

Lung & Bronchus Cancer in Ohio, 2008-2012

Cancers of the lung and bronchus made up the greatest percentage of new invasive cancer cases (incidence) reported to the Ohio Cancer Incidence Surveillance System (OCISS), comprising 16 percent of newly diagnosed cancers in Ohio from 2008 through 2012. The average annual number of new cases of lung and bronchus cancer in Ohio during this time period was 9,623, and the average annual age-adjusted incidence rate was 71.7 cases per 100,000 persons (Table 1). This incidence rate is 22 percent higher than the U.S. rate of 58.7 per 100,000 persons. In the United States, lung and bronchus cancer incidence rates have been decreasing during the past two decades for males and the last decade for females. Decreases in lung and bronchus cancer incidence rates have largely been attributed to decreases in the prevalence of tobacco smoking.

Lung and bronchus cancer is the leading cause of cancer death in Ohio, comprising 30 percent of total cancer deaths. The average annual age-adjusted mortality rate of 55.2 deaths per 100,000 persons in 2008-2012 in Ohio is 17 percent higher than the U.S. mortality rate (47.2 per 100,000 persons). As shown in Table 1, in both Ohio and the United States, lung and bronchus cancer incidence and mortality rates were greater for males, blacks and those 65 years and older.

Key Findings & Populations at High Risk

- Ohio has higher lung and bronchus cancer incidence and mortality rates than the United States.
- In Ohio, incidence and mortality rates were greater for males, blacks and people 65 years and older in 2008-2012.
- From 1996 to 2012, incidence and mortality rates declined for white and black males, but remained relatively unchanged for white and black females in Ohio.
- Incidence rates in Ohio increased with advancing age to 80-84 years in males and 75-79 years in females, then declined.
- In 2008-2012, the majority of Ohio counties with high incidence and mortality rates were in southern Ohio.
- The majority of lung and bronchus cancer cases in Ohio were non-small cell carcinomas (71.7 percent).
- In Ohio, 48 percent of males and 45 percent of females were diagnosed at distant stage.
- Ohio has a higher percentage of lung and bronchus carcinomas, not otherwise specified (NOS) than the United States (14.2 vs. 3.1 percent).
- Nationally, the 5-year survival probability was 3.4 percent lower among blacks compared to whites in 2005-2011. The 5-year survival probability was 5.5 percent lower among males compared to females in 2005-2011.

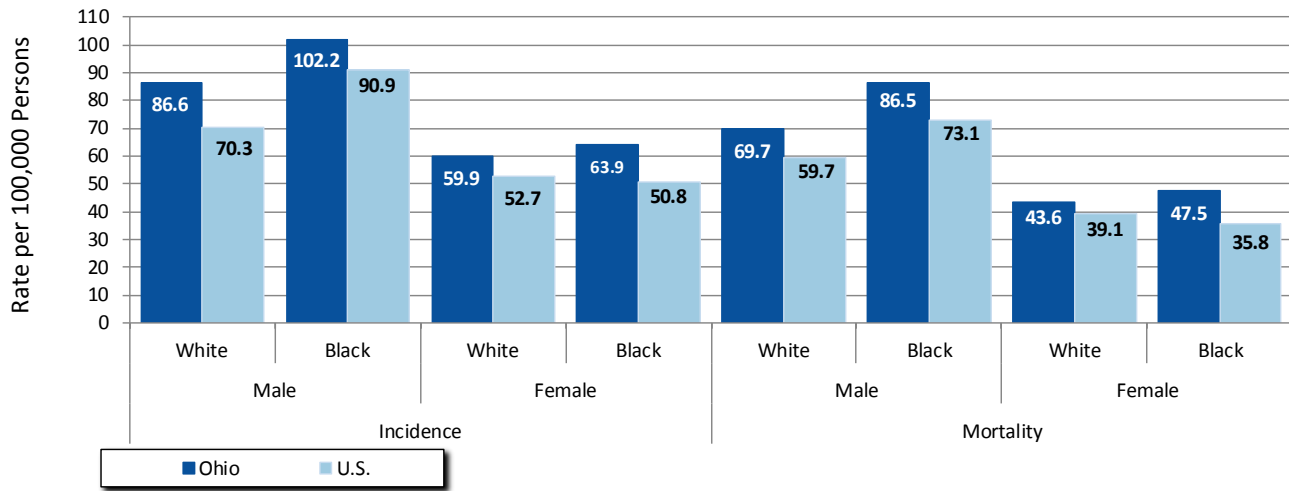
Table 1. Lung & Bronchus Cancer: Average Annual Number of Invasive Cancer Cases and Deaths and Age-adjusted Incidence and Mortality Rates per 100,000 Persons by Sex, Race and Age Group in Ohio and the U.S., 2008-2012

		Incidence			Mortality		
		Ohio Cases	Ohio Rate	U.S. Rate	Ohio Deaths	Ohio Rate	U.S. Rate
Total		9,623	71.7	58.7	7,404	55.2	47.2
Sex	Male	5,192	87.7	70.1	4,125	70.7	59.8
	Female	4,430	59.9	50.2	3,280	43.7	37.8
Race	White	8,537	71.3	60.2	6,577	54.8	47.9
	Black	1,008	79.4	67.5	787	63.1	50.6
	Asian/Pacific Islander	36	29.4	37.1	29	25.7	24.8
Age Group	<65	3,256	24.9	17.5	2,200	16.6	13.2
	65+	6,366	395.7	343.2	5,204	321.7	282.7

Sources: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2015; Bureau of Vital Statistics, Ohio Department of Health, 2015; National Center for Health Statistics, 2015.

Lung & Bronchus Cancer Incidence and Mortality by Race and Sex

Figure 1. Lung & Bronchus Cancer: Average Annual Age-adjusted Incidence and Mortality Rates per 100,000 Persons by Race and Sex in Ohio and the U.S., 2008-2012



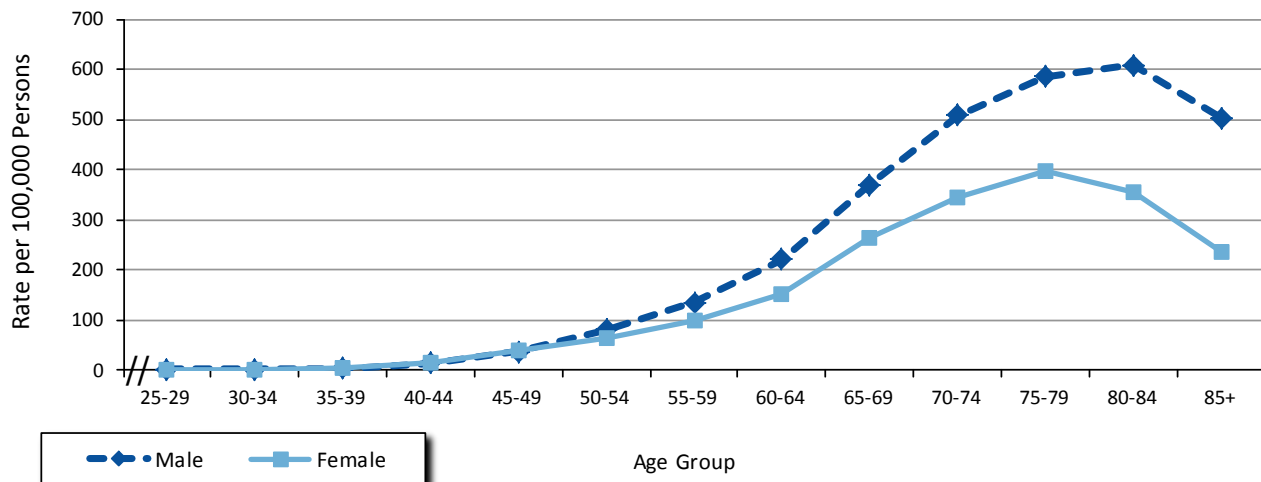
Sources: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2015; Bureau of Vital Statistics, Ohio Department of Health, 2015; National Center for Health Statistics, 2015.

As shown in Figure 1, black males had the highest lung and bronchus cancer incidence and mortality rates in Ohio and the United States in 2008-2012. White females had the lowest incidence and mortality rates in Ohio, and black females had the lowest incidence and mortality rates in the United States. Incidence and mortality rates for each race-sex-specific group were higher in Ohio compared to those in the United States.

Lung & Bronchus Cancer Incidence by Sex and Age

As shown in Figure 2, lung and bronchus cancer incidence rates increased with advancing age to 80-84 years (for males) and 75-79 years (for females), then declined. Incidence rates were similar between males and females until age 45-49 years, then were higher for males 50 years and older.

