

Non-Hodgkin Lymphoma in Ohio, 2011-2015

Incidence and Mortality

Non-Hodgkin lymphoma (NHL) is a cancer that begins in cells called lymphocytes (white blood cells), which are a part of the body's immune system. NHL made up 4 percent of newly diagnosed (incidence) cancer cases in Ohio reported to the Ohio Cancer Incidence Surveillance System (OCISS) from 2011 to 2015. An average of 2,595 cases of NHL were diagnosed annually in Ohio during this time period (Table 1). Between 2011 and 2015, the average annual age-adjusted incidence rate for NHL in Ohio was 19.0 per 100,000, compared to the national (SEER) incidence rate of 19.4 per 100,000. The incidence rate among males diagnosed with NHL (23.1 per 100,000) was 1.5 times higher than the rate among females (15.6 per 100,000), and the incidence rate was 1.4 times higher among whites (19.4 per 100,000) compared to blacks (13.5 per 100,000) in Ohio in 2011-2015.

An average of 888 deaths from NHL occurred each year in Ohio in 2011-2015 (Table 1). The average annual age-adjusted mortality rate for NHL in Ohio was 6.4 per 100,000, compared to the U.S. mortality rate of 5.7 per 100,000. The mortality rate was 1.7 times higher for males (8.3 per 100,000) than females (4.9 per 100,000) in Ohio during this time period.

Key Findings and Populations at High Risk

- An average of 2,595 cases of NHL were diagnosed each year in Ohio in 2011-2015.
- The NHL incidence rate in Ohio was 19.0 per 100,000, compared to the national rate of 19.4 per 100,000 in 2011-2015.
- NHL occurs more often in males than in females.
- Whites have higher incidence and mortality rates of NHL than blacks in Ohio and the United States.
- NHL was most frequently diagnosed among Ohio males ages 65 to 69 and females ages 70 to 74 in 2011-2015.
- Trends in NHL incidence rates remained stable, while mortality rates decreased for men and women in Ohio from 1996 to 2015.
- In Ohio, there was no clear geographic pattern of NHL incidence by county in 2011-2015.
- Half of NHL cases were diagnosed at the distant stage in Ohio in 2011-2015. Over the last 20 years, NHL cases diagnosed at the distant stage in Ohio increased, while cases diagnosed as unstaged/missing stage decreased.

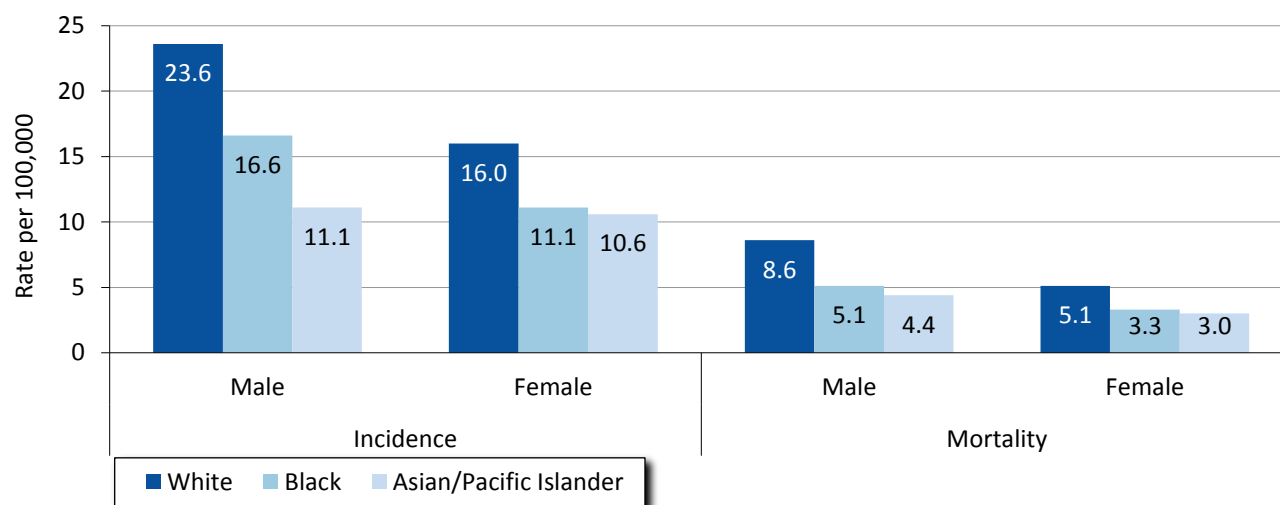
Table 1. Average Annual Number and Age-adjusted Rates of NHL Cases and Deaths per 100,000 Persons by Sex, Race and Age Group, Ohio and the United States, 2011-2015

