

# Cancer Incidence and Mortality in Urban and Rural Census Tracts in Ohio

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## Contents

Introduction	1
Categorizing Urban and Rural Census Tracts	1
Cancer Incidence in Urban and Rural Census Tracts by Site/Type and Sex	3
Cancer Mortality in Urban and Rural Census Tracts by Site/Type and Sex	5
Stage at Diagnosis in Urban and Rural Census Tracts	7
Summary and Interpretation	8
Technical Notes	9
Data Sources	10
Acknowledgments	10

## Introduction

In the United States, several research studies have revealed differences in cancer incidence and mortality rates in urban and rural areas. In general, cancer incidence rates for all sites/types combined are similar in urban and rural areas of the United States, although there are differences for specific cancer types. Some studies have found that incidence rates of female breast, prostate, and thyroid cancers are higher in urban areas of the United States. In contrast, incidence rates of tobacco-associated and human papillomavirus (HPV)-associated cancers are typically higher in rural areas. There are also higher incidence rates in rural areas for some cancers that can be detected or diagnosed at earlier stages, including cancers of the cervix, colon and rectum, lung and bronchus, and oral cavity and pharynx.

Cancer mortality rates are slightly higher in rural areas than in urban areas of the United States, especially for those cancers with effective methods of prevention, early detection, and treatment. Although most cancer mortality rates have been decreasing in the United States, the rates have not decreased equally in urban and rural areas, with mortality rates in rural areas decreasing more slowly.

The purpose of this report is to examine potential disparities in cancer incidence, mortality, and stage at diagnosis in Ohio urban and rural census tracts. Incidence and mortality rates in urban and rural census tracts for specific cancers, as well as sites/types of cancer associated with tobacco and with HPV, are compared. Stage at diagnosis in urban and rural census tracts is compared for all sites/types of cancer combined and for selected screenable cancers.

## Categorizing Urban and Rural Census Tracts

Geographic areas in the United States are categorized as urban and rural using multiple classification systems. For the purpose of this report, 2010 Rural-Urban Commuting Area (RUCA) codes were used to categorize Ohio census tracts. Census tracts are small, relatively permanent statistical subdivisions of a county or equivalent entity with an optimum size of 4,000 people. Census tracts were examined, as opposed to counties, because census tracts are the smallest geographic units that are commonly used to compare urban and rural areas, and because urban/rural status may vary within counties. RUCA codes consider population density, urbanization, and daily commuting flow (from residence to workplace) to designate the urban/rural status of each census tract. RUCA codes contain two levels. Whole numbers (1-10) delineate metropolitan, micropolitan, small town, and rural commuting areas based on the size and direction of the primary (largest) daily commuting flow. These 10 codes are further subdivided into secondary codes based on the size and direction of the secondary, or second largest, daily commuting flow. Secondary commuting flows may indicate other connections among rural and urban areas which provide information about the interconnectedness between communities, including the interchange of people, goods, and services.



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## Categorizing Urban and Rural Census Tracts

RUCA codes were grouped into urban and rural categories, as shown in Table 1.

**Table 1. Urban and Rural Categorization Using 2010 RUCA Codes**

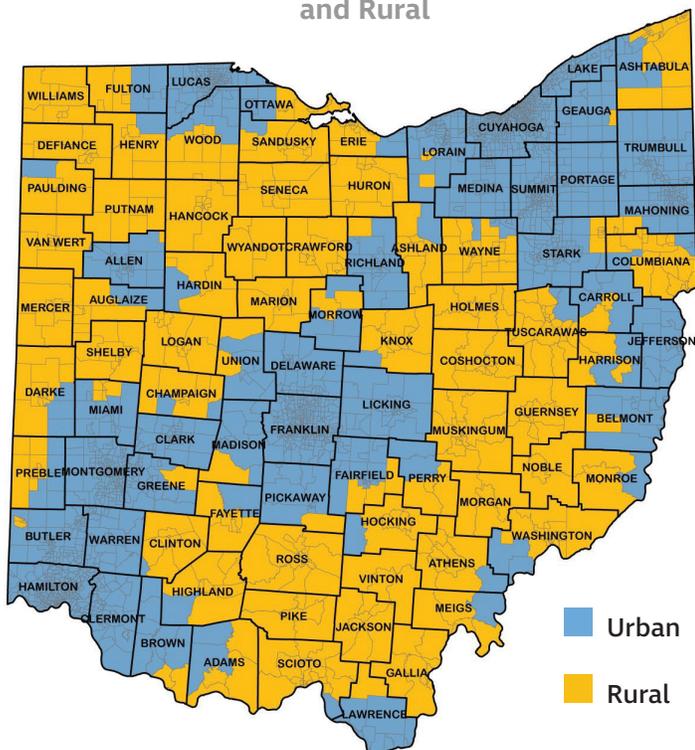
	Secondary RUCA Codes
Urban	1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, and 10.1
Rural	4.0, 4.2, 5.0, 5.2, 6.0, 6.1, 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2, 10.0, 10.2, 10.3, 10.4, 10.5, and 10.6