Figure 2. Lung & Bronchus Cancer: Average Annual Age-specific Incidence Rates per 100,000 Persons by Sex and Age Group in Ohio, 2008-2012



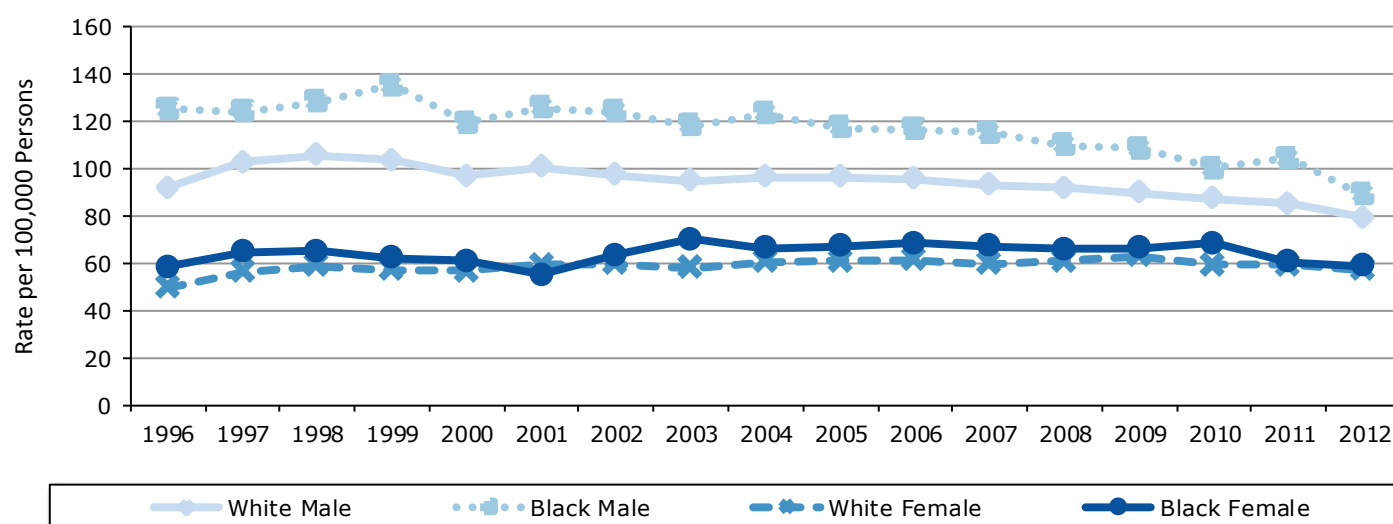
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015.

Lung & Bronchus Cancer Incidence and Mortality Trends by Race and Sex

Figure 3 shows incidence rates of lung and bronchus cancer according to year of diagnosis (1996 through 2012) by race-sex group. For each year, black males had the highest incidence rate. Among black males and white males, incidence rates decreased considerably from 1996 to 2012. For black females and white females, incidence rates remained relatively unchanged.

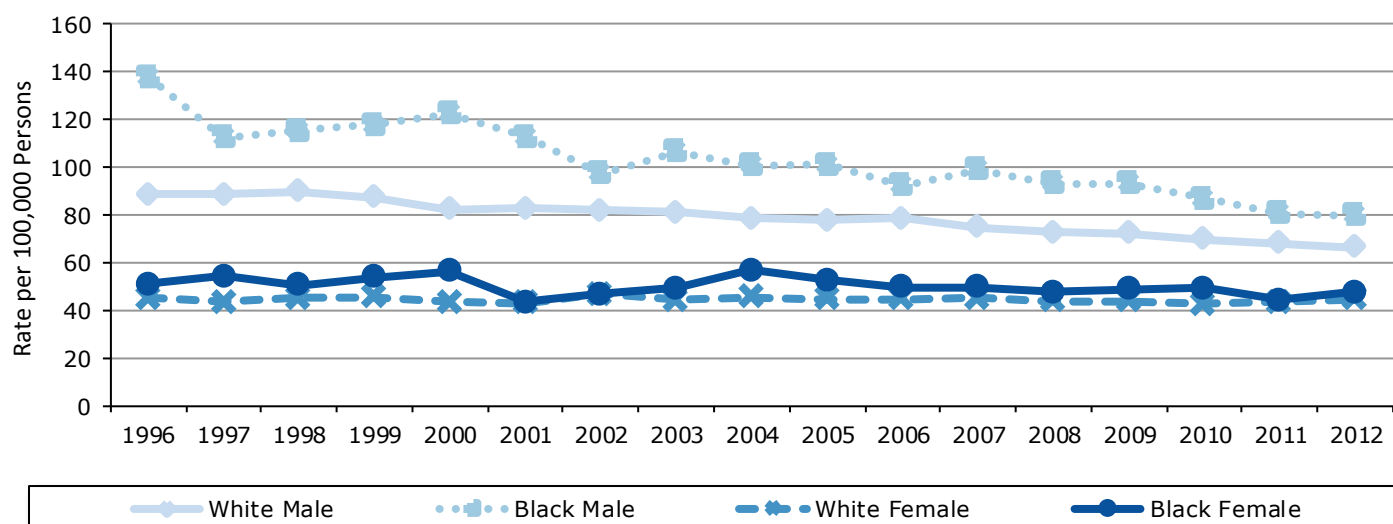
Figure 4 shows lung and bronchus cancer mortality rates according to year of death (1996 through 2012) by race-sex group. For each year, black males had the highest mortality rate. Similar to incidence trends, mortality rates decreased considerably from 1996 to 2012 for both black males and white males. For black females and white females, mortality rates remained relatively unchanged.

Figure 3. Lung & Bronchus Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Persons by Race and Sex in Ohio, 1996-2012



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015.

Figure 4. Lung & Bronchus Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Persons by Race and Sex in Ohio, 1996-2012

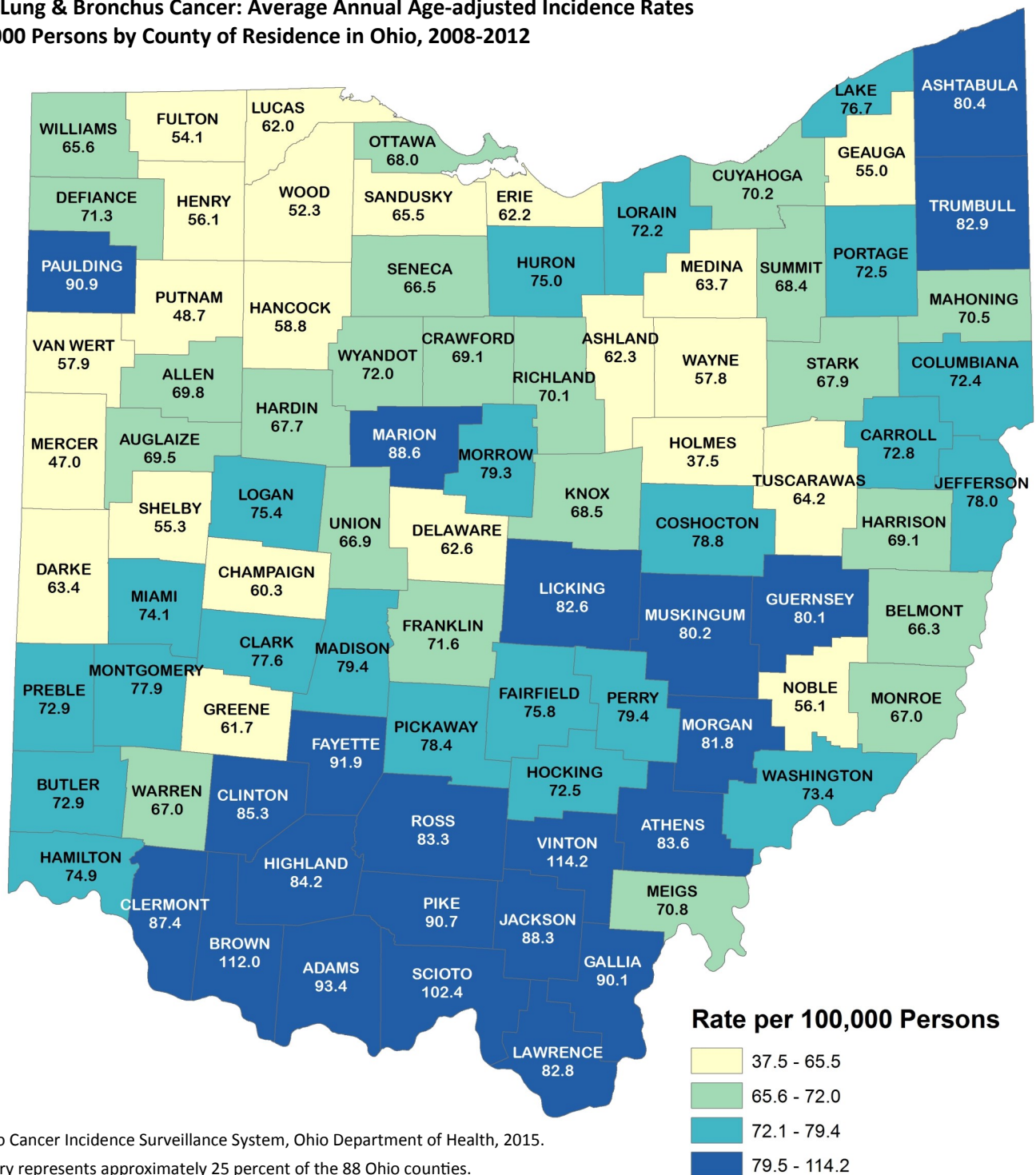


Source: Bureau of Vital Statistics, Ohio Department of Health, 2015.