		Incidence			Mortality		
		Ohio Cases	Ohio Rate	U.S. Rate	Ohio Deaths	Ohio Rate	U.S. Rate
Total		2,595	19.0	19.4	888	6.4	5.7
Sex	Male	1,420	23.1	23.6	491	8.3	7.4
	Female	1,175	15.6	15.9	397	4.9	4.5
Race	White	2,350	19.4	20.3	827	6.6	6.0
	Black	189	13.5	14.4	54	4.1	4.2
	Asian/Pacific Islander	19	11.0	13.6	5	3.6	3.9
Age Group	<65	1,075	8.9	9.1	191	1.5	1.4
	65+	1,520	88.7	90.4	697	40.3	35.9

Sources: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018; Bureau of Vital Statistics, Ohio Department of Health, 2018; Surveillance, Epidemiology and End Results (SEER) Program, National Cancer Institute, 2018.

Incidence and Mortality by Sex and Race

Figure 1. Average Annual Age-adjusted NHL Incidence and Mortality Rates per 100,000 Persons by Sex and Race, Ohio, 2011-2015

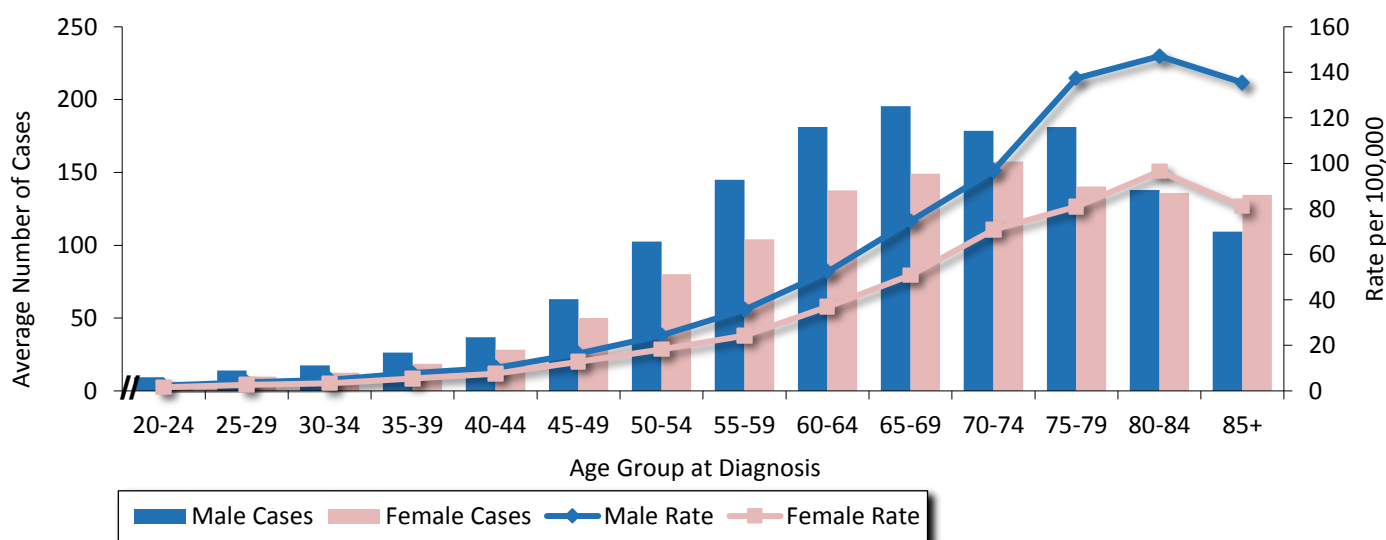


Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018.

White males were more likely to be diagnosed with and die from NHL in Ohio, based on data from 2011 to 2015, followed by black males and white females (Figure 1). In Ohio, Asian/Pacific Islander males and females had lower incidence and mortality rates for NHL compared to both blacks and whites in 2011-2015.

