# The Impact of Tobacco Use on Cancer in Ohio
July 2018



Ohio Department of Health

The James
The Ohio State University
Comprehensive Cancer Center

# Executive Summary

Tobacco use remains the world's most preventable cause of death. Despite decades of declines in cigarette smoking prevalence, almost one-third of cancer deaths in the United States are still caused by smoking. This report describes the prevalence of tobacco use and its impact on cancers associated with tobacco use in Ohio. Key findings from this report include:

- In 2016, 22.5 percent of Ohio adults ages 18 and older were current cigarette smokers compared to the median prevalence of 17.1 percent in the United States.
- In Ohio in 2016, 2.7 percent of Ohio adults were cigar smokers, 5.7 percent used electronic cigarettes and 4.7 percent used smokeless tobacco.
- The prevalence of current smoking among Ohio adults has decreased over the past 20 years. Groups for which the prevalence of current smoking was higher in 2016 include those ages 25 to 44, males, those with lower household income and education, lesbian, gay, bisexual and transgender adults, and those who have a disability or poor mental health.
- County-level smoking prevalence among adult residents of Ohio ranged from 14 percent to 25 percent. Smoking was more common among residents of southern counties in Ohio. Cancer incidence and mortality rates were also highest in southern Ohio as well as southeastern Ohio.
- Cigarette use among Ohio high school students decreased 74.5 percent from 2000 to 2016; however, this may partially be due to the increase in e-cigarette use in youth.
- According to the U.S. Surgeon General, tobacco smoking is associated with 12 cancer sites/types. These are: lung, bronchus and trachea; larynx; esophagus; oral cavity and pharynx; bladder; liver and intrahepatic bile duct; cervix; stomach; kidney and renal pelvis; acute myeloid leukemia; pancreas; and colon and rectum.
- Nationally, approximately one in three cancer deaths are attributable to cigarette smoking.
- In Ohio in 2011-2015, an estimated 7,699 Ohio cancer deaths each year among adults ages 35 and older were attributed to cigarette smoking.
- The incidence rate for all tobacco-associated cancers combined increased slightly from 1996 to 1998 and decreased slightly from 1999 to 2015.
- Ohio incidence rates for eight of the 12 tobacco-associated cancers were higher than the rates for the United States in 2011-2015.
- In 2011-2015, the mortality rate of all tobacco-associated cancers combined for Ohio was 9.9 percent higher than the rate for the United States.
- The mortality rate for all tobacco-associated cancers combined decreased 19 percent from 1996 to 2015.
- Ohio mortality rates for 10 of the 12 tobacco-associated cancers were higher than the rates for the United States in 2011-2015.
- The *Ohio 2017-2019 State Health Improvement Plan* and *The Ohio Comprehensive Cancer Control Plan 2015-2020* include objectives and strategies for the prevention and cessation of tobacco use in Ohio.

# Introduction

**Tobacco use is the leading cause of cancer death and is associated with the following 12 sites/types of cancer:**

- **Lung, Bronchus and Trachea**
- **Larynx**
- **Esophagus**
- **Oral Cavity and Pharynx**
- **Bladder**
- **Liver and Intrahepatic Bile Duct**
- **Cervix**
- **Stomach**
- **Kidney and Renal Pelvis**
- **Acute Myeloid Leukemia**
- **Pancreas**
- **Colon and Rectum**

Tobacco use is the leading cause of cancer, and approximately one-third of all cancer deaths are attributable to cigarette smoking. In addition to cigarettes, use of smokeless tobacco and other tobacco products increase cancer risk. The 2014 Surgeon General's Report on smoking and health provides evidence of the harmful effects that tobacco has on the life expectancy and quality of life for all Americans.[1] Tobacco use is associated with the following 12 sites/types of cancer: lung, bronchus and trachea; larynx; esophagus; oral cavity and pharynx; bladder; liver and intrahepatic bile duct; cervix; stomach; kidney and renal pelvis; acute myeloid leukemia; pancreas; and colon and rectum.[1] Chewing tobacco is specifically associated with cancers of the oral cavity and pharynx, pancreas, esophagus, larynx and lung, and cigars are associated with cancers of the oral cavity and pharynx, esophagus, larynx and lung.[1] In addition, secondhand (environmental) tobacco smoke is associated with approximately 3,000 lung cancer deaths each year among adult nonsmokers in the United States and increases a nonsmoker's chance of developing lung cancer by 20 to 30 percent.[2] A recent study also suggests that exposure to electronic cigarette (e-cigarette) vapor can cause DNA damage in the lungs and bladder, which may increase the risk of cancer.[3]

Tobacco use is associated with later stage at diagnosis for some tobacco-related cancers, such as lung cancer. In addition, some studies have found poorer survival/ prognosis among those with higher levels of tobacco smoking prior to diagnosis and those who continue smoking after diagnosis.

Tobacco use impacts nearly every organ of the body. In addition to cancer, tobacco is associated with respiratory diseases (chronic obstructive pulmonary disease, asthma, tuberculosis), cardiovascular diseases/conditions (coronary heart disease, stroke, aortic aneurysm, atherosclerotic peripheral vascular disease), diabetes, immune and autoimmune disorders (rheumatoid arthritis, impaired immune function), reproductive effects (ectopic pregnancy, reduced fertility, orofacial clefts and other birth defects, erectile dysfunction), eye disease (blindness, cataracts, macular degeneration), hip fractures and overall diminished health.[1]

The economic costs of tobacco use are staggering. In Ohio, the annual healthcare costs directly caused by smoking are an estimated $5.6 billion, and smoking-related productivity losses are $5.9 billion.[4] In state fiscal year 2018, Ohio spent $12.5 million on tobacco prevention and control, which is only 9.5 percent of the CDC-recommended funding level.[4]

This report provides an overview of tobacco use and rates of tobacco-associated cancers in Ohio. Tobacco use prevalence by product, demographics and year as well as tobacco-associated cancer incidence and mortality counts, rates and trends are presented. Cancer incidence and mortality data presented in this report are for adults ages 35 and older. This age group was selected due to the long latency period between tobacco exposure and cancer development. Therefore, the data in this report should only be compared to other cancer data for adults ages 35 and older.

# Smoking/Tobacco Use

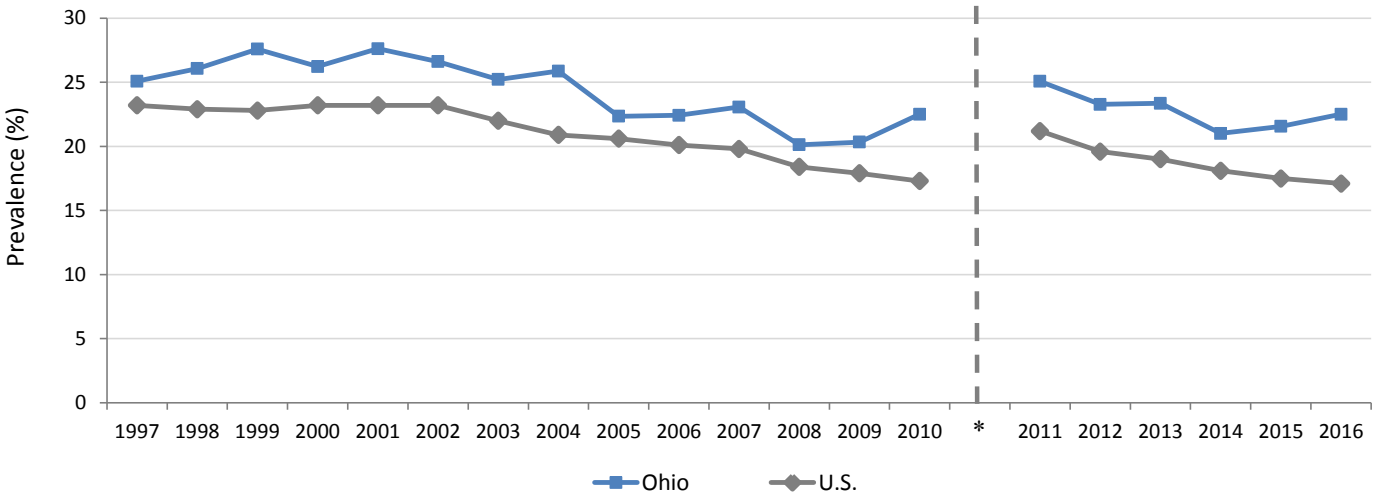
**Table 1. Estimated Prevalence and 95% Confidence Intervals (CI) of Tobacco Use and Exposure among Adults Ages 18 and Older, Ohio, 2016**

| | Prevalance (%) | 95% CI |
|---|---|---|
| Current Cigarette Smoker | 22.5 | 21.3 - 23.8 |
| Current Cigar Smoker | 2.7 | 1.9 - 3.6 |
| Current Little Cigar Smoker* | 3.2 | 1.9 - 4.4 |
| Current E-cigarette Smoker | 5.7 | 5.0 - 6.4 |
| Current Smokeless Tobacco User** | 4.7 | 4.1 - 5.4 |
| Secondhand Smoke Exposure Past 7 Days | 47.5 | 46.0 - 49.0 |
| E-cigarette Vapor/Vaping Vapor Exposure Past 7 Days | 19.6 | 18.3 - 20.8 |
| Smokers Who Stopped Smoking in Past 12 Months in Attempt to Quit | 57.9 | 54.7 - 61.0 |

Source: 2016 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2018.
*Data for current little cigar smoker are from the 2014 Behavioral Risk Factor Surveillance System.
**In 2016, smokeless tobacco included chewing tobacco, snuff, snus and dip.