Lung & Bronchus Cancer Incidence by County

Figure 5 shows 2008-2012 average annual age-adjusted lung and bronchus cancer incidence rates by county of residence. County-specific incidence rates in Ohio ranged from 37.5 to 114.2 per 100,000 persons. The majority of the counties with the highest incidence rates were in southern Ohio. Vinton, Scioto, Brown and Adams Counties had the highest incidence rates. Data used to generate these maps can be found in Table 5 on page 17.

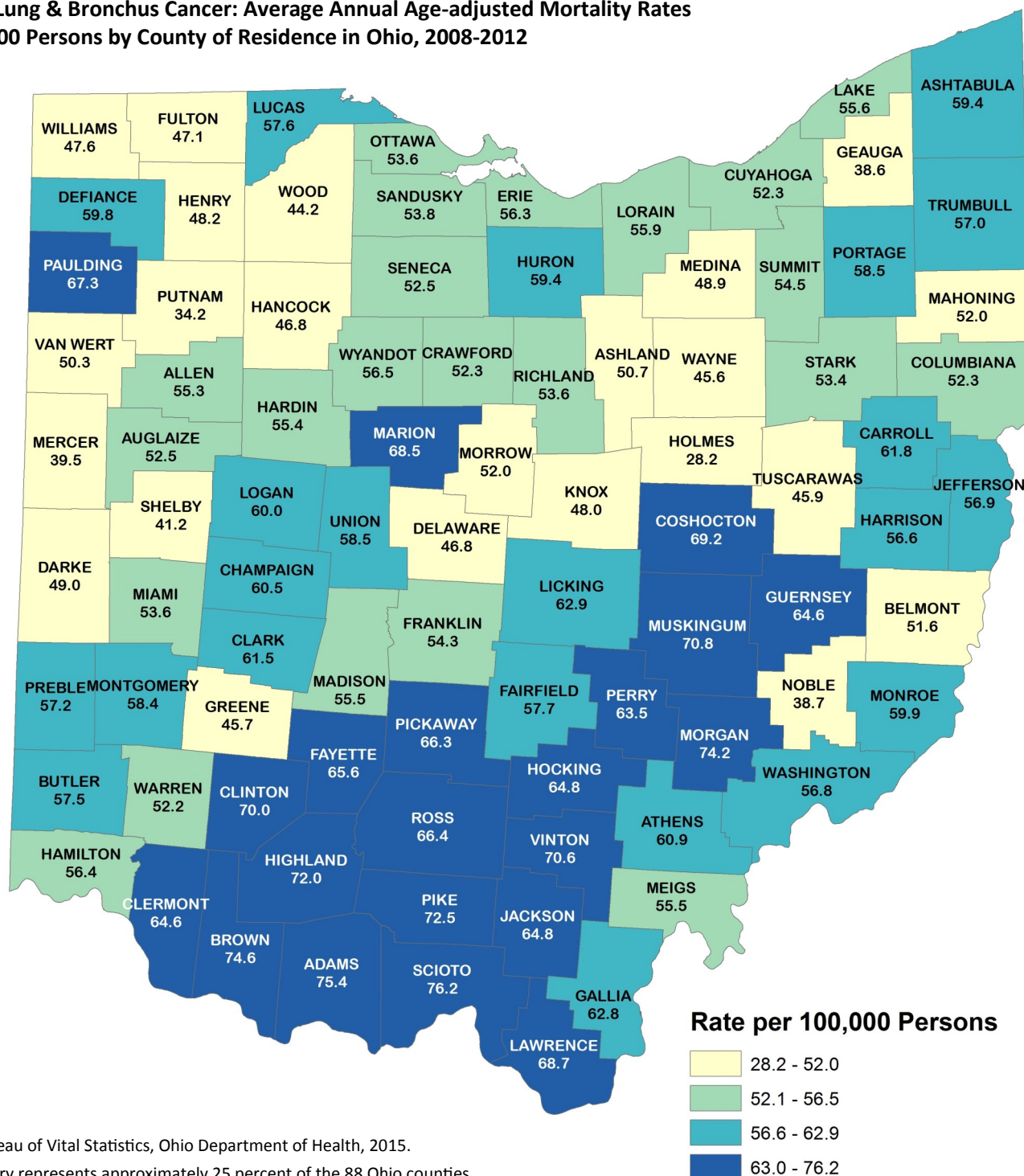
Figure 5. Lung & Bronchus Cancer: Average Annual Age-adjusted Incidence Rates per 100,000 Persons by County of Residence in Ohio, 2008-2012



Lung & Bronchus Cancer Mortality by County

Figure 6 shows 2008-2012 average annual age-adjusted lung and bronchus cancer mortality rates by county of residence. County-specific mortality rates ranged from 28.2 to 76.2 per 100,000 persons. The majority of the counties with the highest mortality rates were in southern Ohio. Similar to incidence, Scioto, Adams, Morgan and Brown Counties had the highest mortality rates. Data used to generate these maps can be found in Table 6 on page 18.

Figure 6. Lung & Bronchus Cancer: Average Annual Age-adjusted Mortality Rates per 100,000 Persons by County of Residence in Ohio, 2008-2012

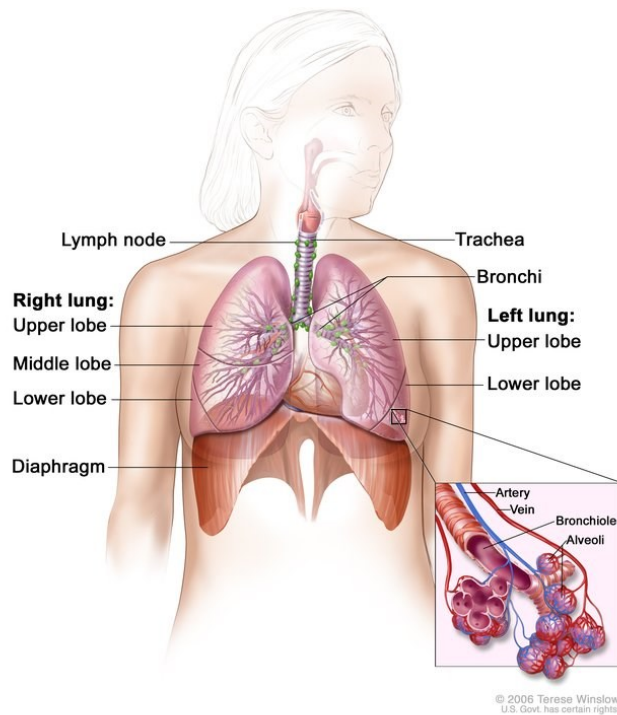


Source: Bureau of Vital Statistics, Ohio Department of Health, 2015.

Each category represents approximately 25 percent of the 88 Ohio counties.

Lung & Bronchus Cancer Incidence by Specific Anatomic Site

Figure 7. Anatomy of the Respiratory System



Source: National Heart, Lung and Blood Institute, National Institutes of Health, 2015.

Photo: <http://www.cancer.gov/types/lung>

Figure 7 shows the anatomy of the respiratory system. As a person breathes, the trachea, also called the windpipe, filters the air that is inhaled and branches into the bronchi, which are two tubes that carry air into each lung. The bronchial tubes lead into the lobes of the lungs. The right lung has three lobes: upper, middle, and lower lobes; the left lung has two lobes: upper and lower lobe. The left lung is smaller to allow room for the heart. Within the lungs, the bronchi branch into smaller, thinner tubes called bronchioles. At the end of the bronchioles are small, spongy sacs called alveoli, where the exchange of oxygen and carbon dioxide occurs. The diaphragm is located below the lungs and is the main muscle used for breathing.

Table 2 shows 2008-2012 Ohio lung and bronchus cancer average annual counts, incidence rates and percents according to specific anatomic site and sex. For both males and females, the highest incidence rates were observed for cancer of the upper lobe of the lung. Approximately 45 percent of invasive lung and bronchus cancers occurred in the upper lobe. Cancers of the lung, NOS and the lower lobe were the next highest rates and percents for both sexes combined, followed by the middle lobe, main bronchus and overlapping lesions of lung. In general, percents of specific anatomic sites were similar for males and females, however the rates for each anatomic site were higher for males. These distributions were also similar to those for the United States.

Table 2: Lung & Bronchus Cancer: Average Annual Number of Invasive Cancer Cases, Age-adjusted Incidence Rates per 100,000 Persons and Percent Distribution by Anatomic Site and Sex in Ohio, 2008-2012

Anatomic Site (ICD-O-3 Code)	Ohio								
	Male			Female			Total		
	Cases	Ohio Rate	Percent	Cases	Ohio Rate	Percent	Cases	Ohio Rate	Percent
All Lung and Bronchus	5,192	87.7		4,430	59.9		9,623	71.7	
Main Bronchus (C340)	189	3.0	3.6%	162	2.2	3.7%	351	2.6	3.6%
Upper Lobe (C341)	2,348	39.2	45.2%	1,976	27.0	44.6%	4,324	32.2	44.9%
Middle Lobe (C342)	173	2.9	3.3%	184	2.5	4.2%	357	2.7	3.7%
Lower Lobe (C343)	1,119	19.2	21.6%	1,017	13.9	23.0%	2,136	16.1	22.2%
Overlapping lesion of lung (C348)	76	1.3	1.5%	67	0.9	1.5%	143	1.1	1.5%
Lung, NOS* (C349)	1,287	22.0	24.8%	1,024	13.5	23.1%	2,310	17.1	24.0%

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015.