Incidence by Age Group and Sex

Figure 2. Average Annual Number and Age-specific NHL Incidence Rates per 100,000 Persons by Age Group and Sex, Ohio, 2011-2015



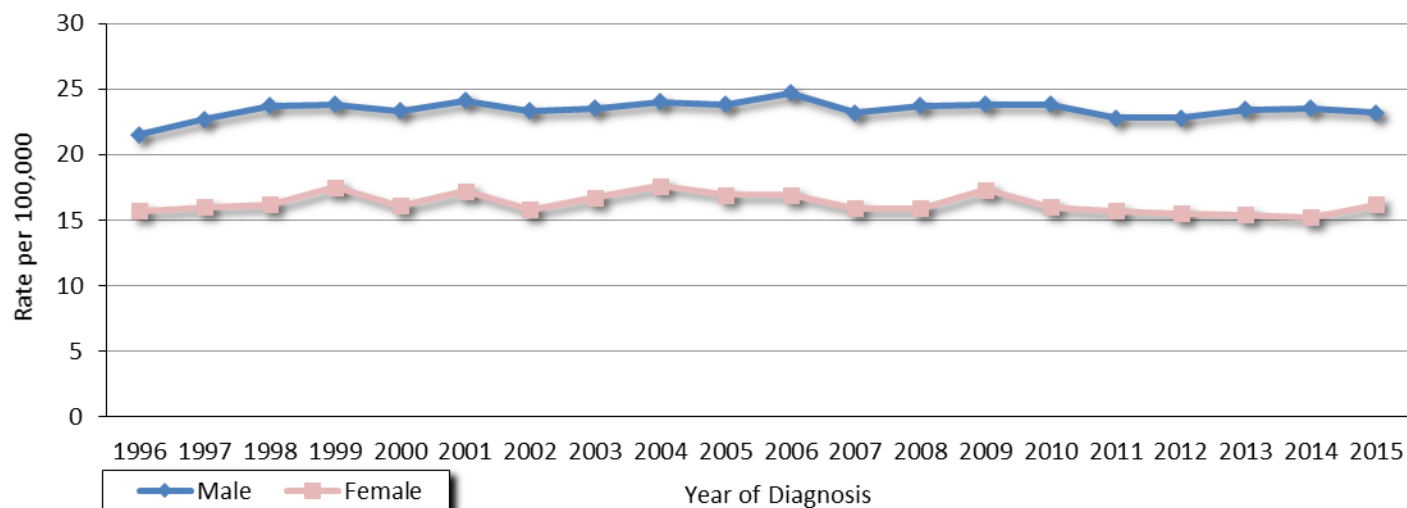
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018.

In Ohio between 2011 and 2015, NHL was most frequently diagnosed among men ages 65 to 69 and among women ages 70 to 74 (Figure 2). Incidence rates for both males and females increased with advancing age group from ages 20-24 years to 80-84 years, followed by a decline.

Trends in Incidence and Mortality

Figure 3 shows incidence rates of NHL according to year of diagnosis (1996 through 2015) for males and females in Ohio. For each year, the incidence rate was higher among Ohio males compared to females. From 1996 to 2015, NHL incidence rates have remained stable for both men and women in Ohio.

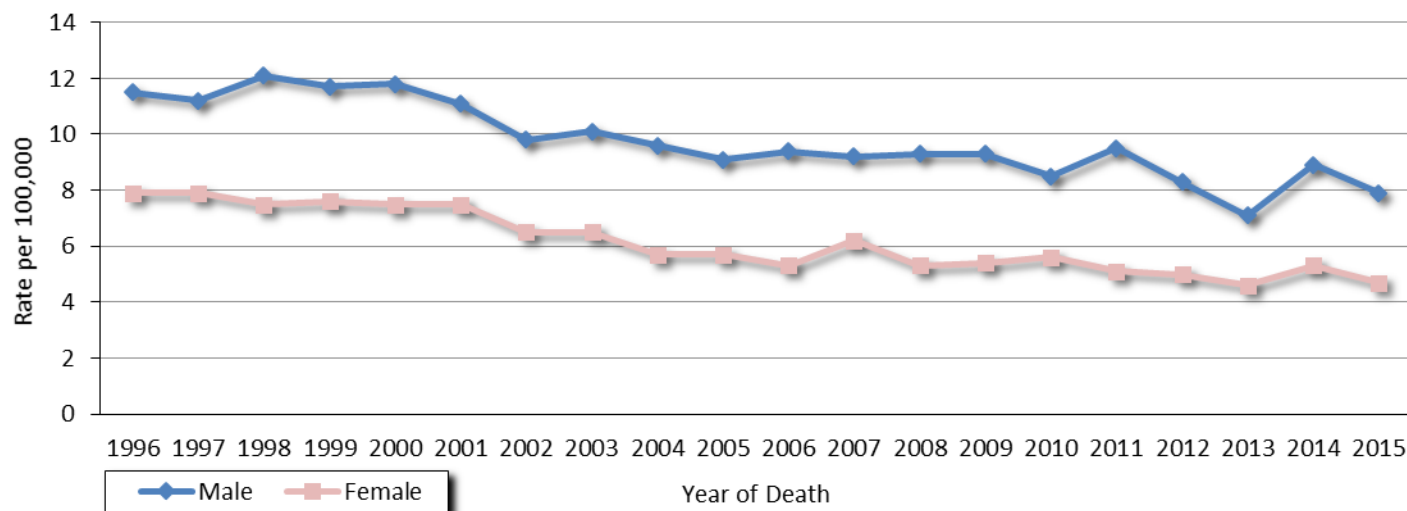
Figure 3. Trends in Age-adjusted NHL Incidence Rates per 100,000 Persons by Sex in Ohio, 1996-2015