- In 2016, 22.5 percent of Ohio adults ages 18 and older were current cigarette smokers compared to the median prevalence of 17.1 percent in the United States.
- In Ohio in 2016, 2.7 percent of Ohio adults were cigar smokers, 5.7 percent used electronic cigarettes and 4.7 percent used smokeless tobacco (Table 1).
- Approximately 58 percent of current cigarette smokers stopped smoking in an attempt to quit in the past 12 months (Table 1).
- From 1997 to 2008, current cigarette use among Ohio adults decreased 19.9 percent, then increased 11.9 percent from 2008 to 2010. Current cigarette use decreased 10.4 percent from 2011 to 2016 (Figure 1).
- For each year from 1997 to 2016, the prevalence of current cigarette smoking was greater in Ohio compared to the United States (Figure 1).

**Figure 1. Trends in Estimated Prevalence of Current Cigarette Smoking among Adults Ages 18 and Older, Ohio and the United States, 1997-2016**




Source: 2016 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2018.
*Behavioral Risk Factor Surveillance System data prior to 2011 cannot be compared to data for 2011 and after due to changes in weighting methodology.

# Smoking/Tobacco Use

**Table 2. Estimated Prevalence and 95% Confidence Intervals (CI) of Current Cigarette Smoking among Adults Ages 18 and Older, Ohio, 2016**

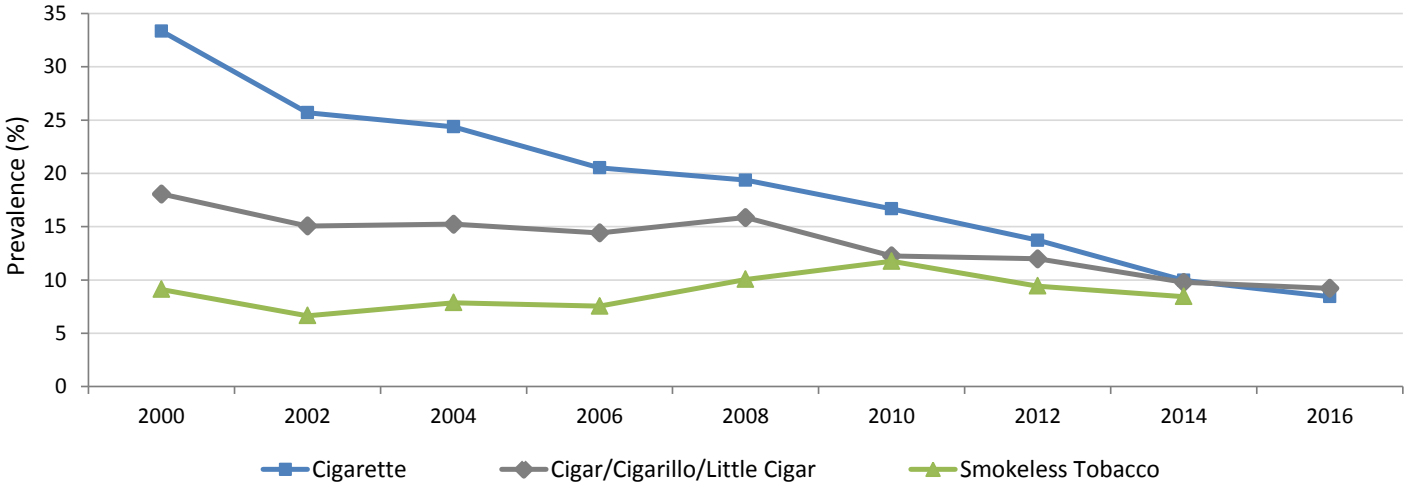
| | | Prevalence (%) | 95% CI |
|---|---|---|---|
| Total | | 22.5 | 21.3 - 23.8 |
| Age | 18-24 | 16.6 | 12.7 - 20.4 |
| | 25-34 | 32.0 | 28.1 - 35.9 |
| | 35-44 | 28.8 | 25.0 - 32.5 |
| | 45-54 | 25.3 | 22.4 - 28.2 |
| | 55-64 | 25.0 | 22.4 - 27.5 |
| | 65+ | 10.6 | 9.1 - 12.1 |
| Sex | Male | 24.7 | 22.7 - 26.6 |
| | Female | 20.5 | 18.9 - 22.1 |
| Race/Ethnicity | White, Non-Hispanic | 22.4 | 21.1 - 23.8 |
| | Black, Non-Hispanic | 23.5 | 19.3 - 27.7 |
| | Hispanic | 22.3 | 13.7 - 30.9 |
| | Other, Non-Hispanic | 11.4 | 5.3 - 17.5 |
| | Multi-Racial | 37.0 | 25.7 - 48.3 |
| Annual Household Income | <$15,000 | 42.3 | 37.1 - 47.5 |
| | $15,000-$24,999 | 34.2 | 30.5 - 38.0 |
| | $25,000-$34,999 | 26.2 | 22.2 - 30.1 |
| | $35,000-$49,999 | 24.8 | 21.2 - 28.4 |
| | $50,000-$74,999 | 18.2 | 15.3 - 21.1 |
| | $75,000+ | 10.9 | 9.1 - 12.7 |
| Education | Less than High School | 43.0 | 37.6 - 48.5 |
| | High School Diploma | 28.5 | 26.3 - 30.7 |
| | Some College | 20.2 | 18.1 - 22.2 |
| | College Graduate | 7.1 | 5.9 - 8.3 |
| Sexual Orientation | LGBT* | 36.8 | 28.7 - 45.0 |
| | Not LGBT* | 21.9 | 20.6 - 23.2 |
| | Other | 6.3 | 0.4 - 12.1 |
| Disability Status | Disability | 29.6 | 26.0 - 33.3 |
| | No Disability | 20.6 | 18.9 - 22.3 |
| Mental Health Status** | Poor Mental Health | 41.8 | 37.6 - 45.9 |
| | No Poor Mental Health | 19.4 | 18.1 - 20.6 |

Source: 2016 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2018.
*LGBT=Lesbian, gay, bisexual and transgender.
**Poor mental health is defined as having 14 or more poor mental health days in the past 30 days.

# Smoking/Tobacco Use

- The prevalence of cigarette smoking in Ohio was significantly lower among adults 65 and older compared to other age groups (Table 2).
- The prevalence of cigarette smoking in Ohio was significantly higher among:
    - males (24.7 percent) compared to females (20.5 percent);
    - multi-racial adults (37.0 percent) compared to white, non-Hispanic adults (22.4 percent), and other, non-Hispanic adults (11.4 percent);
    - lesbian, gay, bisexual and transgender (LGBT) adults (36.8 percent) compared to those who are not LGBT (21.9 percent);
    - adults with a disability (29.6 percent) compared to those without a disability (20.6 percent); and,
    - adults with poor mental health (41.8 percent) compared to those who do not have poor mental health (19.4 percent) (Table 2).
- The prevalence of cigarette smoking in Ohio decreased as annual household income and education increased; 42.3 percent of adults with an annual household income less than $15,000 smoked cigarettes compared to 10.9 percent of adults with a household income of $75,000 or more, and 43.0 percent of adults with no high school diploma smoked cigarettes compared to 7.1 percent of college graduates (Table 2).
- County-level smoking prevalence among adult residents of Ohio ranged from 14 percent to 25 percent. Smoking was more common among residents of southern counties in Ohio (see Figure 13 on page 16).

**Figure 2. Estimated Prevalence of Cigarette, Cigar/Cigarillo/Little Cigar and Smokeless Tobacco Use* in the Past 30 Days among High School Students (Grades 9-12), Ohio, 2000-2016**




Source: 2016 Ohio Youth Tobacco Survey, Ohio Department of Health, 2018.
*In 2000-2008, smokeless tobacco included chewing tobacco, snuff and dip. In 2010-2014, smokeless tobacco also included snus. The sample size for smokeless tobacco use in 2016 was too small to produce stable estimates.

- The trends in current cigarette use and current cigar/cigarillo/little cigar use among Ohio high school students decreased 74.5 percent and 49.2 percent, respectively, between 2000 and 2016 (Figure 2). These trends are largely due to the increase in use of e-cigarettes among youth.
- The trend in current use of smokeless tobacco (chewing tobacco, snuff, snus or dip) among Ohio high school students did not differ considerably from 2000 to 2014 (Figure 2).

# Cancers Attributed to Cigarette Smoking

Average annual numbers of cancer deaths attributed to cigarette smoking were calculated using population attributable fractions (PAF). PAFs (shown in Table 3) were calculated using the estimated prevalence of cigarette smoking for sex- and age-specific groups in the United States and information from studies of associations between cigarette smoking and risk of cancer death.[5] However, it should be noted that PAFs are estimates and do not account for a number of factors, including shared risk factors with diseases other than cancer which pose a competing risk, and that the causes of cancer are complex and multifactorial. Additional information about PAFs and their interpretation is available from sources referenced on page 21 of this report.[6,7,8]

- The majority of deaths from lung, bronchus and tracheal cancers (80 percent), laryngeal cancers (77 percent) and esophageal cancers (51 percent) are attributed to cigarette smoking (Table 3).
- In 2011-2015, an estimated 7,699 Ohio cancer deaths each year among adults ages 35 and older were attributed to cigarette smoking (Table 3).
- Ohioans ages 35-75 who died prematurely from cancers attributed to cigarette smoking lost an average of 10.9 years of potential life per person (data not shown).