*NOS: Not Otherwise Specified.

Lung & Bronchus Cancer by Histology

Table 3 shows average annual numbers of cases in Ohio and percentages in Ohio and the United States of specific histologies of lung and bronchus cancer. In Ohio and the United States, there were vastly greater percentages of carcinoma lung cancers than sarcoma lung cancers. The majority of lung and bronchus cancer cases in Ohio and the United States were non-small cell carcinomas (71.7 and 83.4 percent, respectively). In Ohio, there were lower percentages of non-small cell carcinomas (especially adenocarcinomas) and greater percentages of carcinomas, NOS, compared to the United States.

Table 3: Lung & Bronchus Cancer: Average Annual Number of Invasive Cancer Cases and Percent Distribution by Histology in Ohio and the U.S., 2008-2012

Histology (ICD-0-3 Histology Code/Codes)	Ohio		U.S.
	Cases	Percent	Percent
Carcinoma	9,607	99.8%	99.7%
Small cell (8002, 8041-8045)	1,345	14.0%	13.3%
Non-small cell	6,897	71.7%	83.4%
Squamous and transitional cell ^a	2,071	21.5%	22.6%
Adenocarcinoma ^b	3,242	33.7%	43.3%
Large cell (8145)	195	2.0%	2.1%
Non-small cell carcinoma (8046)	1,012	10.5%	10.5%
Other specified carcinomas ^c	377	3.9%	4.9%
Carcinoma, NOS (8000-8001, 8010-8011, 8020, 8230)	1,364	14.2%	3.1%
Sarcoma^d	8	0.1%	0.2%
Other specific types^e	6	0.1%	0.1%
Total	9,622		

Sources: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2015.

NOS: Not Otherwise Specified.

Percents may not sum to 100 due to rounding.

^a Squamous and transitional cell includes histologies 8051-8052, 8070-8076, 8078, 8083-8084, 8090, 8094, 8120, 8123.

^b Adenocarcinomas includes histologies 8015, 8050, 8140-8141, 8143-8145, 8147, 8190, 8201, 8211, 8250-8255, 8260, 8290, 8310, 8320, 8323, 8333, 8401, 8440, 8470-8471, 8480-8481, 8490, 8503, 8507, 8550, 8570-8572, 8574, 8576.

^c Other specified carcinomas includes histologies 8003-8004, 8022, 8030-8033, 8035, 8200, 8240-8241, 8243-8246, 8249, 8430, 8525, 8560, 8562, 8575.

^d Sarcoma includes histologies 8680, 8711, 8800-8805, 8810-8811, 8815, 8824, 8830, 8840, 8852, 8855, 8890-8891, 8894-8895, 8900-8902, 8910, 8920-8921, 8940, 8990, 9040-9041, 9043, 9120, 9130, 9133, 9150, 9180, 9220, 9231, 9240, 9251, 9473, 9540, 9560, 9580.

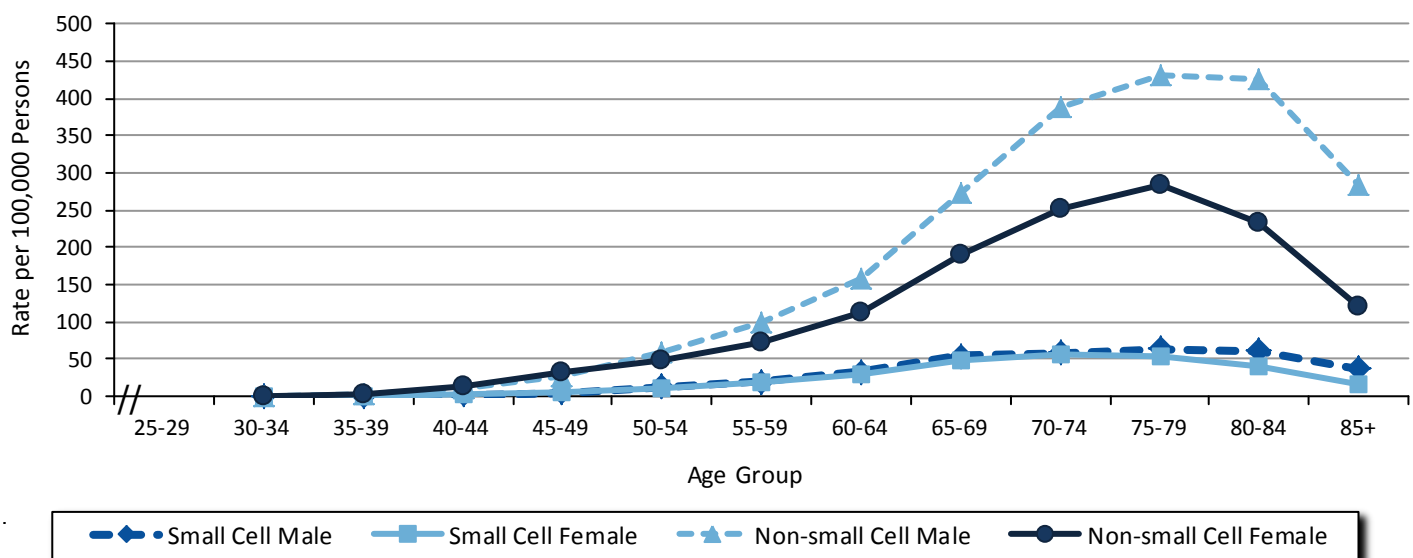
^e Other specific types includes histologies 8580, 8650, 8720-8790, 8933, 8963, 8972-8973, 8980-8982, 9064-9065, 9070, 9080, 9084-9085, 9100, 9260, 9364, 9503, 9530.

Note: Four cases had histology codes that are not included in Table 3; thus, the percent is based on 48,109 cases, rather than 48,113 cases.

Lung & Bronchus Cancer Incidence by Histology, Sex and Age

As shown in Figure 8, for both males and females, there were very few small cell and non-small cell lung and bronchus cancers diagnosed among those younger than 40 years. Beginning at 55-59 years, the highest incidence rate was for non-small cell lung and bronchus cancer in males. Small cell lung and bronchus cancer incidence was similar for males and females up to age 70-74 years, then males had higher rates in age groups 75 years and older. Non-small cell lung and bronchus cancer incidence rates were similar for males and females up to age 50-54 years, then males had higher rates in age groups 55 years and older.

Figure 8. Lung & Bronchus Cancer: Annual Age-specific Incidence Rates per 100,000 Persons by Histology, Sex and Age Group in Ohio and the U.S., 2008-2012



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015.

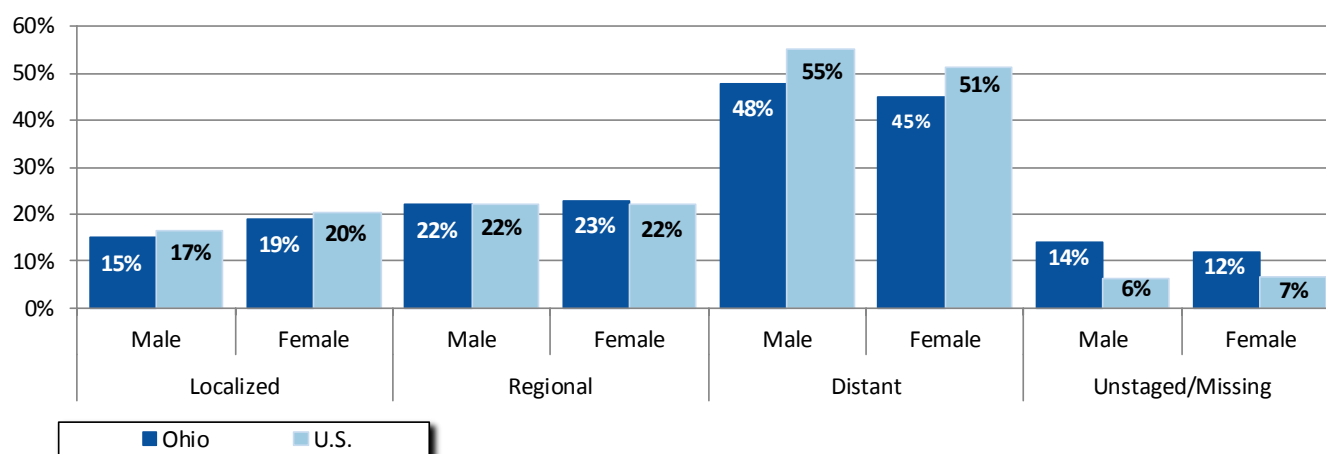
Did You Know?