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018.

Figure 4 shows NHL mortality rates in Ohio according to year of death (1996 through 2015) for males and females. For each year, NHL mortality rates were higher among males compared to females in Ohio. From 1996 to 2015, NHL mortality rates decreased 31 percent and 40 percent among men and women, respectively.

Figure 4. Trends in Age-adjusted NHL Mortality Rates per 100,000 Persons by Sex in Ohio, 1996-2015

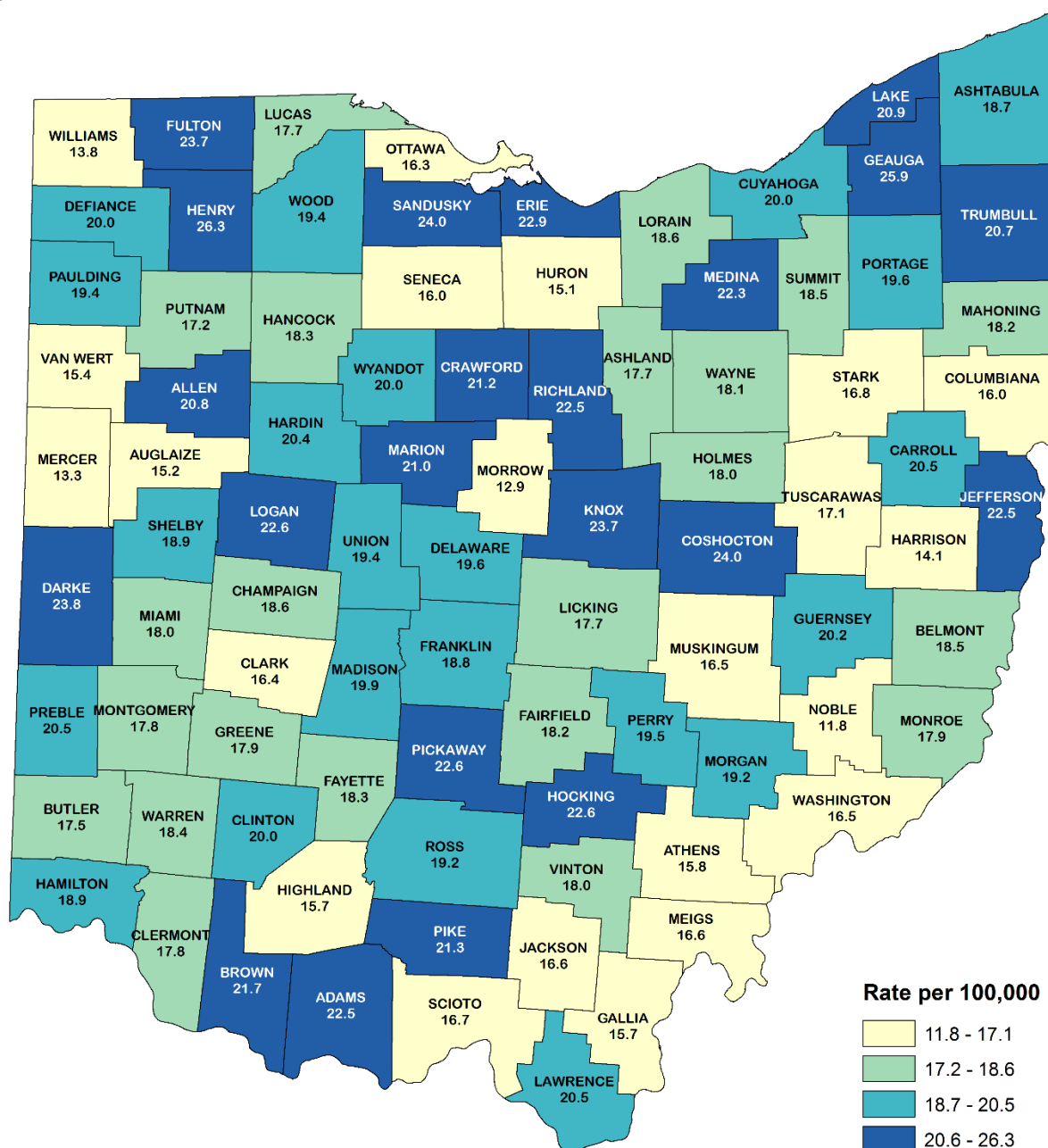


Source: Bureau of Vital Statistics, Ohio Department of Health, 2018.

Incidence by County

Figure 5 shows 2011-2015 average annual age-adjusted NHL incidence rates by county of residence. County-specific NHL incidence rates in Ohio ranged from 11.8 to 26.3 per 100,000 persons, compared with Ohio's rate of 19.0 per 100,000. There was no clear geographic pattern of incidence rates by county. The following counties had the highest incidence rates, in decreasing order, for this time period: Henry, Geauga, Coshocton, Sandusky and Darke.

