5	6.2	Perry	5	10.6	4	8.6
Defiance	9	17.2	4	7.7	Pickaway	9	13.1	5	7.4
Delaware	20	9.6	9	4.6	Pike	6	14.8	2	5.5
Erie	15	14.1	8	6.7	Portage	22	11.3	10	5.2
Fairfield	19	11.2	13	7.0	Preble	7	12.9	5	9.6
Fayette	4	11.4	4	11.5	Putnam	6	14.4	4	7.7
Franklin	130	10.3	73	6.0	Richland	21	13.2	11	6.2
Fulton	9	15.8	5	8.9	Ross	17	17.9	8	8.2
Gallia	7	16.9	5	11.0	Sandusky	10	12.8	5	7.1
Geauga	19	15.9	8	6.6	Scioto	13	13.8	7	7.4
Greene	27	14.1	12	5.7	Seneca	10	15.2	5	7.5
Guernsey	7	13.4	4	7.2	Shelby	5	8.2	3	4.4
Hamilton	120	12.7	63	6.6	Stark	62	12.8	37	7.0
Hancock	11	11.0	7	7.8	Summit	91	13.2	49	6.8
Hardin	3	9.2	3	8.2	Trumbull	30	10.9	21	6.8
Harrison	3	11.2	<2	*	Tuscarawas	8	6.4	7	4.9
Henry	5	14.9	2	5.3	Union	7	12.3	3	5.0
Highland	9	15.1	3	5.2	Van Wert	4	10.0	4	9.1
Hocking	4	13.5	<2	*	Vinton	2	12.3	<2	*
Holmes	5	11.2	3	6.1	Warren	38	14.6	14	5.8
Huron	12	17.3	5	7.0	Washington	16	19.7	6	7.0
Jackson	7	17.3	3	6.6	Wayne	16	11.2	10	6.7
Jefferson	13	15.5	7	7.5	Williams	5	10.6	3	6.9
Knox	15	19.7	5	6.7	Wood	17	12.2	13	8.8
Lake	50	15.8	25	7.2	Wyandot	3	10.8	<2	*

Source: Ohio Cancer Incidence Surveillance System and Bureau of Vital Statistics, Ohio Department of Health, 2023; Surveillance, Epidemiology, and End Results (SEER) Program, National Cancer Institute, 2023.

*Rate not presented when the death count for 2016-2020 is less than 10 (i.e., the average annual count is less than two).

Sources of Data and Additional Information

Ohio Cancer Incidence Surveillance System:

<https://odh.ohio.gov/know-our-programs/ohio-cancer-incidence-surveillance-system/welcome>

National Cancer Institute:

<https://www.cancer.gov/types/leukemia>

American Cancer Society:

<https://www.cancer.org/cancer/leukemia.html>

To address comments and information requests:

Ohio Cancer Incidence Surveillance System (OCISS)
Ohio Department of Health
246 North High Street
Columbus, OH 43215
Phone: (614) 752-2689
E-mail: ociss@odh.ohio.gov

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John Kollman, M.S.; Holly L. Sobotka, M.S.
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