Overall, lung cancer incidence continues to decrease following the significant decreases in smoking in the United States since the 1960s. However, trends vary greatly by histology; the incidence of adenocarcinomas is increasing, while the incidence of other histological types (i.e., small cell, squamous cell and large cell carcinomas) is decreasing. As a result, adenocarcinomas are now the most commonly diagnosed histological type in both men and women.

Lung & Bronchus Cancer by Stage at Diagnosis and Sex

Figure 9 shows the proportion of lung and bronchus cancers by stage at diagnosis and sex in Ohio and the United States in 2008-2012. In both Ohio and the United States, and for both males and females, distant stage was the most common stage at diagnosis of lung and bronchus cancer. There were similar proportions of males and females diagnosed at each stage of lung and bronchus cancer in Ohio and the United States. There were lower proportions of males and females diagnosed with distant stage lung and bronchus cancer in Ohio, compared to the United States. This is probably due to higher proportions of unstaged/missing stage lung and bronchus cancer cases among males and females in Ohio, compared to the United States.

Figure 9. Lung & Bronchus Cancer: Proportion of Cases by Stage at Diagnosis and Sex in Ohio and the U.S., 2008-2012

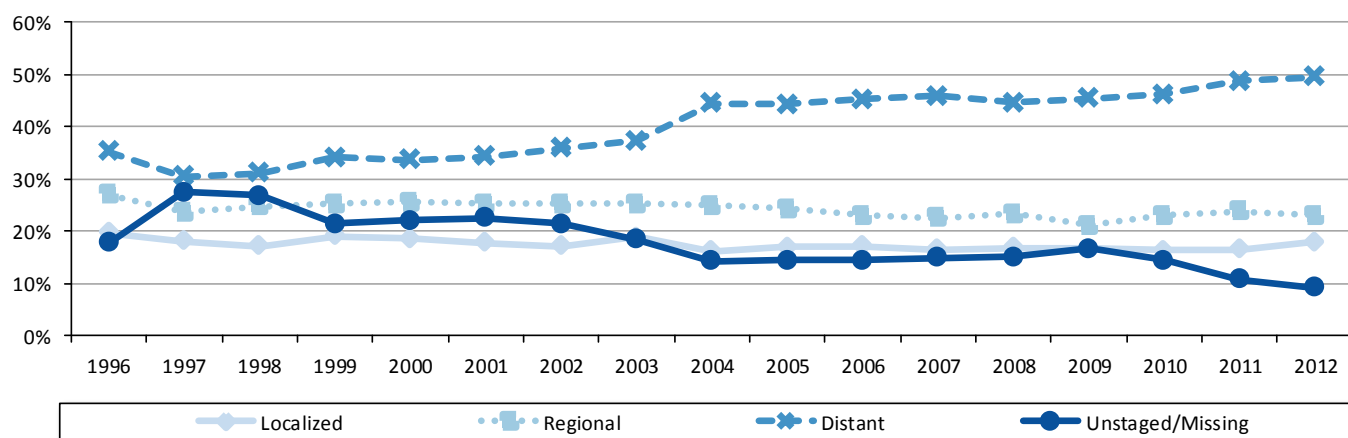


Sources: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2015.

Note: Percentages do not add to 100 because *in situ* cases are not shown (<1 percent in each sex category).

Figure 10 shows proportions of lung and bronchus cancer cases diagnosed at each stage from 1996 to 2012. The proportion of lung and bronchus cancers diagnosed at the regional stage decreased slightly from 1996 to 2012, while the proportion diagnosed at the localized stage remained relatively stable. The increase in the proportion of lung and bronchus cancers diagnosed distant stage is mirrored by the decrease in the proportion diagnosed unstaged/missing stage; the majority of those diagnosed unstaged/missing stage were likely distant stages.

Figure 10. Lung & Bronchus Cancer: Trends in Proportion of Cases by Stage at Diagnosis in Ohio, 1996-2012



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015.

Lung & Bronchus Cancer by Stage at Diagnosis

Figure 11. Lung & Bronchus Cancer: Proportion of Late (Regional & Distant) Stage Cases in Ohio by County, 2008-2012

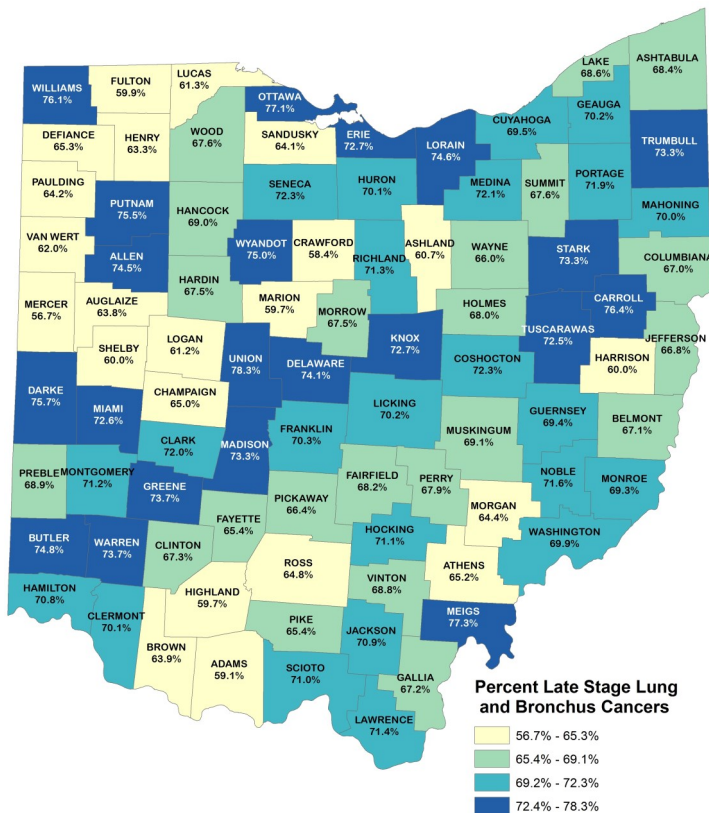
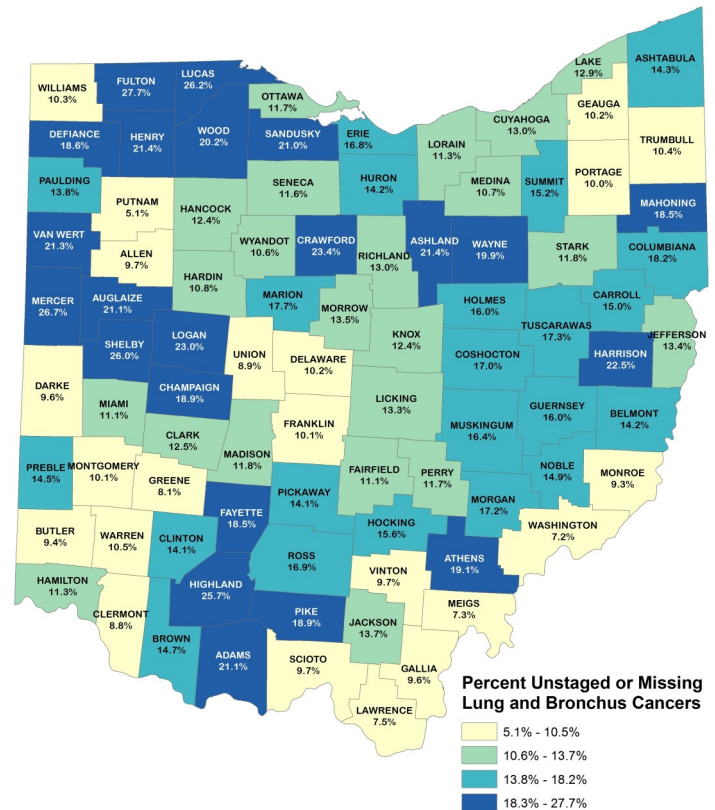


Figure 12. Lung & Bronchus Cancer: Proportion of Unstaged/Missing Stage Cases in Ohio by County, 2008-2012



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015.

Each category represents approximately 25 percent of the 88 Ohio counties.

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015.

Each category represents approximately 25 percent of the 88 Ohio counties.

Figures 11 and 12 present proportions of lung and bronchus cancer cases diagnosed late (i.e., regional and distant) stage and unstaged/missing stage, respectively, by county of residence in 2008-2012. County-specific proportions of late stage at diagnosis in Ohio ranged from 56.7 to 78.3 percent. County-specific proportions of unstaged/missing stage at diagnosis in Ohio ranged from 5.1 to 27.7 percent. The majority of counties in the highest quartile of percent late stage were in the lowest quartile of percent unstaged/missing stage, and vice versa. A high proportion of cases diagnosed unstaged/missing stage may in fact, have late stage lung and bronchus cancer. Data used to generate these maps can be found in Table 7 on page 19.