**Table 3. Population Attributable Fractions for Cigarette Smoking, Average Annual Number of Cancer Deaths and Estimated Average Annual Number of Cancer Deaths Attributed to Cigarette Smoking among Adults Ages 35 and Older, by Cancer Site/Type, Ohio, 2011–2015**

| | Population Attributable Fractions for Cigarette Smoking* | Ohio Cancer Deaths | Ohio Cancer Deaths Attributed to Cigarette Smoking** |
|---|---|---|---|
| Lung, Bronchus & Trachea | 80.2% | 7,283 | 5,841 |
| Larynx | 76.6% | 183 | 140 |
| Esophagus | 50.7% | 704 | 357 |
| Oral Cavity & Pharynx | 47.0% | 370 | 174 |
| Bladder | 44.8% | 710 | 318 |
| Liver & Intrahepatic Bile Duct | 23.6% | 825 | 195 |
| Cervix | 22.2% | 154 | 34 |
| Stomach | 19.6% | 374 | 73 |
| Kidney & Renal Pelvis | 16.8% | 564 | 95 |
| Acute Myeloid Leukemia | 14.6% | 405 | 59 |
| Pancreas | 12.1% | 1,639 | 198 |
| Colon & Rectum | 9.7% | 2,217 | 215 |
| Total** | 48.5% | 15,427 | 7,699 |

Source: Bureau of Vital Statistics, Ohio Department of Health, 2018.
*Siegel RL, Jacob EJ, Newton CC. Deaths Due to Cigarette Smoking for 12 Smoking-Related Cancers in the United States. *JAMA Internal Medicine*. 2015; 175:1574-1576.
**The total number of Ohio cancer deaths attributed to smoking was calculated using the population attributable fraction for cigarette smoking, which differs from the sum of the number of site-specific cancer deaths attributed to cigarette smoking.

# Tobacco-associated Cancer Incidence by Sex and Race

- In 2011-2015, the incidence rate of all tobacco-associated cancers combined for Ohio (393.5 per 100,000) was 10.8 percent higher than the rate for the United States (355.1 per 100,000) (Table 4).
- Ohio incidence rates for the 12 tobacco-associated cancers were higher than those for the United States, with the exceptions of liver and intrahepatic bile duct, stomach, and kidney and renal pelvis cancers, as well as acute myeloid leukemia (Table 4).
- For each tobacco-associated cancer, the incidence rate was higher for males compared to females. For all tobacco-associated cancers combined, the incidence rate among males was 69.4 percent higher than the rate for females (Table 4).
- For all tobacco-associated cancers combined, the incidence rate among blacks was slightly higher than the rate for whites, and more than two times the rate for Asians/Pacific Islanders (Table 4).

**Table 4. Tobacco-associated Cancers: Average Annual Number of Cases and Age-adjusted Incidence Rates per 100,000 Adults Ages 35 and Older, by Cancer Site/Type, Sex and Race, Ohio and the United States, 2011-2015**

| | Sex | | | | Race | | | | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | Female | | White | | Black | | Asian/Pacific Islander | | Ohio | | U.S. |
| | Counts | Rate | Counts | Rate | Counts | Rate | Counts | Rate | Counts | Rate | Counts | Rate | Rate |
| All Tobacco-associated Sites/Types | 16,485 | 510.5 | 11,794 | 301.3 | 24,940 | 391.1 | 2,855 | 403.0 | 166 | 193.7 | 28,281 | 393.5 | 355.1 |
| Lung, Bronchus & Trachea | 5,208 | 163.6 | 4,576 | 117.4 | 8,669 | 134.9 | 1,029 | 147.3 | 47 | 58.0 | 9,785 | 137.1 | 106.8 |
| Larynx | 455 | 13.6 | 138 | 3.5 | 518 | 7.9 | 67 | 9.0 | 2 | 3.4 | 592 | 8.1 | 5.8 |
| Esophagus | 581 | 17.8 | 151 | 3.7 | 676 | 10.4 | 48 | 6.6 | 3 | 3.2 | 731 | 10.1 | 8.1 |
| Oral Cavity & Pharynx | 1,153 | 34.2 | 463 | 12.1 | 1,468 | 22.9 | 119 | 16.0 | 10 | 10.4 | 1,616 | 22.5 | 21.5 |
| Bladder | 2,341 | 76.4 | 731 | 18.3 | 2,830 | 44.1 | 165 | 24.5 | 8 | 11.0 | 3,072 | 43.3 | 30.0 |
| Liver & Intrahepatic Bile Duct | 681 | 19.8 | 282 | 7.2 | 761 | 11.5 | 171 | 21.6 | 15 | 15.8 | 964 | 13.0 | 17.0 |
| Cervix | - | - | 406 | 12.9 | 350 | 12.8 | 44 | 11.3 | 4 | 7.1 | 406 | 12.9 | 12.3 |
| Stomach | 561 | 17.7 | 318 | 8.2 | 717 | 11.2 | 136 | 19.8 | 12 | 14.2 | 878 | 12.4 | 13.9 |
| Kidney & Renal Pelvis | 1,393 | 43.1 | 860 | 23.0 | 1,973 | 31.5 | 256 | 35.5 | 8 | 8.1 | 2,253 | 32.2 | 38.0 |
| Acute Myeloid Leukemia | 270 | 8.8 | 224 | 5.9 | 449 | 7.3 | 37 | 5.4 | 4 | 3.8 | 494 | 7.2 | 7.4 |
| Pancreas | 889 | 27.9 | 904 | 22.5 | 1,561 | 24.1 | 206 | 30.0 | 12 | 15.2 | 1,793 | 25.0 | 24.6 |
| Colon & Rectum | 2,954 | 93.9 | 2,742 | 70.6 | 4,969 | 78.7 | 575 | 81.2 | 41 | 46.8 | 5,696 | 81.1 | 75.7 |

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

# Tobacco-associated Cancer Mortality by Sex and Race

- In 2011-2015, the mortality rate of all tobacco-associated cancers combined for Ohio (213.4 per 100,000) was 9.9 percent higher than the rate for the United States (194.1 per 100,000) (Table 5).
- Ohio mortality rates for the 12 tobacco-associated cancers were higher than those for the United States, with the exceptions of liver and intrahepatic bile duct and stomach cancers (Table 5).
- For each tobacco-associated cancer, the mortality rate was higher for males compared to females. For all tobacco-associated cancers combined, the mortality rate among males was 69.9 percent higher than the rate for females (Table 5).
- For all tobacco-associated cancers combined, the mortality rate among blacks was 14.3 percent higher than the rate for whites, and more than two times the rate for Asians/Pacific Islanders (Table 5).

**Table 5. Tobacco-associated Cancers: Average Annual Number of Deaths and Age-adjusted Mortality Rates per 100,000 Adults Ages 35 and Older, by Cancer Site/Type, Sex and Race, Ohio, 2011-2015**

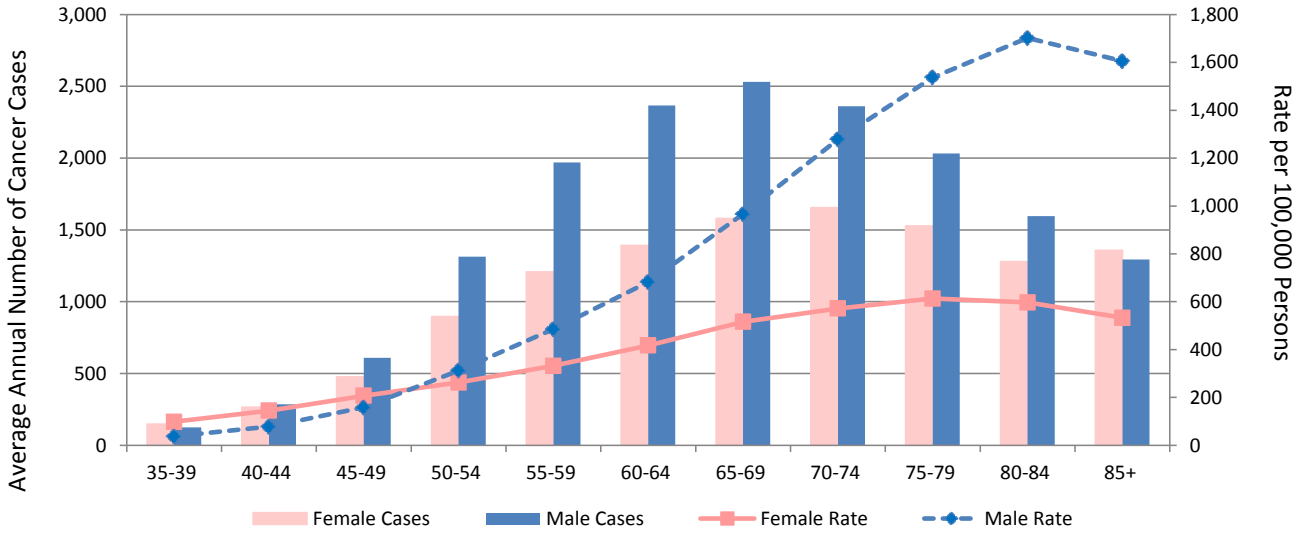
| | Sex | | | | Race | | | | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | Female | | White | | Black | | Asian/Pacific Islander | | Ohio | | U.S. |
| | Deaths | Rate | Deaths | Rate | Deaths | Rate | Deaths | Rate | Deaths | Rate | Deaths | Rate | Rate |
| All Tobacco-associated Sites/Types | 8,812 | 278.3 | 6,615 | 163.8 | 13,638 | 211.5 | 1,660 | 241.7 | 84 | 104.5 | 15,427 | 213.4 | 194.1 |
| Lung, Bronchus & Trachea | 4,001 | 126.0 | 3,282 | 82.0 | 6,470 | 100.5 | 763 | 111.5 | 33 | 43.5 | 7,283 | 100.8 | 84.8 |
| Larynx | 139 | 4.2 | 44 | 1.1 | 157 | 2.4 | 24 | 3.4 | <1 | * | 183 | 2.5 | 2.0 |
| Esophagus | 568 | 17.5 | 135 | 3.3 | 648 | 10.0 | 51 | 7.2 | 2 | 2.1 | 704 | 9.7 | 7.9 |
| Oral Cavity & Pharynx | 266 | 8.0 | 104 | 2.6 | 331 | 5.1 | 36 | 5.0 | 2 | 2.9 | 370 | 5.1 | 4.8 |
| Bladder | 509 | 17.3 | 201 | 4.7 | 656 | 10.1 | 50 | 7.7 | 2 | 3.2 | 710 | 9.8 | 8.6 |
| Liver & Intrahepatic Bile Duct | 555 | 16.5 | 270 | 6.6 | 679 | 10.3 | 127 | 16.8 | 11 | 13.0 | 825 | 11.1 | 12.4 |
| Cervix | - | - | 154 | 4.4 | 129 | 4.2 | 23 | 5.9 | 2 | 2.9 | 154 | 4.4 | 3.9 |
| Stomach | 219 | 7.1 | 156 | 3.8 | 297 | 4.7 | 69 | 10.5 | 7 | 7.8 | 374 | 5.3 | 6.1 |
| Kidney & Renal Pelvis | 357 | 11.1 | 207 | 5.1 | 509 | 7.8 | 54 | 7.8 | 1 | 1.4 | 564 | 7.7 | 7.4 |
| Acute Myeloid Leukemia | 227 | 7.6 | 178 | 4.6 | 371 | 5.9 | 29 | 4.5 | 3 | 2.8 | 405 | 5.8 | 5.2 |
| Pancreas | 822 | 25.9 | 817 | 19.9 | 1,435 | 22.2 | 189 | 28.1 | 9 | 10.9 | 1,639 | 22.6 | 21.3 |
| Colon & Rectum | 1,150 | 37.2 | 1,067 | 25.8 | 1,955 | 30.4 | 244 | 35.9 | 12 | 14.5 | 2,217 | 30.8 | 28.1 |