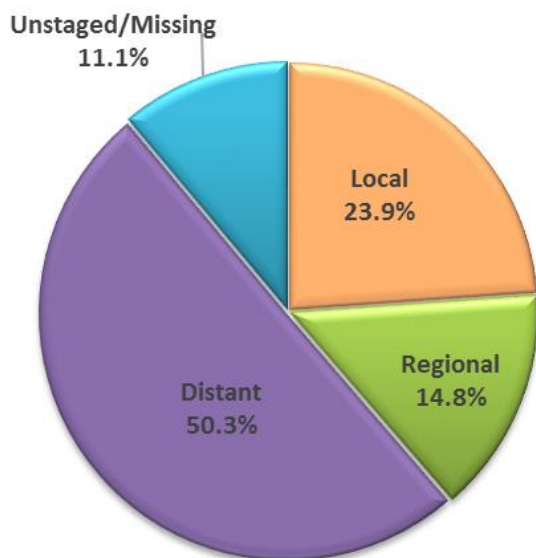
Figure 5. Average Annual Age-adjusted NHL Incidence Rates per 100,000 Persons by County of Residence in Ohio, 2011-2015



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018.
Each category represents approximately 25 percent of the 88 Ohio counties.

Stage at Diagnosis

Figure 6. Proportion of NHL Cases (%) by Stage at Diagnosis, Ohio, 2011-2015



Cancer stage at diagnosis, which refers to the extent or spread of a cancer in the body, is used to select appropriate treatment and is an important determinant of survival. If cancer cells are present only in the layer of cells where they developed and have not spread, the stage is *in situ*. If cancer cells have penetrated beyond the original layer of tissue, the cancer has become invasive and is categorized as local, regional or distant based on the extent of spread.

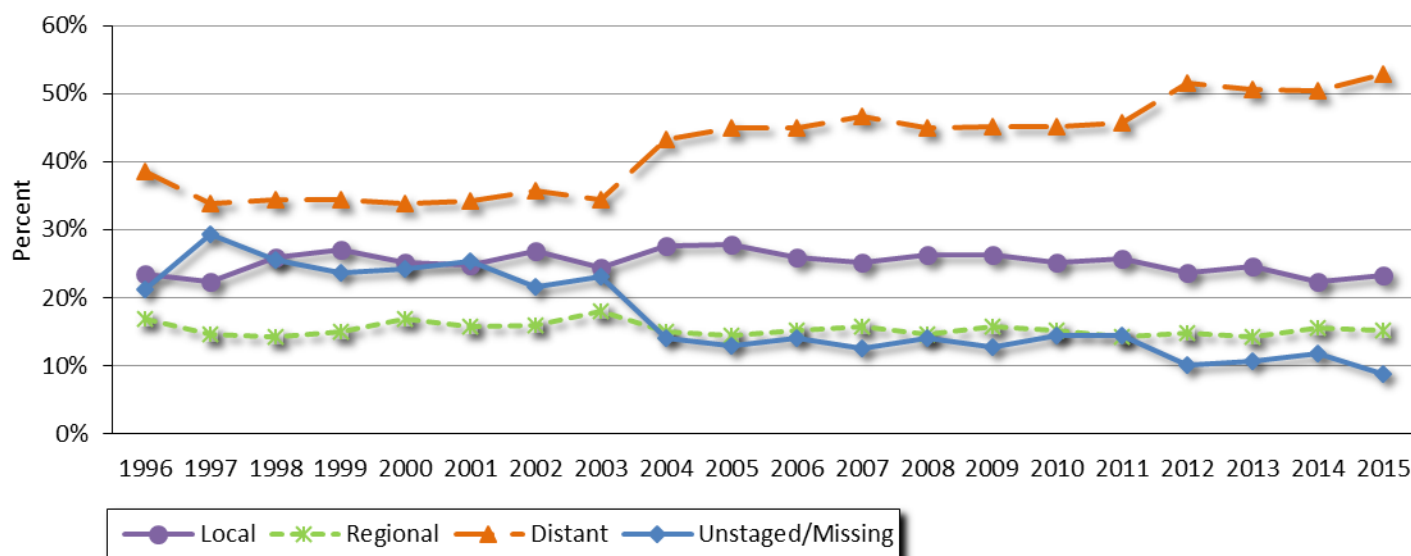
In Ohio, approximately half (50.3 percent) of NHL cases were diagnosed at the distant stage in 2011-2015 (Figure 6).

