Colon & Rectum Cancer in Ohio, 2007-2011

Ohio Cancer Incidence Surveillance System

Colon and rectum cancer is the third most common invasive cancer in both men and women. Colon cancer forms in the tissues of the colon, the longest part of the large intestine; while rectal cancer forms in the tissues of the rectum, the last several inches of the large intestine.

Cancers of the colon and rectum made up the fourth greatest percentage of new invasive cancer cases (incidence) reported to the Ohio Cancer Incidence Surveillance System (OCISS), comprising 9.6 percent of newly diagnosed cancers in Ohio from 2007 through 2011. The average annual number of new cases of colon and rectum cancer in Ohio during this time period was 5,862, and the average annual age-adjusted incidence rate was 44.5 cases per 100,000 persons (Table 1). This incidence rate is similar to the U.S. rate of 43.7 per 100,000 persons during the same time period. Colon and rectum cancer incidence rates have been decreasing for most of the past two decades, which has largely been attributed to increases in use of colon and rectum cancer screening tests that allow for detection and removal of colon and rectum polyps before they progress to cancer.

Colon and rectum cancer is the second-leading cause of cancer death in Ohio, comprising 9.3 percent of total cancer deaths. The average annual age-adjusted mortality rate of 17.5 deaths per 100,000 persons from 2007–2011 in Ohio is 10 percent higher than the U.S. mortality rate (15.9 per 100,000 persons). As shown in Table 1, in both Ohio and the United States, colon and rectum cancer incidence and mortality rates were greater for males, blacks and those 65 years and older.

Key Findings & Populations at High Risk

- In Ohio, incidence and mortality rates were greater for males, blacks and people 65 years and older in 2007-2011.
- From 1996 to 2011, incidence and mortality rates declined for both white and black males and females in Ohio.
- Incidence rates in Ohio increased from 1996 to 2011 among people 25 to 44 years old.
- In 2007-2011, the majority of Ohio counties with high incidence and mortality rates were rural.
- High proportions of late (regional and distant) stage diagnoses were found in predominately rural counties and central Ohio.
- In Ohio, 18 percent of males and 17 percent of females were diagnosed distant stage.
- Nationally, the survival probability was 8 percent lower among blacks compared to whites in 2006-2010.
- Higher incidence rates were observed for cancers of the rectum and sigmoid colon compared to other anatomic sites.
- Ohio males, whites, those 50-54 years old and those who had less than a high school education were least likely to meet U.S. Preventive Services Task Force (USPSTF) colon and rectum cancer screening guidelines.

Table 1: Colon & Rectum Cancer: Average Annual Number and Age-adjusted Rates of Invasive Cancer Cases and Cancer Deaths by Sex, Race and Age Group in Ohio and the U.S., 2007-2011

		Incidence			Mortality		
		Ohio Cases[1]	Ohio Rate[1]	U.S. Rate[2]	Ohio Deaths[3]	Ohio Rate[3]	U.S. Rate[4]
Total		5,862	44.5	43.7	2,323	17.5	15.9
Sex	Males	2,974	51.8	50.6	1,188	21.3	19.1
	Females	2,888	38.9	38.2	1,134	14.5	13.5
Race	White	5,138	43.7	42.9	2048	17.1	15.5
	Black	594	47.6	43.6	261	22.1	22.1
	Asian/Pacific Islander	33	25.8	35.8	10	7.9	11.0
Age Group	<64	2,123	17.5	18.1	630	5.1	4.9
	65+	3,738	231.6	220.8	1693	103.1	92.1