Source: Bureau of Vital Statistics, Ohio Department of Health, 2018. With the exception of all tobacco-associated cancer sites/types combined and acute myeloid leukemia, 2011-2015 U.S. age-specific mortality rates, used in calculating U.S. age-adjusted mortality rates, were obtained from *SEER Cancer Statistics Review, 1975-2015*.[9] For all tobacco-associated cancer sites/types combined and acute myeloid leukemia, 2010-2014 U.S. age-specific mortality rates were from CDC Wonder.[10]
* Rate not calculated when the case count for 2011-2015 is less than five (*i.e.*, the average annual count is less than one).

# Tobacco-associated Cancer Incidence and Mortality by Age and Sex

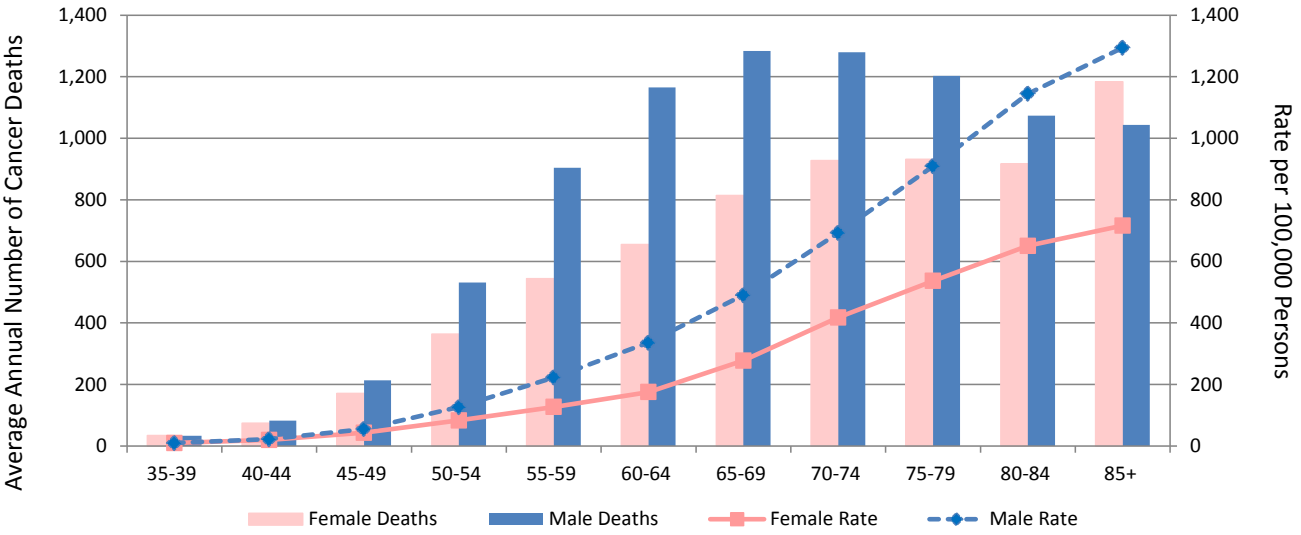
- The number of tobacco-associated cancer cases in 2011-2015 was highest among males ages 65 to 69 years, and among females ages 70 to 74 years (Figure 3).
- The incidence rate for all tobacco-associated cancers combined increased with advancing age for males to ages 80 to 84 years, then declined; for females, the incidence rate increased to ages 75 to 79 years, then declined (Figure 3).
- The number of tobacco-associated cancer deaths in 2011-2015 was highest among males ages 65 to 69 years, and among females ages 85 years and older (Figure 4).
- The mortality rate for all tobacco-associated cancers combined increased with advancing age for both males and females through ages 85 years and older (Figure 4).

**Figure 3. All Tobacco-associated Cancers Combined: Average Annual Number of Cancer Cases and Age-specific Incidence Rates per 100,000 Adults Ages 35 and Older by Age Group, Ohio, 2011-2015**




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

**Figure 4. All Tobacco-associated Cancers Combined: Average Annual Number of Cancer Deaths and Age-specific Mortality Rates per 100,000 Adults Ages 35 and Older by Age Group, Ohio, 2011-2015**

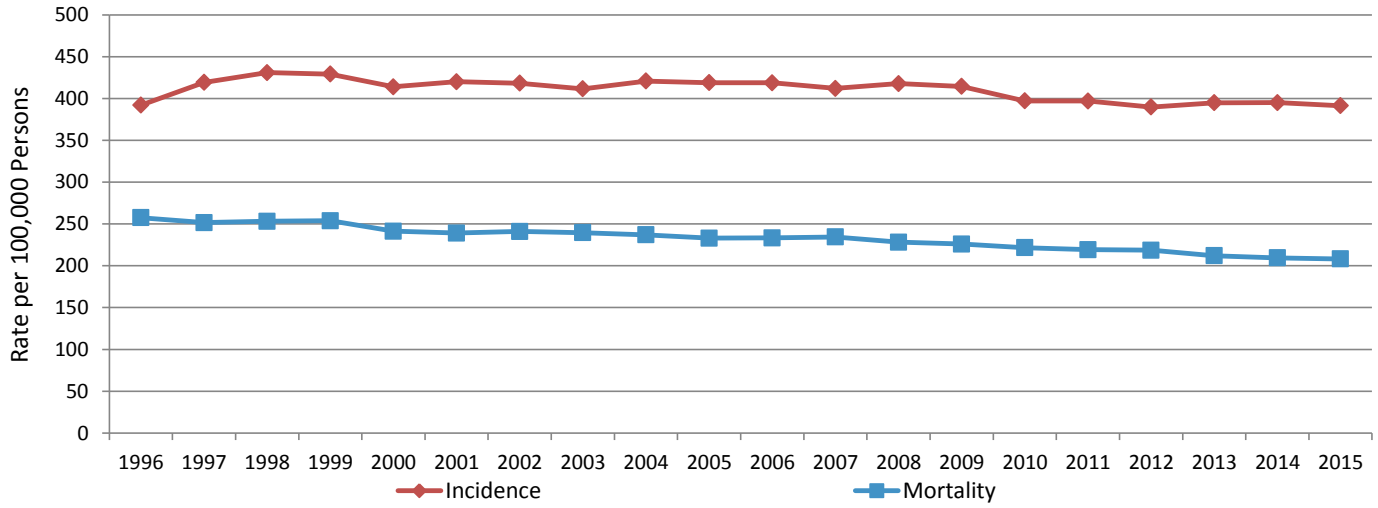



Source: Bureau of Vital Statistics, Ohio Department of Health, 2018.

# Tobacco-associated Cancer Incidence and Mortality by Year

- The incidence rate for all tobacco-associated cancers combined increased slightly from 1996 to 1998 and decreased slightly from 1999 to 2015. The mortality rate for all tobacco-associated cancers combined decreased 19 percent from 1996 to 2015 (Figure 5).