Source: USDA Economic Research Service, U.S. Department of Agriculture.  
<https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/>.

The source of cancer incidence and stage at diagnosis data for Ohio is the Ohio Cancer Incidence Surveillance System (OCISS) at the Ohio Department of Health (ODH), which is the central cancer registry for Ohio. Of the 363,218 cancer cases reported to OCISS in 2014 to 2018, 361,281 (99.5%) were matched to a census tract. Cancer mortality data for Ohio are from the Bureau of Vital Statistics at ODH; 123,049 (96.8%) of the 127,120 cancer deaths in 2014 to 2018 were matched to the appropriate census tract.

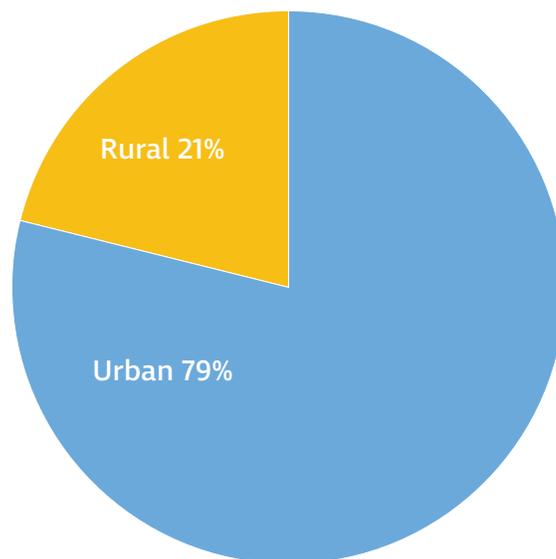
Figure 1 shows the 2,952 census tracts in Ohio categorized as urban or rural using 2010 RUCA codes. As shown in Figure 2, the majority (79%) of Ohio cancer cases reside in census tracts categorized as urban, and 21% reside in rural census tracts.

**Figure 1. Ohio Census Tracts Categorized as Urban and Rural**



Source: USDA Economic Research Service, U.S. Department of Agriculture.  
<https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/>.

**Figure 2. Percent Breakdown of 2014-2018 Ohio Cancer Cases by Urban and Rural Census Tracts**



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2021; USDA Economic Research Service, U.S. Department of Agriculture. <https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/>.

## Cancer Incidence in Urban and Rural Census Tracts by Site/Type and Sex

Table 2 (on page 4) shows average annual, age-adjusted cancer incidence rates in urban and rural census tracts by site/type and sex in Ohio from 2014 to 2018. For all sites/types of cancer combined, the incidence rate was higher in urban census tracts among females and the total population. The rate was slightly higher in rural census tracts among males. Incidence rates were at least 10% higher in urban or rural census tracts for the following cancer site/types:

### Urban

- **Total population:** liver and intrahepatic bile duct, multiple myeloma, and stomach.
- **Males:** Hodgkin lymphoma, liver and intrahepatic bile duct, multiple myeloma, prostate, and stomach.
- **Females:** brain and other central nervous system (CNS), breast, liver and intrahepatic bile duct, multiple myeloma, pancreas, and stomach.

### Rural

- **Total population:** esophagus, larynx, and HPV-associated cancers.
- **Males:** colon and rectum, esophagus, larynx, and lung and bronchus.
- **Females:** cervix, larynx, and HPV-associated cancers.