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018.

Trends in Stage at Diagnosis

Figure 7 shows the distribution of stage at diagnosis of NHL cases according to year of diagnosis from 1996 to 2015. The proportion of NHL cases diagnosed at the distant stage in Ohio increased from 38.6 percent in 1996 to 52.9 percent in 2015. There was a corresponding decrease in cases diagnosed as unstaged/missing stage during this 20-year period, from 21.2 percent in 1996 to 8.8 percent in 2015. The proportion of cases diagnosed at a local stage or regional stage remained stable in Ohio from 1996 to 2015.

Figure 7. Trends in the Proportion of NHL Cases (%) by Stage at Diagnosis, Ohio, 1996-2015



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018.

Survival

Relative survival probability 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. Table 2 shows the U.S. (SEER) five-year relative survival probability for NHL in 2008-2014 was 71.4 percent for all stages combined. Five-year relative survival probabilities were 83.3 percent at the local stage, 75.2 percent at the regional stage and 64.1 percent for distant-stage tumors. Five-year relative survival probability was greater for females (73.3 percent) compared to males (69.9 percent) for all stages combined.

Table 2: Five-year Relative Survival Probability (%) by Stage at Diagnosis and Sex in the United States, 2008-2014

	Male	Female	Total
All Stages	69.9%	73.3%	71.4%
Local	82.4%	84.2%	83.3%
Regional	75.0%	75.3%	75.2%
Distant	62.4%	66.3%	64.1%
Unstaged/Missing	66.9%	72.6%	69.6%

Source: Surveillance, Epidemiology and End Results (SEER) Program, National Cancer Institute, 2018.

Types of NHL

Lymphoma is cancer that begins in cells of the lymph system. The lymph system is part of the immune system, which helps the body fight infection and disease. Because lymph tissue is found all through the body, lymphoma can begin almost anywhere. The two main types of lymphoma are Hodgkin lymphoma and NHL. These can occur in both children and adults.

Did You Know?

- *There are many different types of NHL that form from different types of white blood cells (B-cells, T-cells, NK cells).*
- *Most types of NHL form from B-cells.*
- *NHL may be indolent (slow-growing) or aggressive (fast-growing).*
- *The most common types of NHL in adults are diffuse large B-cell lymphoma, which is usually aggressive, and follicular lymphoma, which is usually indolent.*

Risk Factors and Populations at High Risk

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 NHL:

Potentially Modifiable Risk Factors

Certain viruses: Having an infection with the Epstein-Barr virus (EBV), HIV, *Helicobacter pylori*, human herpes virus 8 (HHV8) or human T-cell leukemia/lymphoma type I (HTLV-1) increases risk of developing NHL.

Certain chemicals: Chemicals such as benzene and certain herbicides and insecticides (weed- and insect-killing substances) are linked with an increased risk of NHL.

Radiation: Studies of survivors of atomic bombs and nuclear reactor accidents have shown they have an increased risk of developing NHL. Patients treated with radiation therapy for some other cancers, such as Hodgkin disease, have a slightly higher risk of developing NHL later in life.

Non-Modifiable Risk Factors

Age: Risk of NHL increases with advancing age.