**Figure 5. All Tobacco-associated Cancers Combined: Age-adjusted Incidence and Mortality Rates per 100,000 Adults Ages 35 and Older, by Year, Ohio, 1996-2015**

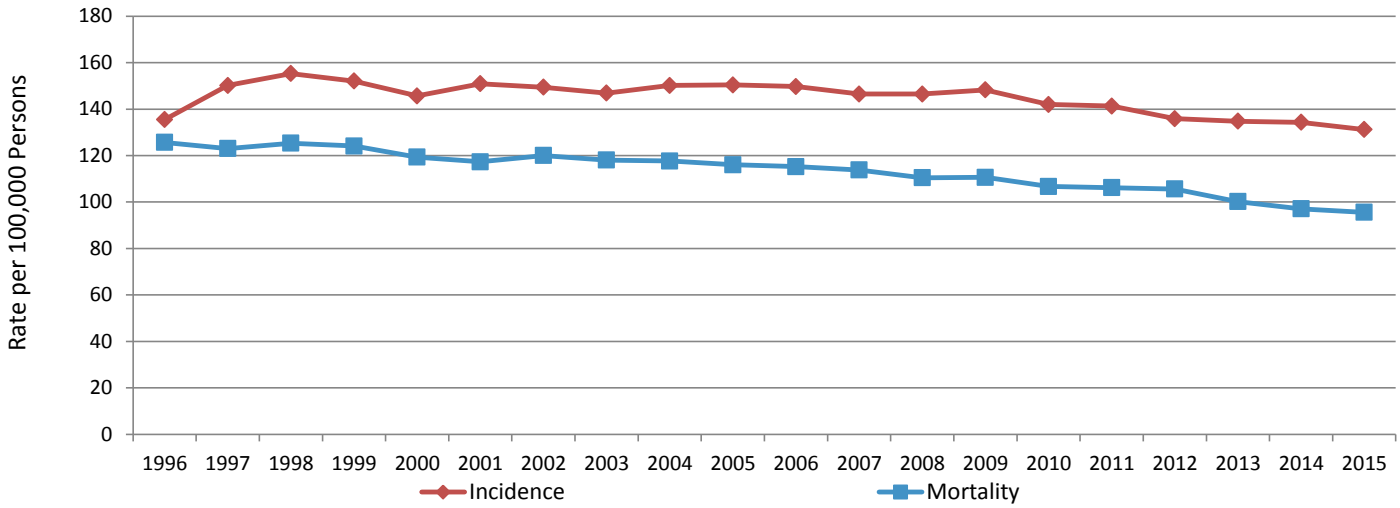



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018; Bureau of Vital Statistics, Ohio Department of Health, 2018.

Figures 6 through 10 show trends in incidence and mortality rates for the five sites/types of cancer with the highest (45 percent or greater) percentages attributed to cigarette smoking.

- The lung, bronchus and tracheal cancer incidence rate increased from 1996 to 1998, remained relatively stable through 2009, and then decreased through 2015. The mortality rate decreased 24 percent from 1996 to 2015 (Figure 6).

**Figure 6. Lung, Bronchus and Tracheal Cancer: Age-adjusted Incidence and Mortality Rates per 100,000 Adults Ages 35 and Older, by Year, Ohio, 1996-2015**

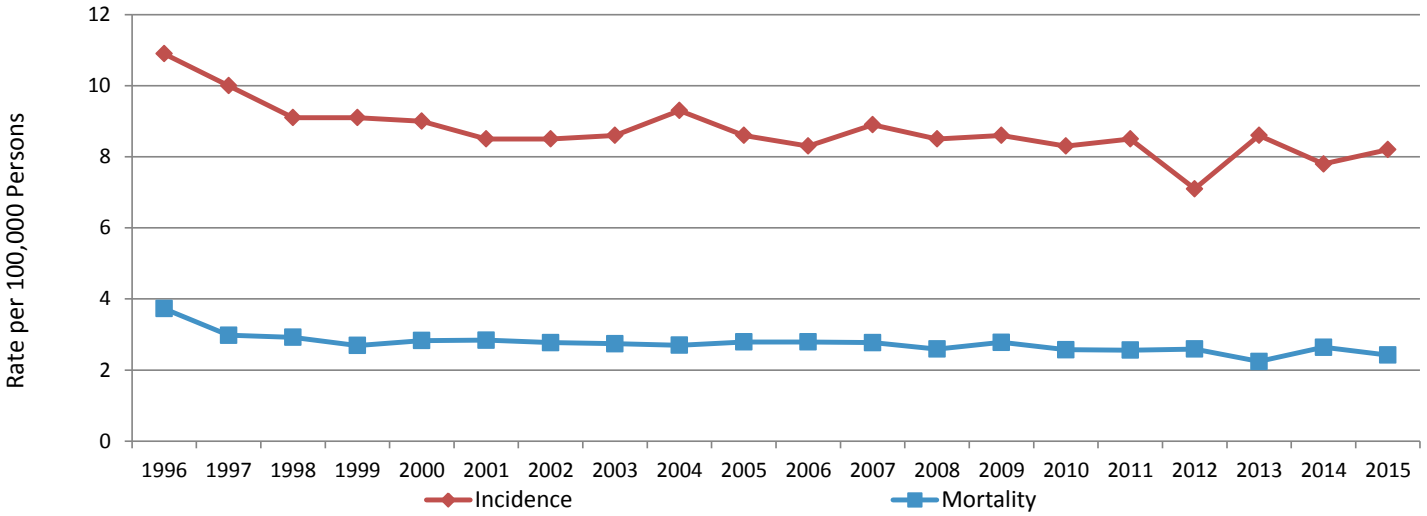



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018; Bureau of Vital Statistics, Ohio Department of Health, 2018.

# Tobacco-associated Cancer Incidence and Mortality by Year

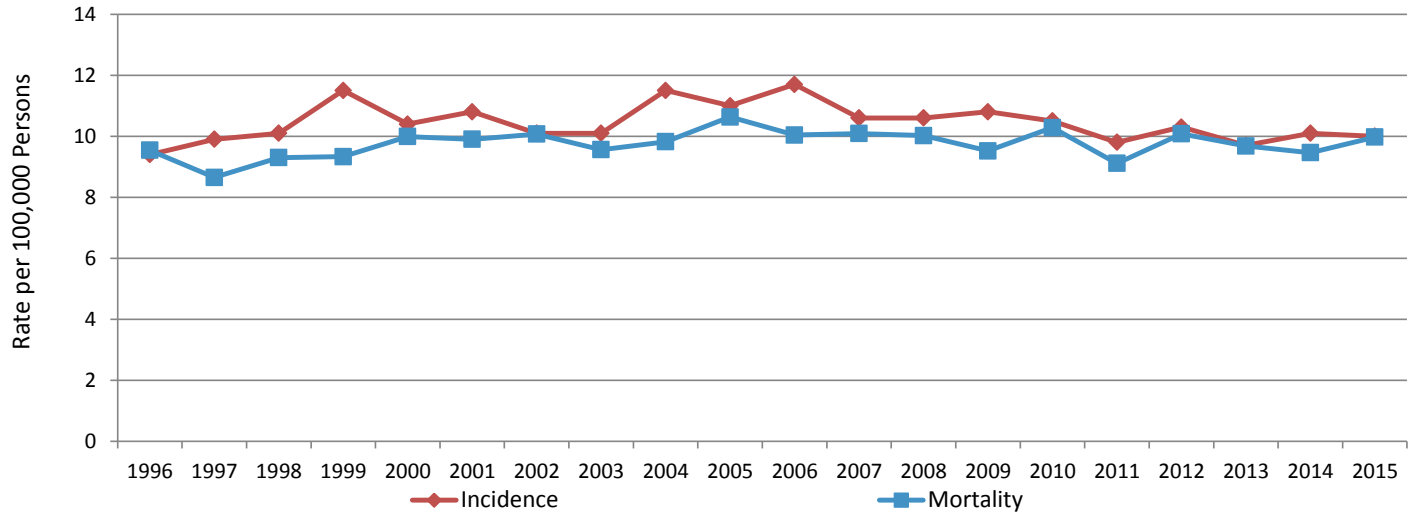
- The laryngeal cancer incidence rate generally decreased from 1996 to 2015; the mortality rate remained relatively stable from 1997 to 2015 (Figure 7).
- The esophageal cancer incidence rate was sporadic from 1996 to 2006, decreased from 2006 to 2011, and then remained stable through 2015; the mortality rate was relatively stable from 1996 to 2015 (Figure 8).
- Incidence and mortality rates for esophageal cancer were nearly identical because the survival probability for individuals diagnosed with esophageal cancer is low (Figure 8).

**Figure 7. Laryngeal Cancer: Age-adjusted Incidence and Mortality Rates per 100,000 Adults Ages 35 and Older, by Year, Ohio, 1996-2015**




Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018; Bureau of Vital Statistics, Ohio Department of Health, 2018.

**Figure 8. Esophageal Cancer: Age-adjusted Incidence and Mortality Rates per 100,000 Adults Ages 35 and Older, by Year, Ohio, 1996-2015**

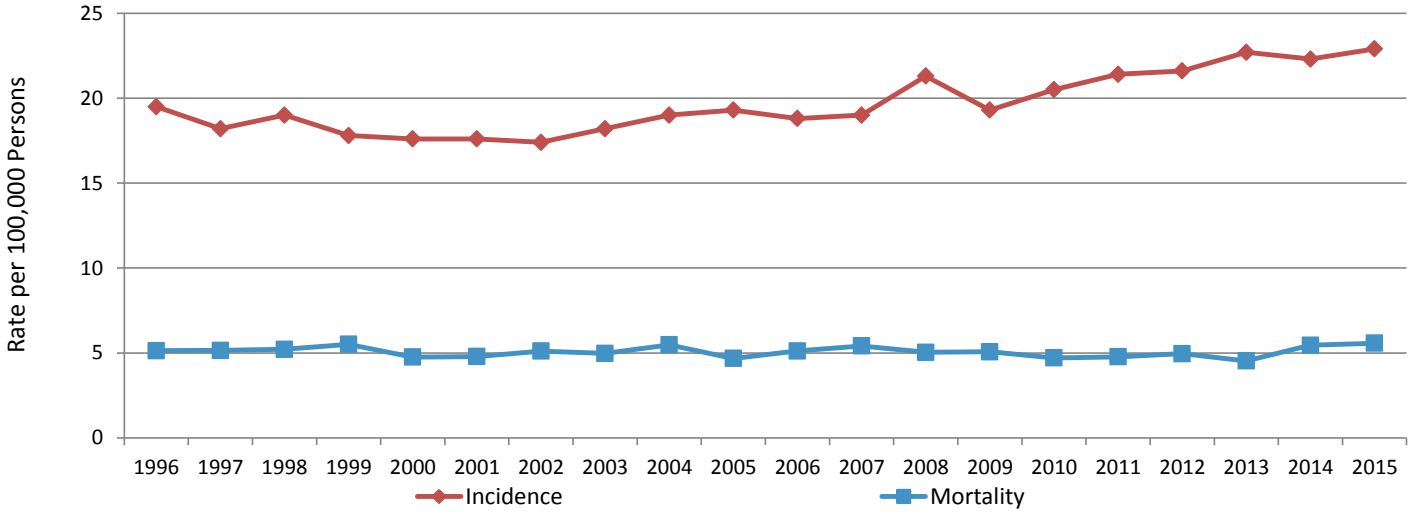



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018; Bureau of Vital Statistics, Ohio Department of Health, 2018.