Lung & Bronchus Cancer Survival Probability by Stage at Diagnosis, Sex and Race

Table 4. Lung & Bronchus Cancer: Five-year Survival Probability by Stage at Diagnosis, Sex and Race in the U.S., 2005-2011

	Five-year Survival Probability			
	Male	Female	White	Black
All Stages	14.8%	20.3%	17.7%	14.3%
Localized	49.1%	60.0%	55.3%	47.3%
Regional	24.8%	30.2%	27.5%	24.3%
Distant	3.5%	5.0%	4.0%	4.1%
Unstaged/Missing	6.7%	8.3%	7.1%	9.1%

Source: Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2015.

Table 4 shows the U.S. five-year lung and bronchus cancer survival probability in 2005-2011 by stage at diagnosis, sex and race. For all stages combined, females and whites had higher five-year survival probabilities, compared to males and blacks, respectively. Survival probability decreased with advancing stage for all sex and race groups.

Lung & Bronchus Cancer Screening

The American Cancer Society recommends annual lung cancer screening with low-dose computed tomography (CT) scans among patients who are age 55-74 years, in fairly good health, have at least a 30 pack-year smoking history, and are either still smoking or have quit smoking within the last 15 years.

The U.S. Preventive Services Task Force recommends annual screening for lung cancer with low-dose CT in adults age 55-80 years who have a 30 pack-year smoking history and currently smoke or have quit within the past 15 years. Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.

Did You Know?

The Ohio Tobacco Quit Line provides personal quit coaching and telephone counseling free of charge to Ohioans who are uninsured, have Medicaid, are pregnant or are covered through the Ohio Tobacco Collaborative (a public-private partnership that provides commercial carriers, employers and third-party administrators with access to tobacco cessation services). Call 1-800-QUIT-NOW (1-800-784-8669) and an intake specialist will assist you with quitting tobacco.

Lung & Bronchus Cancer Risk Factors and Populations at High Risk

A cancer risk factor is anything that increases a person's risk of developing cancer. However, having one or more risk factors does not mean that a person will develop cancer. According to the National Cancer Institute (NCI), the following have been identified as risk factors for lung cancer:

Tobacco smoking: Smoking (cigarette, cigar and pipe) is the leading cause of lung cancer. Risk of developing lung cancer increases with the amount and duration of use.

Family history: Having a first degree relative who has had lung cancer increases risk.

HIV infection: Infection with the human immunodeficiency virus (HIV) is linked with a higher risk of lung cancer.

Exposure to secondhand smoke: Compared to nonsmokers not exposed to secondhand smoke, nonsmokers exposed to secondhand smoke have approximately a 20 percent increased risk of lung cancer.

Radiation exposure: Increased risk from radiation exposure follows a dose-response gradient, with smaller increases in risk for low levels of exposure and greater increases in risk for high levels of exposure. Tobacco smoking greatly potentiates this effect.

Occupational exposure to lung carcinogens: Workplace exposure to asbestos, arsenic, beryllium, cadmium, chromium and nickel increases the risk of lung cancer incidence and mortality. Risks follow a dose-response gradient with high-level exposures associated with large increases in risk. Tobacco smoking potentiates this risk.

Air pollution: Exposure to outdoor air pollution, specifically small particles, increases risk.

Radon: Radon is a cancer-causing gas that occurs naturally as a decay product of radium. Radon is the second leading cause of lung cancer.

Age: More than two-thirds of people diagnosed with lung cancer are 65 and older.

Gender: Men have higher incidence rates of this cancer than women.

Race: Black men have the highest incidence and mortality rates of this cancer.

Socioeconomic status: Persons of lower income and educational levels are more likely to smoke, which increases the risk of lung cancer.

Radon

Radon is a cancer-causing, radioactive gas that comes from the decay of uranium found in the soil and rocks under and around the foundation of homes. Radon gas can enter homes and elevate to dangerous levels. Radon is the leading cause of lung cancer among nonsmokers and the second leading cause among smokers. The U.S. Environmental Protection Agency (EPA) estimates that exposure to indoor radon is responsible for 21,000 lung cancer deaths in the United States every year. About 2,900 of these deaths occur among people who have never smoked. If you smoke and your home has elevated levels of radon, your risk of lung cancer is significantly increased.

Testing is the only way to know if you have elevated levels of radon in your home. Radon testing is easy; you can test your home yourself with an inexpensive radon test kit or hire an Ohio licensed radon professional. The EPA and the U.S. Surgeon General recommend fixing homes with radon levels at or above 4 picocuries per liter of air (pCi/l). Radon mitigation can reduce radon levels to below 4pCi/l which will help to reduce your risk of lung cancer.

For information or to request a free radon test kit, call the Ohio Department of Health (ODH) Radon Information line at 1-800-523-4439 or visit <http://bit.do/bH6Y3>.

Tobacco Use

Figure 13 shows proportions of current cigarette smoking in Ohio according to sex, race, age group, education and household income. Current cigarette smoking was more common among males, blacks and those in younger age groups. Smoking prevalence increased dramatically with decreasing educational attainment and household income.

Figure 13. Lung & Bronchus Cancer: Proportion of Current Cigarette Smoking among Adults 18 Years and Older in Ohio by Sex, Race, Age Group, Educational Attainment and Household Income, 2014

		Current Cigarette Smoking
Sex	Male	21.7%
	Female	20.4%
Race	White, Non-Hispanic	20.7%
	Black, Non-Hispanic	22.0%
Age Group	18-34	26.1%
	35-49	23.9%
	50-64	21.8%
	65+	10.2%
Education	Less than High School	38.9%
	High School Graduate	25.0%
	Some College or Technical School	19.7%
	College or Technical School Graduate	7.3%
Income	<\$15,000	40.6%
	\$15,000-\$24,999	31.1%
	\$25,000-\$34,999	22.9%
	\$35,000-\$49,999	22.2%
	\$50,000+	12.2%

Source: 2014 Ohio Behavioral Risk factor Surveillance System, Ohio Department of Health, 2015

"Don't Know" and "Refused" were excluded from the denominator. This can cause an artificially high percentage.

Current cigarette smoking is defined as persons who reported smoking at least 100 cigarettes in their lifetime and currently smoke every day or some days.

Did You Know?

Secondhand smoke is the combination of "sidestream" smoke (the smoke given off by a burning tobacco product) and "mainstream" smoke (the smoke exhaled by a smoker). People can be exposed to secondhand smoke in homes, cars, the workplace and public places such as bars and restaurants. Approximately 3,000 lung cancer deaths occur each year among adult nonsmokers in the United States as a result of exposure to secondhand smoke. The U.S. Surgeon General estimates that living with a smoker increases a nonsmoker's chances of developing lung cancer by 20 to 30 percent.

Lung & Bronchus Cancer Signs and Symptoms

Early stage lung and bronchus cancer usually does not have any signs and symptoms. Signs and symptoms of advanced disease may include the following:

- Chest discomfort or pain
- A cough that doesn't go away or gets worse over time
- Trouble breathing
- Wheezing
- Blood in sputum (mucus coughed up from the lungs)
- Hoarseness
- Loss of appetite
- Weight loss for no known reason
- Feeling very tired
- Trouble swallowing
- Swelling in the face and/or veins in the neck

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

Lung & Bronchus Cancer Protective Factors

According to the NCI, the following protective factors decrease the risk of lung cancer:

Smoking avoidance: The best way to prevent lung cancer is to not smoke.

Smoking cessation: Smokers can decrease their risk of lung cancer by quitting. After a person has quit smoking for 10 years, the risk of lung cancer decreases 30 to 50 percent.

Eliminating secondhand smoke: Preventing exposure to secondhand smoke decreases risk of lung cancer.

Reducing or eliminating occupational exposure to lung carcinogens: Reducing or eliminating exposures to known lung carcinogens in the workplace would be expected to decrease the risk of lung cancer.

Reducing or eliminating exposure to radon: High levels of radon in homes can be reduced by steps to prevent radon leakage, such as sealing basements.

Did You Know?

Exposure to asbestos can cause both lung cancer and mesothelioma, a cancer of the thin membrane that surrounds the lungs and other internal organs. Asbestos exposure dramatically increases lung cancer risk in smokers compared to nonsmokers. Nonsmoking asbestos workers are five times as likely to develop lung cancer than nonsmokers not exposed to asbestos.

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., 2008-2012). 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 1996-2012 rates were calculated using bridged-race intercensal population estimates for July 1, 1996-July 1, 1999 (U.S. Census Bureau and National Center for Health Statistics, 2004); revised bridged-race intercensal population estimates for July 1, 2000-July 1, 2009 (U.S. Census Bureau and National Center for Health Statistics, 2012); and vintage 2013 bridged-race postcensal population estimates for July 1, 2010-July 1, 2012 (U.S. Census Bureau and National Center for Health Statistics, 2013).

Incidence: The number of cases diagnosed during a specified time period (e.g., 2008-2012). Lung and bronchus cancer cases were defined as follows: International Classification of Diseases for Oncology, Third Edition (ICD-O-3), codes C340-C349, excluding histology types 9590-9989.

Invasive Cancer: A malignant tumor that has infiltrated the organ in which the tumor originated. Invasive cancers consist of those diagnosed at the localized, 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., 2008-2012). Lung and bronchus cancer deaths were defined as follows: International Statistical Classification of Diseases and Related Health Problems, Ninth Edition (ICD-9), codes 1622-1629 for 1996-1998 and International Statistical Classification of Diseases and Related Health Problems, Tenth Edition (ICD-10), codes C340-C349 for 1999-2012.