Sex: Overall, the risk of NHL is higher in men compared to women, but there are certain types of NHL that are more common in women.

Race: Whites are more likely to develop NHL than blacks or Asians/Pacific Islanders.

Weakened immune system: The risk of developing NHL is increased by having a weakened immune system (such as from an inherited condition or certain drugs used after an organ transplant).

Signs and Symptoms

NHL can cause many symptoms:

- Swollen, painless lymph nodes in the neck, armpits or groin
- Unexplained weight loss
- Fever
- Soaking night sweats
- Coughing, trouble breathing or chest pain
- Weakness and tiredness that don't go away
- Pain, swelling or a feeling of fullness in the 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

At present, there are no screening tests available for the early detection of NHL. The best strategy for early detection is prompt attention to signs and symptoms.

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 five-year 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., 2011-2015). 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 1996-2015 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 (released 10/26/2012); revised bridged-race intercensal population estimates for July 1, 2005-July 1, 2009 (released 6/26/2014) and vintage 2016 bridged-race postcensal population estimates for July 1, 2010-July 1, 2016 (released 6/26/2017).

Incidence: The number of cases diagnosed during a specified time period (e.g., 2011-2015). NHL cases were defined by International Classification of Diseases for Oncology, Third Edition (ICD-O-3), and categorized by site and histology codes by 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/missing 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., 2011-2015). NHL deaths were defined as follows: International Statistical Classification of Diseases and Related Health Problems, Ninth Edition (ICD-9), code 200, 202.0-202.2, 202.8-202.9 for 1996-1998 and International Statistical Classification of Diseases and Related Health Problems, Tenth Edition (ICD-10), codes C820-C859 or C963 for 1999-2015.

Rate: The number of cases or deaths per unit of population (e.g., per 100,000 persons) during a specified time period (e.g., 2011-2015). Rates may be unstable and are not presented when the count is less than five.

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. It does not distinguish between patients who have no evidence of cancer and those who have relapsed or are still in treatment.

Stage at Diagnosis: The degree to which a tumor has spread from its site of origin at the time of diagnosis. Cancer stage is often related to survival and is used to select appropriate treatment. Patients with early stage disease often have better long-term survival, and detecting cancers at an early stage may lead to a reduction in mortality. The stages of cancer, in the order of increasing spread, are *in situ*, local, regional and distant. *In situ* and localized tumors are referred to as early stage tumors, and regional and distant tumors are termed late stage. Cancers diagnosed at the local, regional, distant and unstaged/missing stages are categorized as invasive.

in situ—Noninvasive cancer that has not penetrated surrounding tissue.

Local—A malignant tumor confined entirely to the organ of origin.

Regional—A malignant tumor that has extended beyond the organ of origin directly into surrounding organs or tissues or into regional lymph nodes.

Distant—A malignant tumor that has spread to parts of the body (distant organs, tissues and/or lymph nodes) remote from the primary tumor.

Unstaged/Missing—Insufficient information is available to determine the stage or extent of the disease at diagnosis.

Table 3. Average Annual Number of Invasive NHL Cases and Age-adjusted Incidence Rates per 100,000 Persons by County of Residence and Sex, Ohio and the United States, 2011-2015