# Tobacco-associated Cancer Incidence and Mortality by Year

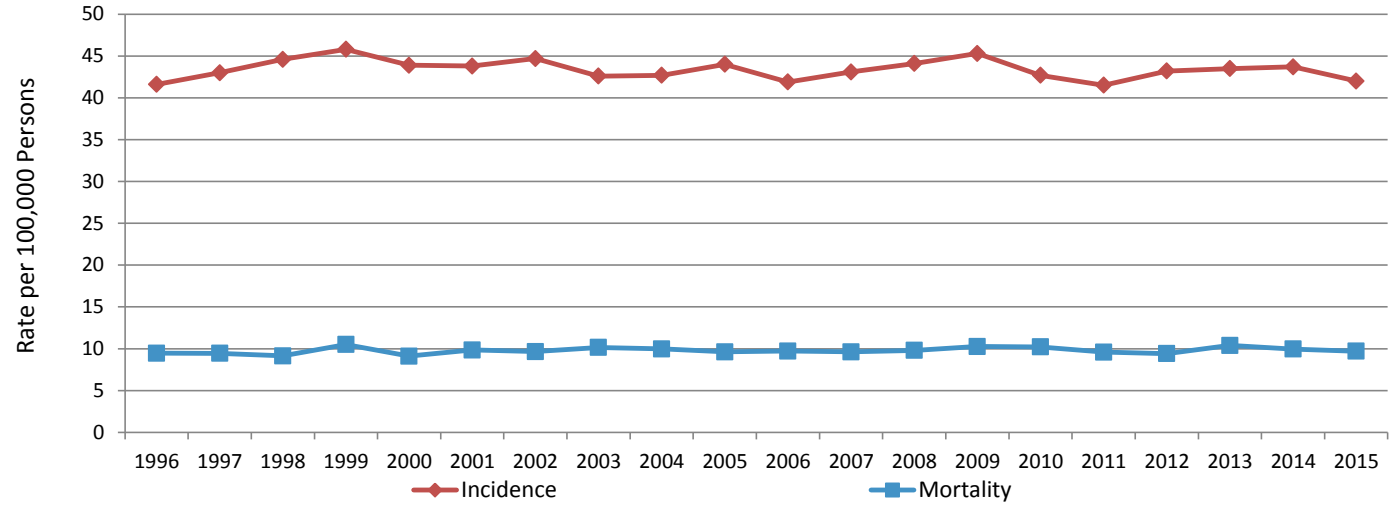
- The oral cavity and pharyngeal cancer incidence rate declined slightly from 1996 to 2002 and then increased through 2015; the mortality rate remained relatively stable from 1996 to 2015 (Figure 9).
- Bladder cancer incidence and mortality rates were relatively stable from 1996 to 2015 (Figure 10).

**Figure 9. Oral Cavity and Pharyngeal Cancer: Age-adjusted Incidence and Mortality Rates per 100,000 Adults Ages 35 and Older, by Year, Ohio, 1996-2015**




Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018; Bureau of Vital Statistics, Ohio Department of Health, 2018.

**Figure 10. Bladder Cancer: Age-adjusted Incidence and Mortality Rates per 100,000 Adults Ages 35 and Older, by Year, Ohio, 1996-2015**

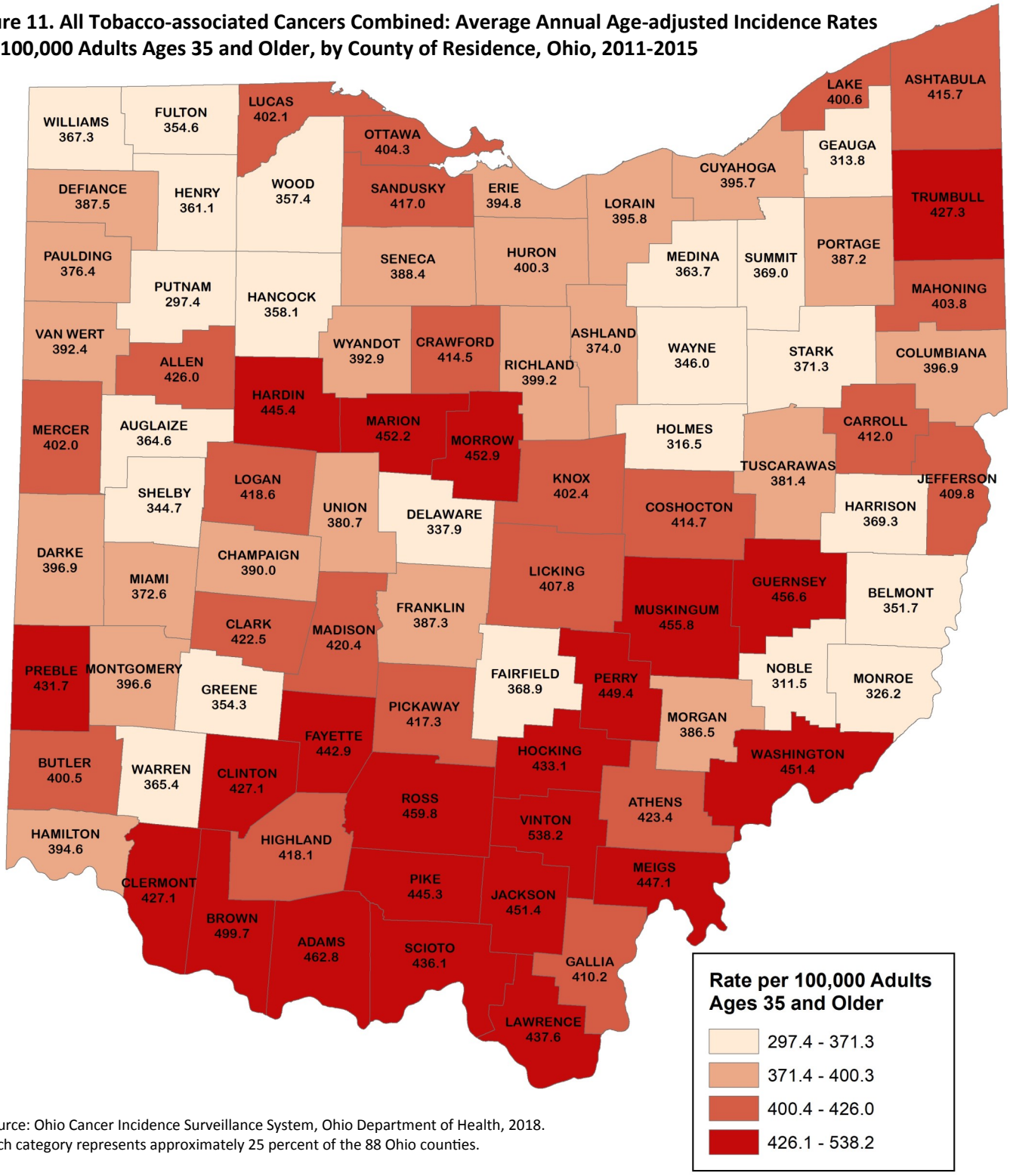



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018; Bureau of Vital Statistics, Ohio Department of Health, 2018.

# Tobacco-associated Cancer Incidence by County

- Incidence rates of tobacco-associated cancers in Ohio by county ranged from 297.4 per 100,000 to 538.2 per 100,000 in 2011-2015. The majority of counties with the highest incidence rates were located in southern Ohio (Figure 11).