**Table 2. Average Annual Age-adjusted Cancer Incidence Rates per 100,000 People in Urban and Rural Census Tracts by Site/Type and Sex, Ohio, 2014-2018**

	Urban			Rural		
	Male	Female	Total	Male	Female	Total
<b>All Sites/Types</b>	<b>503.9</b>	<b>533.5</b>	<b>518.6</b>	<b>510.8</b>	<b>503.1</b>	<b>506.3</b>
Bladder	34.6	10.7	22.4	37.1	10.4	23.5
Brain and Other CNS <sup>^</sup>	8.1	6.4	7.2	8.0	5.4	6.7
Breast (Female)	*	142.2	*	*	122.0	*
Cervix	*	7.8	*	*	8.8	*
Colon and Rectum	43.0	39.4	41.2	48.6	42.0	45.3
Esophagus	8.5	2.2	5.3	10.8	2.3	6.5
Hodgkin Lymphoma	3.2	2.5	2.8	2.8	2.4	2.6
Kidney and Renal Pelvis	21.9	13.6	17.7	23.4	14.8	19.1
Larynx	5.9	1.7	3.8	7.6	2.2	4.9
Leukemia	14.9	10.3	12.6	15.2	10.7	12.9
Liver and Intrahepatic Bile Duct	11.0	4.8	7.8	9.3	4.1	6.7
Lung and Bronchus	72.2	65.6	68.8	82.9	63.1	72.8
Melanoma of Skin	28.4	21.9	25.0	28.4	23.3	25.7
Multiple Myeloma	7.5	5.6	6.5	6.7	4.8	5.8
Non-Hodgkin Lymphoma	22.2	17.3	19.7	22.1	17.0	19.5
Oral Cavity and Pharynx	17.4	7.2	12.3	18.7	7.1	12.9
Ovary	*	11.2	*	*	10.3	*
Pancreas	14.7	13.5	14.1	14.0	12.2	13.1
Prostate	106.1	*	*	93.2	*	*
Stomach	8.3	4.7	6.5	7.0	4.0	5.4
Testis	5.7	*	*	6.0	*	*
Thyroid	7.4	22.8	15.1	7.5	23.4	15.4
Uterus	*	32.9	*	*	34.6	*
Tobacco-associated Cancers <sup>1</sup>	231.2	170.1	200.1	254.6	170.8	212.0
HPV-associated Cancers <sup>2</sup>	11.6	15.9	13.8	12.7	18.1	15.4

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2021.

<sup>1</sup> Tobacco-associated cancers include acute myeloid leukemia and cancers of the lung and bronchus; larynx; esophagus; oral cavity and pharynx; bladder; liver and intrahepatic bile duct; cervix; stomach; kidney and renal pelvis; pancreas; and colon and rectum.

<sup>2</sup> HPV-associated cancers include all carcinomas of the cervix and squamous cell carcinomas of the vagina, vulva, anus, penis, and oropharynx (squamous cell carcinomas of the base of tongue and lingual tonsil, tonsil, and other oropharynx).

<sup>^</sup> Central Nervous System.

\* Not applicable.

## Cancer Mortality in Urban and Rural Census Tracts by Site/Type and Sex

Table 3 (on page 6) shows average annual, age-adjusted cancer mortality rates in urban and rural census tracts by site/type and sex. For all sites/types of cancer combined, the mortality rate was higher in rural census tracts among males and the total population, and the rate was slightly higher in urban census tracts among females. Mortality rates were at least 10% higher in urban or rural census tracts for the following cancer site/types:

### Urban

- **Total population:** liver and intrahepatic bile duct and stomach.
- **Males:** liver and intrahepatic bile duct and stomach.
- **Females:** liver and intrahepatic bile duct, multiple myeloma, and stomach.

### Rural

- **Total population:** colon and rectum, esophagus, kidney and renal pelvis, larynx, oral cavity and pharynx, and thyroid.
- **Males:** colon and rectum, esophagus, kidney and renal pelvis, larynx, lung and bronchus, oral cavity and pharynx, testis, and thyroid.
- **Females:** cervix, colon and rectum, esophagus, and larynx.