	Male		Female		Total			Male		Female		Total	
	Cases	Rate	Cases	Rate	Cases	Rate		Cases	Rate	Cases	Rate	Cases	Rate
Ohio	1,420	23.1	1,175	15.6	2,595	19.0	Lawrence	9	24.9	7	16.6	16	20.5
U.S.						19.4	Licking	17	19.0	18	16.7	35	17.7
Adams	5	29.9	3	15.7	8	22.5	Logan	7	27.6	6	18.8	13	22.6
Allen	14	24.8	11	16.9	25	20.8	Lorain	41	24.4	29	14.2	70	18.6
Ashland	7	23.3	5	13.3	12	17.7	Lucas	47	21.5	40	14.7	87	17.7
Ashtabula	14	24.4	10	14.3	24	18.7	Madison	5	22.1	4	18.4	9	19.9
Athens	5	18.4	4	12.3	9	15.8	Mahoning	31	21.6	28	15.7	59	18.2
Auglaize	5	18.7	4	12.9	9	15.2	Marion	10	27.3	7	16.5	17	21.0
Belmont	10	21.6	9	16.1	19	18.5	Medina	25	25.8	21	19.6	45	22.3
Brown	6	23.9	6	20.0	12	21.7	Meigs	2	15.1	3	17.8	5	16.6
Butler	37	20.9	32	15.0	69	17.5	Mercer	4	16.1	3	11.0	7	13.3
Carroll	5	26.6	3	14.5	8	20.5	Miami	12	18.6	12	17.5	24	18.0
Champaign	4	17.5	5	19.8	9	18.6	Monroe	3	27.9	1	11.0	4	17.9
Clark	15	18.9	15	14.2	30	16.4	Montgomery	63	21.8	55	14.9	118	17.8
Clermont	21	20.8	19	15.2	40	17.8	Morgan	3	28.5	1	11.6	4	19.2
Clinton	6	25.7	4	15.8	10	20.0	Morrow	3	16.3	2	9.4	5	12.9
Columbiana	14	21.7	9	11.0	23	16.0	Muskingum	9	19.0	8	14.2	17	16.5
Coshocton	6	27.0	5	21.2	12	24.0	Noble	1	6.3	2	21.2	3	11.8
Crawford	6	24.3	6	18.3	12	21.2	Ottawa	7	23.2	3	10.4	10	16.3
Cuyahoga	174	25.7	143	15.8	317	20.0	Paulding	3	28.4	1	10.9	5	19.4
Darke	9	29.3	7	19.4	17	23.8	Perry	5	25.8	4	14.6	8	19.5
Defiance	6	22.9	5	17.6	10	20.0	Pickaway	8	28.1	6	17.8	14	22.6
Delaware	18	20.8	17	18.7	35	19.6	Pike	3	21.0	4	20.6	7	21.3
Erie	12	24.9	12	21.3	24	22.9	Portage	19	23.1	16	16.9	36	19.6
Fairfield	17	22.8	13	14.7	30	18.2	Preble	5	21.9	6	19.6	11	20.5
Fayette	4	27.2	2	11.4	7	18.3	Putnam	4	21.9	3	14.2	7	17.2
Franklin	122	24.2	92	14.5	214	18.8	Richland	20	28.7	15	17.1	35	22.5
Fulton	7	28.8	5	19.3	12	23.7	Ross	7	16.7	10	21.1	17	19.2
Gallia	5	24.3	2	8.8	7	15.7	Sandusky	11	31.4	8	18.4	19	24.0
Geauga	17	31.1	14	21.8	31	25.9	Scioto	7	16.9	9	17.5	16	16.7
Greene	19	21.2	15	14.6	34	17.9	Seneca	6	19.5	5	13.2	11	16.0
Guernsey	5	19.1	6	21.2	10	20.2	Shelby	6	21.9	6	17.2	11	18.9
Hamilton	90	22.9	79	15.9	169	18.9	Stark	42	19.1	40	14.8	82	16.8
Hancock	10	22.9	7	14.2	17	18.3	Summit	69	23.9	53	14.3	123	18.5
Hardin	4	29.6	2	13.1	6	20.4	Trumbull	34	26.1	25	16.1	59	20.7
Harrison	2	22.3	1	N/A	3	14.1	Tuscarawas	12	22.0	8	12.9	20	17.1
Henry	6	37.4	4	17.3	9	26.3	Union	5	22.5	5	16.7	10	19.4
Highland	4	17.6	4	14.7	9	15.7	Van Wert	3	17.8	3	14.7	6	15.4
Hocking	5	32.6	3	14.3	8	22.6	Vinton	1	20.0	1	16.7	3	18.0
Holmes	4	19.7	4	15.9	8	18.0	Warren	25	23.5	18	14.3	43	18.4
Huron	6	16.8	5	13.2	11	15.1	Washington	7	17.7	8	16.0	15	16.5
Jackson	4	24.6	2	9.5	6	16.6	Wayne	13	20.1	12	16.2	25	18.1
Jefferson	9	21.7	12	22.5	21	22.5	Williams	4	19.2	3	9.3	7	13.8
Knox	10	31.7	6	16.6	17	23.7	Wood	15	24.4	11	15.1	26	19.4
Lake	31	23.1	32	18.9	63	20.9	Wyandot	3	28.2	2	13.5	5	20.0

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018; Surveillance, Epidemiology and End Results (SEER) Program, National Cancer Institute, 2018.

Sources of Data and Additional Information

Ohio Cancer Incidence Surveillance System:

http://www.odh.ohio.gov/health/cancer/ocisshs/ci_surv1.aspx

National Cancer Institute:

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

American Cancer Society:

<https://www.cancer.org/cancer/non-hodgkin-lymphoma.html>

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