**Figure 11. All Tobacco-associated Cancers Combined: Average Annual Age-adjusted Incidence Rates per 100,000 Adults Ages 35 and Older, by County of Residence, Ohio, 2011-2015**

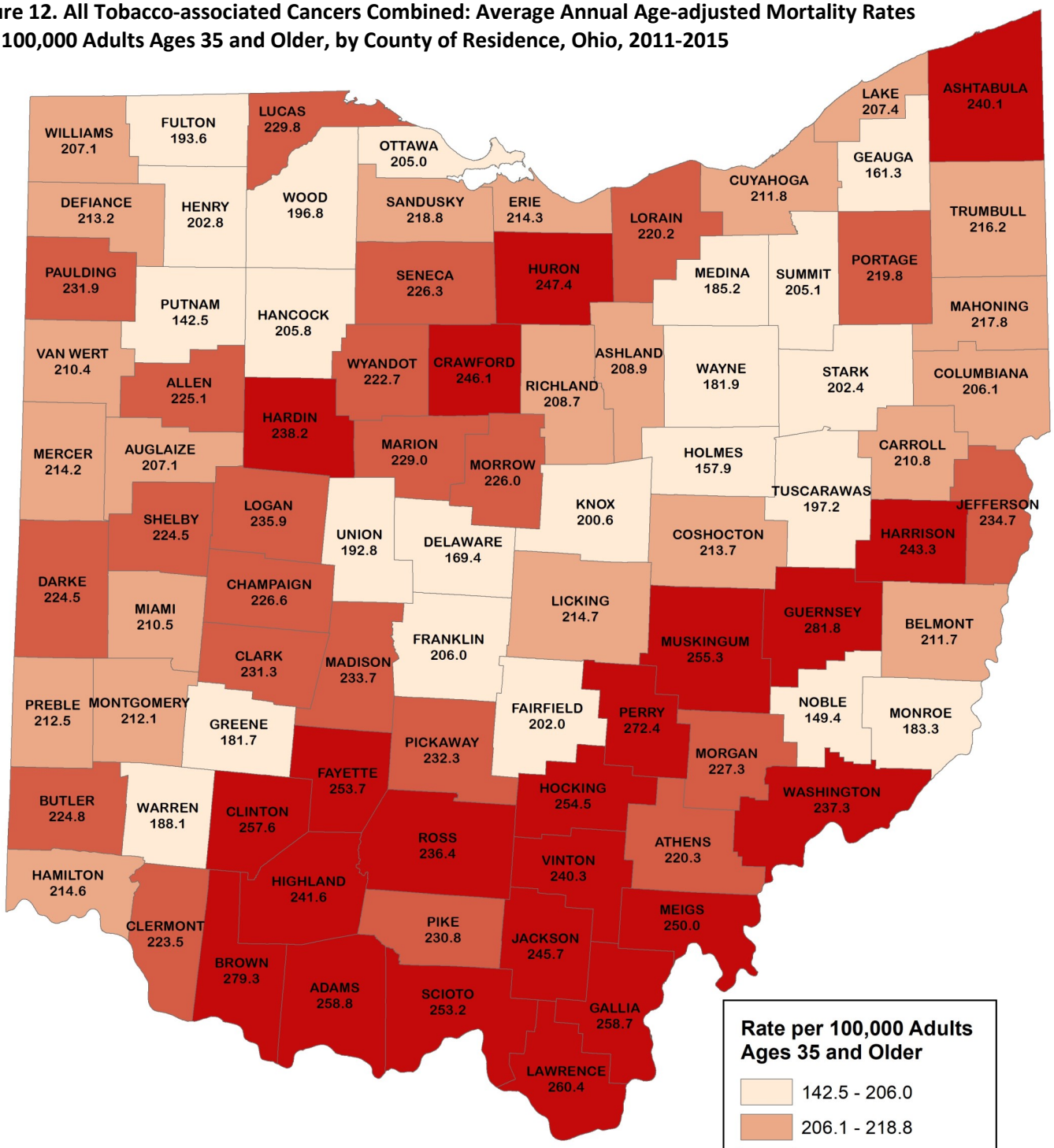



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2018.
Each category represents approximately 25 percent of the 88 Ohio counties.

# Tobacco-associated Cancer Mortality by County

- Mortality rates of tobacco-associated cancers in Ohio ranged from 142.5 per 100,000 to 281.8 per 100,000 in 2011-2015, with the highest mortality rates in southern counties and some rural counties (Figure 12).

**Figure 12. All Tobacco-associated Cancers Combined: Average Annual Age-adjusted Mortality Rates per 100,000 Adults Ages 35 and Older, by County of Residence, Ohio, 2011-2015**

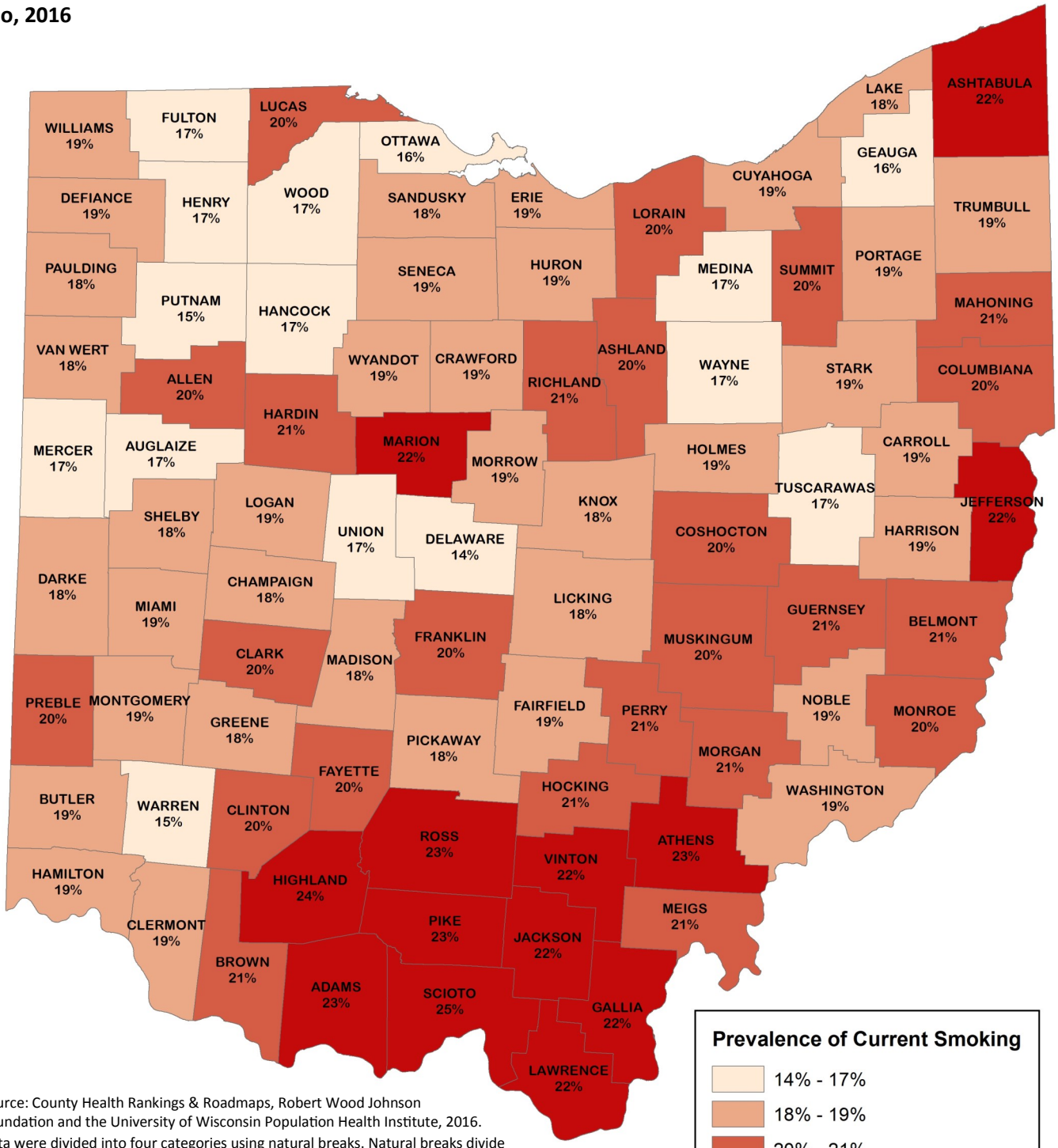



Source: Bureau of Vital Statistics, Ohio Department of Health, 2018.
Each category represents approximately 25 percent of the 88 Ohio counties.

# Current Smoking by County

- The prevalence of current tobacco smoking among adults in Ohio was greatest in southern Ohio (Figure 13). The geographic pattern of current tobacco smoking in Ohio is similar to the patterns of tobacco-associated cancer incidence and mortality (Figures 11 and 12 on pages 14 and 15, respectively).

**Figure 13. Estimated Prevalence of Current Smoking among Adults Ages 18 and Older, by County of Residence, Ohio, 2016**




Source: County Health Rankings & Roadmaps, Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute, 2016.
Data were divided into four categories using natural breaks. Natural breaks divide data into classes using an algorithm that groups similar values and maximizes differences between classes. For more information: http://pro.arcgis.com/en/pro-app/help/mapping/layer-properties/data-classification-methods.htm