**Table 3. Average Annual Age-adjusted Mortality Rates per 100,000 People in Urban and Rural Census Tracts by Site/Type and Sex, Ohio, 2014-2018**

	Urban			Rural		
	Male	Female	Total	Male	Female	Total
<b>All Sites/Types</b>	<b>182.2</b>	<b>160.6</b>	<b>171.2</b>	<b>197.1</b>	<b>159.1</b>	<b>177.7</b>
Bladder	7.4	2.9	5.1	7.7	2.8	5.2
Brain and Other CNS <sup>^</sup>	5.2	4.0	4.6	5.6	3.7	4.6
Breast (Female)	*	23.8	*	*	21.9	*
Cervix	*	2.2	*	*	2.6	*
Colon and Rectum	15.3	13.7	14.5	18.5	16.0	17.2
Esophagus	7.7	1.8	4.7	9.6	2.0	5.8
Hodgkin Lymphoma	0.4	0.2	0.3	0.4	0.2	0.3
Kidney and Renal Pelvis	4.9	2.7	3.8	5.5	3.0	4.2
Larynx	1.8	0.6	1.2	2.0	0.7	1.3
Leukemia	7.7	5.4	6.5	8.4	5.7	7.0
Liver and Intrahepatic Bile Duct	8.5	4.4	6.4	7.0	3.7	5.4
Lung and Bronchus	51.3	41.7	46.4	59.2	40.4	49.6
Melanoma of the Skin	3.5	1.8	2.6	3.8	1.9	2.8
Multiple Myeloma	4.0	3.1	3.5	4.1	2.8	3.5
Non-Hodgkin Lymphoma	6.9	5.0	5.9	6.9	5.5	6.2
Oral Cavity and Pharynx	3.8	1.6	2.7	4.8	1.6	3.2
Ovary	*	7.4	*	*	7.0	*
Pancreas	12.5	11.8	12.2	12.4	11.2	11.8
Prostate	16.7	*	*	15.2	*	*
Stomach	3.3	2.1	2.7	2.4	1.6	2.0
Testis	0.2	*	*	0.4	*	*
Thyroid	0.4	0.5	0.4	0.5	0.5	0.5
Uterus	*	5.8	*	*	5.5	*

Source: Bureau of Vital Statistics, Ohio Department of Health, 2021.

<sup>^</sup> Central Nervous System.

\* Not applicable.

## Stage at Diagnosis in Urban and Rural Census Tracts

**Table 4. Percent of Incident Cancer Cases in Urban and Rural Census Tracts by Stage at Diagnosis for All Sites/Types Combined and Selected Screenable Cancers, Ohio, 2014-2018**

	Urban			Rural		
	Early	Late	Unstaged/ Missing	Early	Late	Unstaged/ Missing
<b>All Sites/Types</b>	<b>50%</b>	<b>41%</b>	<b>9%</b>	<b>48%</b>	<b>43%</b>	<b>10%</b>
Breast (Female)	65%	33%	2%	64%	33%	4%
Cervix	45%	51%	4%	44%	52%	4%
Colon and Rectum	33%	57%	11%	33%	58%	9%
Lung and Bronchus	23%	69%	8%	22%	68%	10%
Melanoma of Skin	70%	14%	16%	68%	17%	16%
Oral Cavity and Pharynx	30%	66%	4%	28%	67%	5%
Prostate	69%	21%	10%	67%	24%	10%
Testis	64%	32%	5%	67%	31%	2%

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2021.

Table 4 shows the percentage of incident cancer cases in urban and rural census tracts by stage at diagnosis for all sites/types combined and selected screenable cancers. Stage at diagnosis is an important determinant of survival, with early stage often leading to better prognoses. Early stage includes cancers diagnosed at the *in situ* and localized stages, and late stage includes cancers diagnosed at the regional and distant stages. Differences in the percentage of cancer cases diagnosed at early and late stage in urban and rural census tracts should be interpreted in light of the percentage classified as unstaged or with missing stage information.