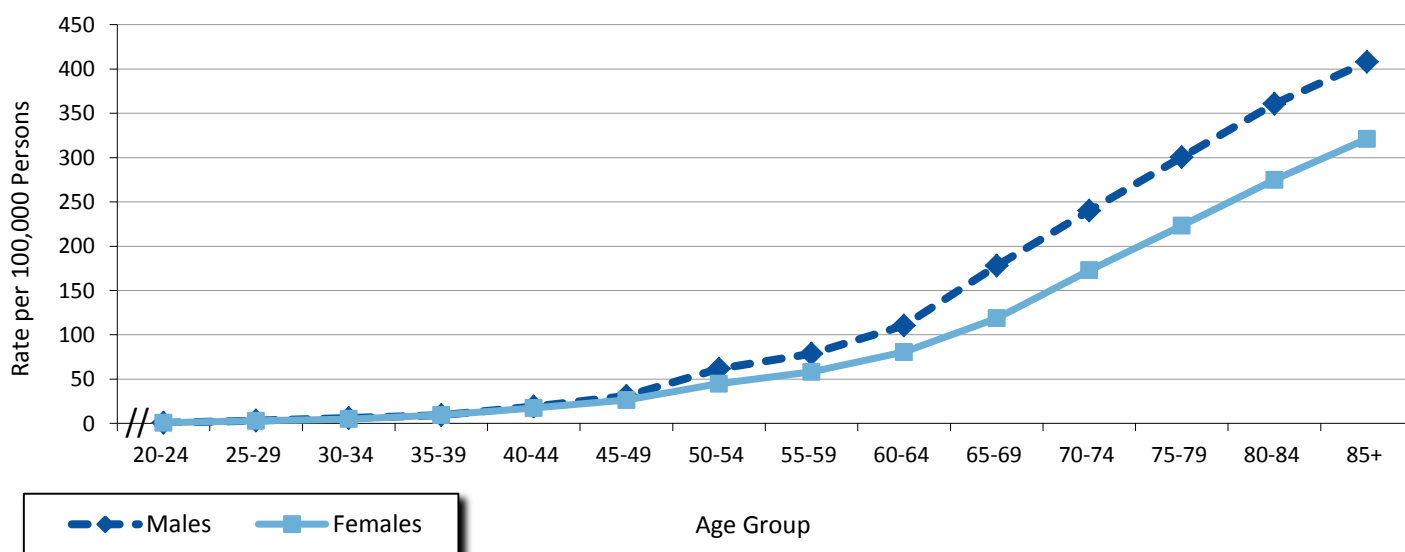# Colon & Rectum Cancer Incidence and Mortality by Race, Sex and Age

Figure 1: Colon & Rectum Cancer: Average Annual Age-adjusted Incidence and Mortality Rates per 100,000 Persons by Race and Sex in Ohio and the U.S., 2007-2011
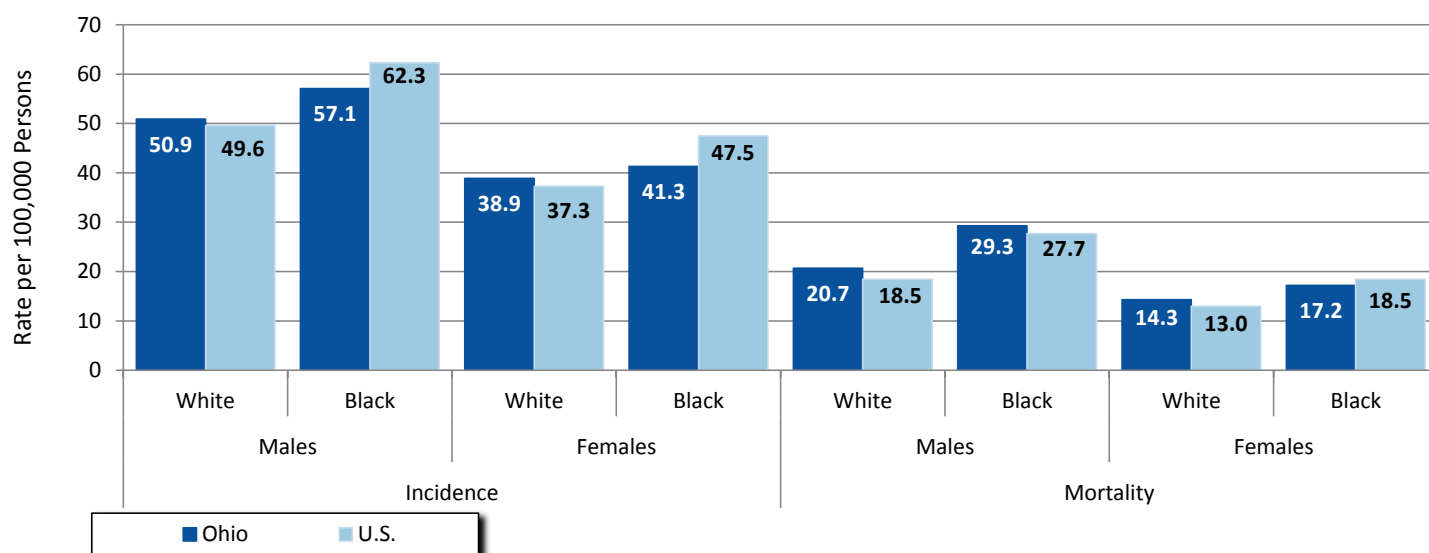
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014; The Office of Vital Statistics, Ohio Department of Health, 2014; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2014; National Center for Health Statistics, 2014.