# Tobacco-related Events and Policies

**Table 6. Selected Ohio and Federal Tobacco-related Events and Policies by Year, 1964-2017**

| Year | Tobacco-related Events and Policies |
|---|---|
| 1964 | *Smoking and Health: Report of the Advisory Committee of the Surgeon General of the Public Health Service* is published |
| 1988 | The Ohio Department of Health receives federal funding for tobacco control through the Preventive Health and Health Services Block Grant |
| 1991 | Ohio Tobacco Control Resource Group, now the Tobacco Free Ohio Alliance, is formed |
| 1994 | Tobacco Control Program at the Ohio Department of Health, funded by the Centers for Disease Control and Prevention, is formed |
| 1998 | Master Settlement Agreement (MSA) between states and the largest tobacco manufacturers is enacted; requires annual payments to states and limits advertising, marketing and promotion of cigarettes |
| 2000 | Tobacco Use Prevention and Control Foundation, funded by the MSA, is formed; implemented youth prevention and cessation initiatives across Ohio from 2000 to 2008 |
| 2006 | Ohio Smoke-free Workplace Law is enacted |
| 2009 | Family Smoking Prevention and Tobacco Control Act is enacted; gives Food and Drug Administration authority to regulate the manufacture, distribution and marketing of tobacco products |
| 2009 | Federal Cigarette Excise Tax is increased from $0.39 to $1.01 per pack |
| 2010 | Patient Protection and Affordable Care Act (ACA) extends coverage for cessation services |
| 2012 | *Preventing Tobacco Use Among Youth and Young Adults: A Report from the Surgeon General* is published |
| 2014 | *The Health Consequences of Smoking—50 Years of Progress: A Report from the Surgeon General* is published |
| 2014 | *Ohio's Plan to Prevent and Reduce Chronic Disease 2014-2018* is released by the Ohio Chronic Disease Collaborative; includes objectives to prevent and reduce tobacco use |
| 2014 | Disputed MSA dollars are earmarked for tobacco control by Ohio Governor John Kasich |
| 2015 | Ohio Cigarette Tax is increased from $1.25 to $1.60 per pack |
| 2015 | Upper Arlington is the first Ohio city to adopt Tobacco21, followed by Bexley, Grandview Heights, New Albany, Cleveland, Columbus, Euclid, Powell, Dublin, Akron and Worthington as of July 2018 |
| 2015 | *Ohio Infant Mortality Reduction Plan 2015-2020* is released by the Ohio Infant Mortality Task Force; includes strategies to reduce tobacco use before, during and after pregnancy |
| 2015 | *The Ohio Comprehensive Cancer Control Plan 2015-2020* is released by the Ohio Partners for Cancer Control; includes objectives to prevent and reduce tobacco use |
| 2016 | *E-Cigarette Use Among Youth and Young Adults: A Report from the Surgeon General* is published |
| 2016 | U.S. Department of Housing and Urban Development (HUD) institutes Smoke-Free Public Housing Rule |
| 2016 | FDA is allowed to regulate any product made or derived from tobacco, including e-cigarettes |
| 2016 | Ohio senate bill 332 is passed; includes infant mortality recommendations to reduce tobacco use in pregnant women |
| 2017 | *Ohio 2017-2019 State Health Improvement Plan* is released by the Ohio Department of Health and Health Policy Institute of Ohio; includes tobacco prevention and cessation strategies to address mental health and addiction, chronic disease, and maternal and infant health |

Ohio tobacco-related event or policy  Federal tobacco-related event or policy

Source: Tobacco Use Prevention and Cessation Program, Ohio Department of Health, 2018.

# Ohio 2017-2019 State Health Improvement Plan

The *Ohio 2017-2019 State Health Improvement Plan* (SHIP) is a strategic menu of priorities, objectives and evidence-based strategies to be implemented by state agencies, local health departments, hospitals, community partners, and sectors beyond health such as education and employers. The plan addresses three priority topic areas (mental health and addiction, chronic disease and infant mortality) through cross-cutting factors, including tobacco prevention and cessation. The following are strategies in the SHIP to address the prevention and cessation of tobacco use:

- Implementing smoke-free policies, including maintenance of the Smoke-free Workplace Law; increasing policy adoption for multi-unit housing, schools and other settings; and implementing policies for outdoor areas
- Increasing the price of tobacco products (cigarette and other tobacco product taxes)
- Implementing policies to decrease accessibility and availability of tobacco products to youths
- Conducting mass-reach communications regarding tobacco prevention and cessation
- Expanding access to evidence-based tobacco cessation treatments, including counseling and cessation medications
- Removing barriers that impede access to covered cessation treatments
- Promoting increased utilization of covered treatment benefits by tobacco users

Implementation of these strategies by multiple sectors will help to reduce the prevalence of tobacco use in the state, and ultimately the cancer and other health-related outcomes associated with tobacco.

# 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 or Medicare, 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). If a person is not eligible for Quit Line Services, they are referred to community resources in their area. Call 1-800-QUIT-NOW (1-800-784-8669) and an intake specialist will assist you with quitting tobacco.

# The Ohio Comprehensive Cancer Control Plan 2015-2020

Ohio Partners for Cancer Control (OPCC, http://www.ohiocancerpartners.org/) is a statewide coalition dedicated to reducing the burden of cancer in Ohio. The coalition includes representatives of organizations and individual members who have cancer prevention and control as a focus of their mission. Organizations represented include hospitals, universities, cancer centers, health care professional associations, nonprofit organizations, government agencies, minority health coalitions and community organizations. The OPCC's mission is to create "A Cancer-Free Future for All Ohioans" by stressing a unified fight against cancer through collaboration and use of a comprehensive approach.

Under the leadership of the Ohio Department of Health's Comprehensive Cancer Control Program, OPCC has developed a strategic plan to reduce the cancer burden in the state with the creation of *The Ohio Comprehensive Cancer Control Plan 2015-2020* (The Cancer Plan).[11] The Cancer Plan is designed to provide guidance to individuals and organizations spanning a wide range of health and social disciplines that can play a role in controlling cancer. Several aspects of the cancer continuum are addressed, which include primary prevention, screening and early detection and patient-centered services.

Five of The Cancer Plan's primary prevention objectives relate to reducing tobacco use and exposure to secondhand smoke. These objectives, as well as progress made toward them, are detailed in Table 6.

**Table 6. Tobacco-associated Cancer Plan Objectives: Baselines, Current Progress and Targets**

| Tobacco-associated Cancer Plan Objectives | Baseline | Current Progress | Target |
|---|---|---|---|
| By December 31, 2020, increase the percentage of Ohio cigarette smokers who report attempting to quit smoking for one day or longer during the previous 12 months.[1] | 59.5% | 57.9% | 75.0% |
| By December 31, 2020, increase the excise tax on other tobacco products such as snus, snuff, chewing tobacco and e-cigarettes.[2] | 17.0% | 17.0% | 37.0% |
| By December 31, 2020, increase the number of Ohio school districts with 100 percent tobacco-free policies.[3] | 36 | 107 | 65 |
| By December 31, 2020, increase the number of colleges and universities with 100 percent tobacco-free policies.[4] | 17 | 9* | 25 |
| By December 31, 2020, increase the percentage of public multi-unit housing complexes in Ohio with 100 percent smoke-free policies.[5] | 39.0% | ** | 50.0% |

Source:
[1]2016 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2018.
[2]Ohio Revised Code Section 5743.63.
[3]Ohio Department of Health Tobacco-Free School Database.
[4]Ohio Department of Health Tobacco-Free University Database.
[5]Ohio Department of Health Smoke-Free Multi-Unit Housing Database.
*In 2017, the Tobacco Use Prevention and Cessation Program developed a model college campus policy and a scoring rubric. Colleges are now scored as exceptional, strong, satisfactory or as needing improvement. This number represents those policies currently scored as exceptional or strong.
**Federal legislation required housing complexes where all units are publicly funded or subsidized (Section 9) be 100 percent smoke-free by July 2018. Current progress was unavailable at the time of publication.

# Tobacco-free Schools

Implementing tobacco-free policies is an evidence-based intervention to prevent and reduce tobacco use among youth. While the rates of initiation of cigarette use among youth are decreasing, youth are experimenting with and becoming daily users of emerging tobacco products such as e-cigarettes and JUUL (a type of e-cigarette that looks like a USB flash drive). For this reason, it is important for schools to provide tobacco-free environments for their students.

Ohio is achieving tobacco-free schools, district by district, through a collaboration between the Ohio Department of Health's Tobacco Use Prevention and Cessation Program (TUPCP) and local school districts, the Ohio School Board Association (OSBA) and many other state and local partners. School superintendents were surveyed about barriers to policy adoption, and the resulting information led to the development of new promotional materials that included school-specific scoring of their current policies, as well as specific language changes to improve the policies. TUPCP staff also worked with OSBA to modify their existing smoke-free model policy to be consistent with Ohio's 100 percent Tobacco-Free Policy.

As a result of these efforts, the number of Ohio school districts that adopted 100 percent Tobacco-Free Policies from February 2016 through June 2018 more than doubled, from 43 to 107, and many others strengthened their policy. Support for tobacco-free policies by school administrators was overwhelmingly positive, and schools with strong policies reported significantly less evidence of tobacco use on their property than schools with weaker policies.

# Multi-unit Housing Initiative

A United States Department of Housing and Urban Development (HUD) rule required public housing to be 100 percent smoke-free by July 31, 2018. Tobacco products, including cigarettes, cigars, pipes and waterpipes (hookahs), will be prohibited in all public housing units, indoor public housing common areas and administrative buildings, and outdoor areas within 25 feet of the buildings. In addition to limiting exposure to secondhand smoke, this rule will reduce the significant damage and maintenance costs associated with smoking. This rule applies to all public housing units with the exception of those in mixed-finance buildings (i.e., Section 8 housing).

The Smoke-Free Public Housing Ohio Team, comprised of members from state and local health departments, the Ohio Housing Finance Agency, American Cancer Society and Centers for Disease Control and Prevention's Office on Smoking and Health, has developed an action plan to support this rule. The action plan consists of the following priorities:

- Providing technical assistance to support the implementation of HUD's smoke-free multi-unit housing rule in 100 percent of public housing authorities;
- Insuring health and smoking cessation services are available to all residents who wish to use them; and
- Implementing a media campaign to increase general awareness of the rule and possible expansion.

# 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 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 2016 bridged-race postcensal population estimates for July 1, 2010-July 1, 2015 (U.S. Census Bureau and National Center for Health Statistics, 2016).

**Incidence:** The number of cases diagnosed during a specified time period (e.g., 2011-2015).

**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).

**Natural Breaks:** Natural breaks divide data into classes using an algorithm that groups similar values and maximizes differences between classes. More information about classification methods can be found here: http://pro.arcgis.com/en/pro-app/help/mapping/layer-properties/data-classification-methods.htm

**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 case 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 of diagnosis, in the order of increasing spread, are *in situ*, local, regional and distant. In general, *in situ* and local 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.

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The James
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