Pack-year: The number of packs of cigarettes smoked per day times the number of years smoked.

Rate: The number of cases or deaths per unit of population (e.g., per 100,000 persons) during a specified time period (e.g., 2008-2012). Rates may be unstable and are not presented when the count is less than five.

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 presented in this report, in the order of increasing spread, are *in situ*, localized, 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 localized, regional, distant and unstaged/missing stages are categorized as invasive.

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

Localized—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.

Survival Probability: The probability that an individual will survive a given number of years after diagnosis. Five-year relative survival probabilities are from the Surveillance, Epidemiology and End Results Program 18 areas for diagnosis years 2005-2011. Probabilities are based on follow-up of patients into 2013.

Clinical Trials Information

Clinical trials test many types of treatments including new drugs, surgical procedures, radiation therapy and combinations of these. The goal of conducting clinical trials is to find better ways to treat cancer. To obtain information concerning clinical trials for lung and bronchus cancer, please talk with your healthcare provider or visit one of the following Web sites:

National Cancer Institute:

<http://www.cancer.gov/clinicaltrials>

American Cancer Society:

http://www.cancer.org/docroot/ETO/ETO_6.asp?sitearea=ETO

The Ohio State University Comprehensive Cancer Center-Arthur G. James Cancer Hospital and Richard J. Solove Research Institute:

http://cancer.osu.edu/patientsandvisitors/cancerinfo/clinical_trials/Pages/index.aspx

The Cleveland Clinic:

http://my.clevelandclinic.org/cancer/clinical_trials/default.aspx

Case Western Reserve University Comprehensive Cancer Center:

<http://cancer.case.edu/patientinfo/clinical-trials/>

University of Cincinnati:

<http://cancer.uc.edu/patientcare/ClinicalTrials/Overview.aspx>

Toledo Community Hospital Oncology Program:

<http://trials.tcop.info/clinical-trials/>

Dayton Clinical Oncology Program:

<http://www.med.wright.edu/dcop/Clinical%20Trials.htm>

Columbus Community Clinical Oncology Program:

<http://columbusccop.org/>

Sources of Data and Additional Information

Ohio Cancer Incidence Surveillance System:

http://www.healthy.ohio.gov/cancer/ocisshs/ci_surv1.aspx

National Cancer Institute:

<http://www.cancer.gov/cancertopics/types/lung>

<http://www.cancer.gov/types/lung/patient/lung-prevention-pdq>

American Cancer Society:

<http://www.cancer.org/cancer/lungcancer/index>

Table 5: Lung & Bronchus Cancer: Average Annual Number of Invasive Cancer Cases and Age-adjusted Incidence Rates per 100,000 Persons by County of Residence and Sex in Ohio, 2008-2012

	Male		Female		Total			Male		Female		Total	
	Cases	Rate	Cases	Rate	Cases	Rate		Cases	Rate	Cases	Rate	Cases	Rate
Ohio	5,192	87.7	4,430	59.9	9,623	71.7	Lawrence	35	102.4	29	68.8	64	82.8
U.S.		70.1		50.2		58.7	Licking	86	106.5	66	65.3	152	82.6
Adams	18	105.6	16	83.3	34	93.4	Logan	24	96.6	18	59.2	42	75.4
Allen	51	88.7	38	55.3	88	69.8	Lorain	138	88.2	120	61.0	258	72.2
Ashland	24	78.5	18	49.2	41	62.3	Lucas	159	74.4	143	53.2	303	62.0
Ashtabula	52	89.8	51	73.9	103	80.4	Madison	22	101.1	15	61.9	37	79.4
Athens	25	98.6	21	71.1	46	83.6	Mahoning	131	91.0	105	55.9	236	70.5
Auglaize	23	88.0	17	54.9	40	69.5	Marion	41	110.0	29	70.8	70	88.6
Belmont	33	77.3	31	58.8	65	66.3	Medina	67	77.9	54	52.9	122	63.7
Brown	34	133.2	26	94.9	60	112.0	Meigs	11	76.7	11	68.2	22	70.8
Butler	142	86.5	128	63.0	271	72.9	Mercer	15	67.6	9	31.7	24	47.0
Carroll	18	105.7	10	46.6	28	72.8	Miami	53	94.5	41	59.1	93	74.1
Champaign	16	75.4	12	49.6	29	60.3	Monroe	10	96.8	4	38.5	15	67.0
Clark	77	97.9	62	62.3	139	77.6	Montgomery	261	91.5	251	68.3	512	77.9
Clermont	95	102.9	86	76.9	181	87.4	Morgan	9	85.6	8	78.2	17	81.8
Clinton	21	100.1	20	76.3	41	85.3	Morrow	22	112.3	11	49.2	33	79.3
Columbiana	60	91.6	45	58.4	105	72.4	Muskingum	46	97.8	39	66.4	85	80.2
Coshocton	20	93.9	17	67.3	38	78.8	Noble	7	46.3	6	75.6	13	56.1
Crawford	25	94.5	17	49.2	42	69.1	Ottawa	27	89.6	16	48.1	43	68.0
Cuyahoga	581	85.2	546	59.7	1127	70.2	Paulding	11	98.0	11	84.9	22	90.9
Darke	25	79.0	19	52.0	44	63.4	Perry	17	86.6	16	73.8	32	79.4
Defiance	19	86.3	14	57.1	33	71.3	Pickaway	27	96.6	21	63.6	48	78.4
Delaware	46	70.8	46	57.8	92	62.6	Pike	17	102.2	15	79.3	32	90.7
Erie	38	76.5	28	50.0	66	62.2	Portage	67	84.7	59	63.3	127	72.5
Fairfield	66	97.4	51	60.1	117	75.8	Preble	19	77.9	19	69.1	39	72.9
Fayette	20	123.2	13	68.0	32	91.9	Putnam	12	65.3	8	37.2	20	48.7
Franklin	384	86.8	349	60.5	733	71.6	Richland	64	88.3	51	57.2	114	70.1
Fulton	16	68.6	12	42.8	27	54.1	Ross	46	109.0	30	62.6	76	83.3
Gallia	22	123.7	14	63.9	35	90.1	Sandusky	31	89.6	19	46.4	50	65.5
Geauga	32	61.1	33	51.0	65	55.0	Scioto	56	129.5	43	80.6	99	102.4
Greene	55	68.7	56	56.2	111	61.7	Seneca	25	85.1	19	52.4	45	66.5
Guernsey	23	98.7	18	65.8	41	80.1	Shelby	15	60.3	15	50.4	30	55.3
Hamilton	333	87.3	331	66.2	664	74.9	Stark	187	86.2	144	53.5	331	67.9
Hancock	31	77.9	21	44.6	52	58.8	Summit	243	85.0	208	56.4	451	68.4
Hardin	14	88.0	10	53.7	24	67.7	Trumbull	138	106.0	103	65.4	241	82.9
Harrison	9	85.4	7	55.8	16	69.1	Tuscarawas	48	88.9	30	44.8	78	64.2
Henry	11	67.4	9	48.6	20	56.1	Union	17	81.1	14	55.2	31	66.9
Highland	28	113.6	17	59.1	45	84.2	Van Wert	12	75.3	9	45.5	22	57.9
Hocking	14	78.4	13	69.1	27	72.5	Vinton	11	151.6	7	88.9	18	114.2
Holmes	10	51.9	5	25.5	15	37.5	Warren	72	80.0	63	57.4	135	67.0
Huron	30	98.2	21	56.1	51	75.0	Washington	36	92.1	27	59.7	64	73.4
Jackson	22	121.6	13	62.0	35	88.3	Wayne	40	65.7	38	52.5	78	57.8
Jefferson	42	94.1	35	66.3	78	78.0	Williams	18	84.0	13	51.0	31	65.6
Knox	28	87.2	20	53.5	48	68.5	Wood	41	70.0	28	38.5	70	52.3
Lake	111	84.9	119	71.5	229	76.7	Wyandot	13	104.4	7	47.2	21	72.0

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2015.

Note: Low county numbers and rates may reflect underreporting for that county.