### Key differences in stage at diagnosis in urban and rural census tracts include the following:

- For all sites/types of cancer combined, 41% of cancers in urban census tracts and 43% of cancers in rural census tracts were diagnosed late stage.
- For melanoma of the skin, 14% of cancers in urban census tracts and 17% of cancers in rural census tracts were diagnosed late stage.
- For prostate cancer, 21% of cancers in urban census tracts and 24% of cancers in rural census tracts were diagnosed late stage.

## Summary and Interpretation

Studies of cancer in urban and rural areas reveal many possible explanations for differences in cancer incidence and mortality rates, including differences in the prevalence of cancer risk factors and social determinants of health. There is a higher prevalence of some cancer-related behaviors, including tobacco use and obesity, in rural areas, potentially resulting in higher incidence rates of tobacco- and obesity-associated cancers. Ohio urban and rural areas also differ in racial composition, with higher percentages of Black residents in urban areas. As a result, incidence rates of cancer sites/types typically found to be higher among Black residents, specifically multiple myeloma and cancers of the liver and intrahepatic bile duct, prostate, and stomach, may be higher in urban areas. In addition, social determinants of health, which are the social, economic, and physical conditions in the environment in which people are born, live, learn, play, work, and age (including education, income, discrimination, quality of health care, and access to healthy foods), vary between urban and rural areas, and the differences in these factors may impact the risk of developing and dying from cancer.

The findings of this analysis of cancer in urban and rural census tracts in Ohio are, in large part, similar to those reported for the United States.

- In Ohio, for all sites/types of cancer combined, the incidence rate for the total population was higher in urban census tracts, while the mortality rate was higher in rural census tracts.
- For the total population, both incidence and mortality rates of liver and intrahepatic bile duct and stomach cancers were at least 10% higher in urban census tracts in Ohio. These differences may result because the proportion of Blacks is higher in urban census tracts in Ohio.
- For the total population, both incidence and mortality rates of two tobacco-associated cancers, esophagus and larynx, were at least 10% higher in rural Ohio census tracts. These differences may be the result of a higher prevalence of tobacco use in rural areas.
- In urban Ohio census tracts, each of the cancer sites/types with mortality rates that were at least 10% higher than those in rural census tracts were also at least 10% higher for incidence, suggesting that the higher mortality rates for these cancers in urban census tracts were largely due to higher incidence.
- In rural census tracts, however, some cancer sites/types with mortality rates that were at least 10% higher than those in urban census tracts were not at least 10% higher for incidence (e.g., colon and rectum and oral cavity and pharynx), suggesting that the higher mortality rates for these cancers in rural census tracts were due to factors other than incidence. These factors may include differences in cancer-related behaviors (e.g., cancer screening), social determinants of health, and treatment.
- Stage at diagnosis for all sites/types of cancer combined and for selected screenable cancers was largely similar between urban and rural census tracts in Ohio.

## Technical Notes

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

**Incidence:** The number of cases diagnosed during a specified time period (e.g., 2014 to 2018).

**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., 2014 to 2018).

**Prevalence:** The proportion of people with a certain disease, characteristic, or risk factor at a given time.

**Rate:** The number of cases or deaths per unit of population (e.g., per 100,000 persons) during a specified time period (e.g., 2014 to 2018). Rates may be unstable and are not presented when the case count is less than five.

**Stage at Diagnosis:** The extent or spread of the disease from the site of origin, often classified into the following stages.

***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.

For this report, stage at diagnosis is categorized as early (*in situ* or local), late (regional or distant), and unstaged/missing stage.

## Data Sources

**Cancer Incidence and Mortality:** Ohio cancer incidence data are from OCISS at ODH. Ohio cancer mortality data are from the Bureau of Vital Statistics at ODH and are based on the underlying cause of death. Incidence and mortality rates in this publication are age-adjusted to the 2000 U.S. standard population to allow for comparisons across populations that have different age distributions.

**Census Data:** Census tract population estimates are from the U.S. Census Bureau, available at: [Explore Census Data](#).

**Rural-Urban Commuting Area (RUCA) Codes:** 2010 RUCA codes are from the U.S. Department of Agriculture's Economic Research Service. Detailed documentation of the codes is available at: [USDA ERS - Documentation](#).

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