Table 6: Lung & Bronchus Cancer: Average Annual Number of Cancer Deaths and Age-adjusted Mortality Rates per 100,000 Persons by County of Residence and Sex in Ohio, 2008-2012

	Male		Female		Total			Male		Female		Total	
	Deaths	Rate	Deaths	Rate	Deaths	Rate		Deaths	Rate	Deaths	Rate	Deaths	Rate
Ohio	4,125	70.7	3,280	43.7	7,404	55.2	Lawrence	30	89.4	22	52.7	52	67.5
U.S.		59.8		37.8		47.2	Licking	64	80.0	50	50.5	114	62.9
Adams	17	100.8	10	54.1	27	75.4	Logan	20	81.9	13	43.8	33	59.7
Allen	41	71.8	29	41.9	70	54.9	Lorain	106	68.0	94	47.2	199	55.9
Ashland	20	68.0	13	35.8	33	50.7	Lucas	148	71.0	134	48.4	282	57.5
Ashtabula	38	66.8	38	53.3	76	59.0	Madison	16	70.8	10	41.0	26	55.5
Athens	18	73.0	15	49.6	32	60.5	Mahoning	104	71.9	74	37.7	178	51.9
Auglaize	19	77.0	11	33.3	30	52.5	Marion	32	86.4	23	54.0	55	68.5
Belmont	25	60.0	25	46.4	50	51.3	Medina	52	61.1	41	40.1	93	48.9
Brown	25	100.2	15	52.3	39	74.1	Meigs	9	66.3	8	47.7	17	55.5
Butler	114	71.1	97	47.5	211	57.5	Mercer	13	57.0	8	26.1	21	39.5
Carroll	16	92.5	8	37.1	23	61.8	Miami	39	69.3	29	42.4	68	53.6
Champaign	17	78.5	12	47.7	28	60.5	Monroe	10	92.4	4	30.5	13	59.9
Clark	66	84.5	45	43.6	111	61.4	Montgomery	207	73.6	178	47.6	385	58.4
Clermont	73	83.0	57	51.4	130	64.6	Morgan	9	86.7	7	62.4	16	74.2
Clinton	17	84.1	16	61.6	33	70.0	Morrow	15	77.4	6	29.5	21	52.0
Columbiana	43	66.1	32	41.2	75	52.1	Muskingum	43	92.9	32	53.4	75	70.8
Coshocton	18	87.8	14	55.9	32	69.2	Noble	5	32.9	4	47.9	9	38.7
Crawford	19	74.1	12	35.6	31	52.0	Ottawa	23	79.7	11	30.8	33	53.6
Cuyahoga	455	67.3	396	41.8	851	52.3	Paulding	8	73.7	8	62.7	16	67.3
Darke	21	66.9	13	34.1	34	49.0	Perry	14	79.4	12	54.1	25	63.5
Defiance	17	81.0	11	41.0	28	59.4	Pickaway	25	86.7	16	49.0	41	66.3
Delaware	37	60.9	29	36.9	66	46.8	Pike	14	88.3	11	58.2	25	72.5
Erie	36	72.2	25	42.5	60	56.3	Portage	56	71.5	45	48.5	100	58.5
Fairfield	52	77.6	37	43.2	88	57.7	Preble	17	72.8	13	45.0	30	57.2
Fayette	14	89.1	9	48.8	23	65.6	Putnam	11	60.9	3	14.8	14	34.2
Franklin	289	67.4	259	44.8	548	54.3	Richland	53	73.0	35	38.6	88	53.5
Fulton	14	60.9	10	36.7	24	47.1	Ross	38	92.3	22	45.8	59	66.1
Gallia	15	89.0	9	42.6	24	62.8	Sandusky	25	72.2	17	39.2	41	53.8
Geauga	23	45.6	22	33.8	45	38.6	Scioto	43	101.3	30	56.4	73	76.2
Greene	42	53.5	40	39.6	82	45.7	Seneca	23	75.8	13	34.5	36	52.5
Guernsey	19	80.1	14	51.0	33	64.6	Shelby	10	41.4	12	40.0	22	41.2
Hamilton	262	69.4	239	47.0	500	56.4	Stark	146	68.1	115	42.1	261	53.3
Hancock	26	67.3	15	31.9	41	46.8	Summit	202	71.3	158	42.3	361	54.5
Hardin	11	69.9	9	46.1	20	55.4	Trumbull	94	73.0	73	44.4	167	56.6
Harrison	8	77.8	5	37.3	13	55.7	Tuscarawas	34	63.7	22	32.1	56	45.9
Henry	10	63.5	7	35.9	17	48.2	Union	16	74.4	11	45.8	27	58.5
Highland	24	97.8	15	50.2	39	72.0	Van Wert	10	59.3	10	43.2	19	50.3
Hocking	14	79.8	10	53.5	24	64.8	Vinton	7	97.3	4	49.6	11	70.6
Holmes	8	43.9	3	15.0	12	28.2	Warren	59	66.9	43	40.6	103	52.1
Huron	25	81.6	15	41.3	40	59.4	Washington	29	75.0	20	43.0	49	56.6
Jackson	17	93.3	9	42.5	26	64.8	Wayne	35	56.8	27	37.1	62	45.6
Jefferson	30	66.9	27	49.6	57	56.4	Williams	13	60.8	9	37.1	23	47.6
Knox	19	60.3	15	38.4	34	48.0	Wood	34	60.0	24	32.5	58	44.2
Lake	85	66.5	82	48.5	167	55.5	Wyandot	11	86.2	6	35.0	17	56.5

Source: Bureau of Vital Statistics, Ohio Department of Health, 2015; National Center for Health Statistics, 2015.

Table 7. Lung and Bronchus Cancer: Percentage of New Cancer Cases by County of Residence and Stage at Diagnosis in Ohio, 2008-2012

	Early Stage %	Late Stage %	Unstaged/ Missing %	Average Annual Cases		Early Stage %	Late Stage %	Unstaged/ Missing %	Average Annual Cases
Ohio	17%	70%	13%	9,631	Lawrence	21%	71%	8%	64
U.S.	18%	75%	6%		Licking	17%	70%	13%	152
Adams	20%	59%	21%	34	Logan	16%	61%	23%	42
Allen	16%	75%	10%	89	Lorain	14%	75%	11%	258
Ashland	18%	61%	21%	41	Lucas	13%	61%	26%	302
Ashtabula	17%	68%	14%	104	Madison	15%	73%	12%	37
Athens	16%	65%	19%	46	Mahoning	12%	70%	19%	236
Auglaize	15%	64%	21%	40	Marion	23%	60%	18%	70
Belmont	19%	67%	14%	65	Medina	17%	72%	11%	122
Brown	21%	64%	15%	60	Meigs	15%	77%	7%	22
Butler	16%	75%	9%	271	Mercer	17%	57%	27%	24
Carroll	9%	76%	15%	28	Miami	16%	73%	11%	94
Champaign	16%	65%	19%	29	Monroe	21%	69%	9%	15
Clark	15%	72%	12%	139	Montgomery	19%	71%	10%	513
Clermont	21%	70%	9%	181	Morgan	18%	64%	17%	17
Clinton	19%	67%	14%	41	Morrow	19%	67%	13%	33
Columbiana	15%	67%	18%	105	Muskingum	15%	69%	16%	85
Coshocton	11%	72%	17%	38	Noble	13%	72%	15%	13
Crawford	18%	58%	23%	42	Ottawa	11%	77%	12%	43
Cuyahoga	17%	70%	13%	1,128	Paulding	22%	64%	14%	22
Darke	15%	76%	10%	44	Perry	20%	68%	12%	32
Defiance	16%	65%	19%	33	Pickaway	20%	66%	14%	48
Delaware	16%	74%	10%	93	Pike	16%	65%	19%	32
Erie	11%	73%	17%	67	Portage	18%	72%	10%	127
Fairfield	21%	68%	11%	117	Preble	17%	69%	15%	39
Fayette	16%	65%	19%	32	Putnam	19%	76%	5%	20
Franklin	20%	70%	10%	734	Richland	16%	71%	13%	114
Fulton	12%	60%	28%	27	Ross	18%	65%	17%	76
Gallia	23%	67%	10%	35	Sandusky	15%	64%	21%	50
Geauga	20%	70%	10%	65	Scioto	19%	71%	10%	99
Greene	18%	74%	8%	111	Seneca	16%	72%	12%	45
Guernsey	15%	69%	16%	41	Shelby	14%	60%	26%	30
Hamilton	18%	71%	11%	666	Stark	15%	73%	12%	331
Hancock	19%	69%	12%	52	Summit	17%	68%	15%	452
Hardin	22%	68%	11%	24	Trumbull	16%	73%	10%	241
Harrison	18%	60%	23%	16	Tuscarawas	10%	73%	17%	79
Henry	15%	63%	21%	20	Union	13%	78%	9%	31
Highland	15%	60%	26%	45	Van Wert	17%	62%	21%	22
Hocking	13%	71%	16%	27	Vinton	22%	69%	10%	19
Holmes	16%	68%	16%	15	Warren	16%	74%	10%	136
Huron	16%	70%	14%	51	Washington	23%	70%	7%	64
Jackson	15%	71%	14%	35	Wayne	14%	66%	20%	78
Jefferson	20%	67%	13%	78	Williams	14%	76%	10%	31
Knox	15%	73%	12%	48	Wood	12%	68%	20%	69
Lake	18%	69%	13%	229	Wyandot	14%	75%	11%	21

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2015; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2015.

The total case counts by stage at diagnosis include *in situ* cancers and thus differ from tables with counts and rates of invasive cancer cases only.

Early stage includes tumors diagnosed *in situ* and localized stages, and late stage includes tumors diagnosed regional and distant stages.

To address comments and information requests:

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E-mail: ociss@odh.ohio.gov
OCISS website: http://www.odh.ohio.gov/healthstats/ociss/ci_surv1.aspx
Healthy Ohio website: <http://www.healthy.ohio.gov>

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