As shown in Figure 1, black males had the highest colon and rectum cancer incidence and mortality rates in Ohio and the United States from 2007–2011; whereas, white females had the lowest incidence and mortality rates in both Ohio and the United States. Ohio incidence rates were higher than the rates for the United States for white males and females but were lower than U.S. rates for black males and females. Mortality rates for each sex-race-specific group were higher in Ohio compared to those in the United States, except for black females.

Figure 2: Colon & Rectum Cancer: Average Annual Age-specific Incidence Rates per 100,000 Persons, by Sex and Age Group in Ohio, 2007-2011
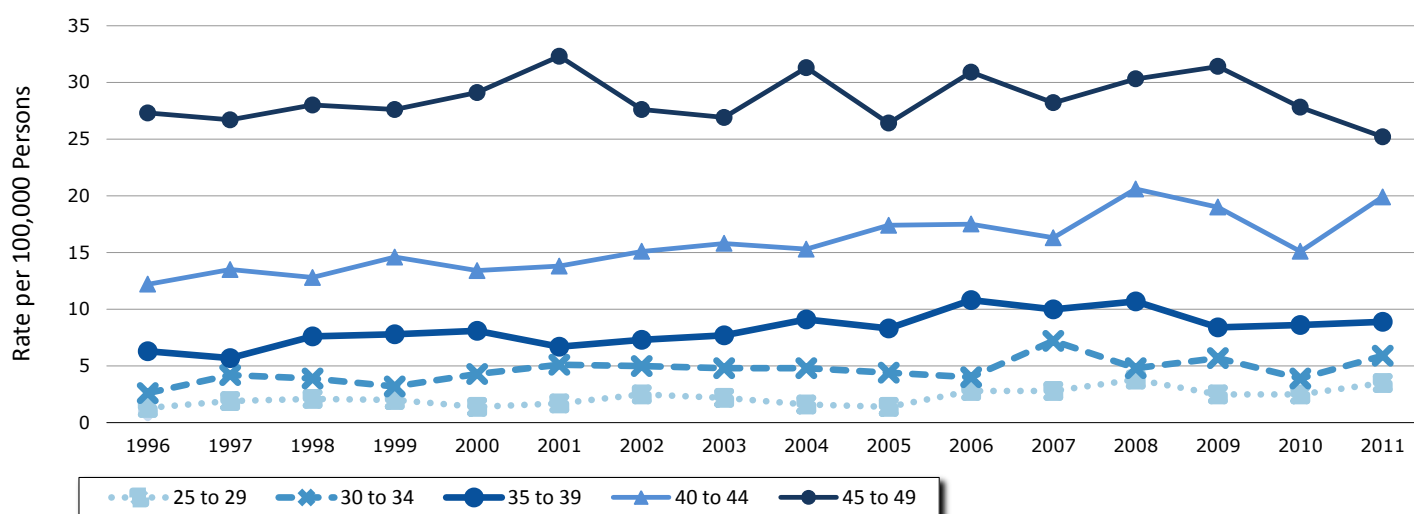

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014.

Colon & Rectum Cancer Incidence by Age

As shown in Figure 2 (page 2), for both males and females, colon and rectum cancer incidence rates increased with advancing age. Incidence rates were similar for males and females up to 45-49 years but increased more rapidly among males than females, starting at 50 years.

Approximately 90 percent of colon and rectum cancers are diagnosed among persons 50 years and older. However, in Ohio and the United States, there is an increasing trend in colon and rectum cancer incidence rates among younger age groups. As shown in Figure 3, incidence rates increased from 1996-2011 for all age groups from 25 to 44 years. The greatest increase (169 percent) during this time period was among persons 25-29 years.

Figure 3: Colon & Rectum Cancer: Age-adjusted Incidence Rates per 100,000 Persons, by Age Group (25-49 years) in Ohio, 2007-2011

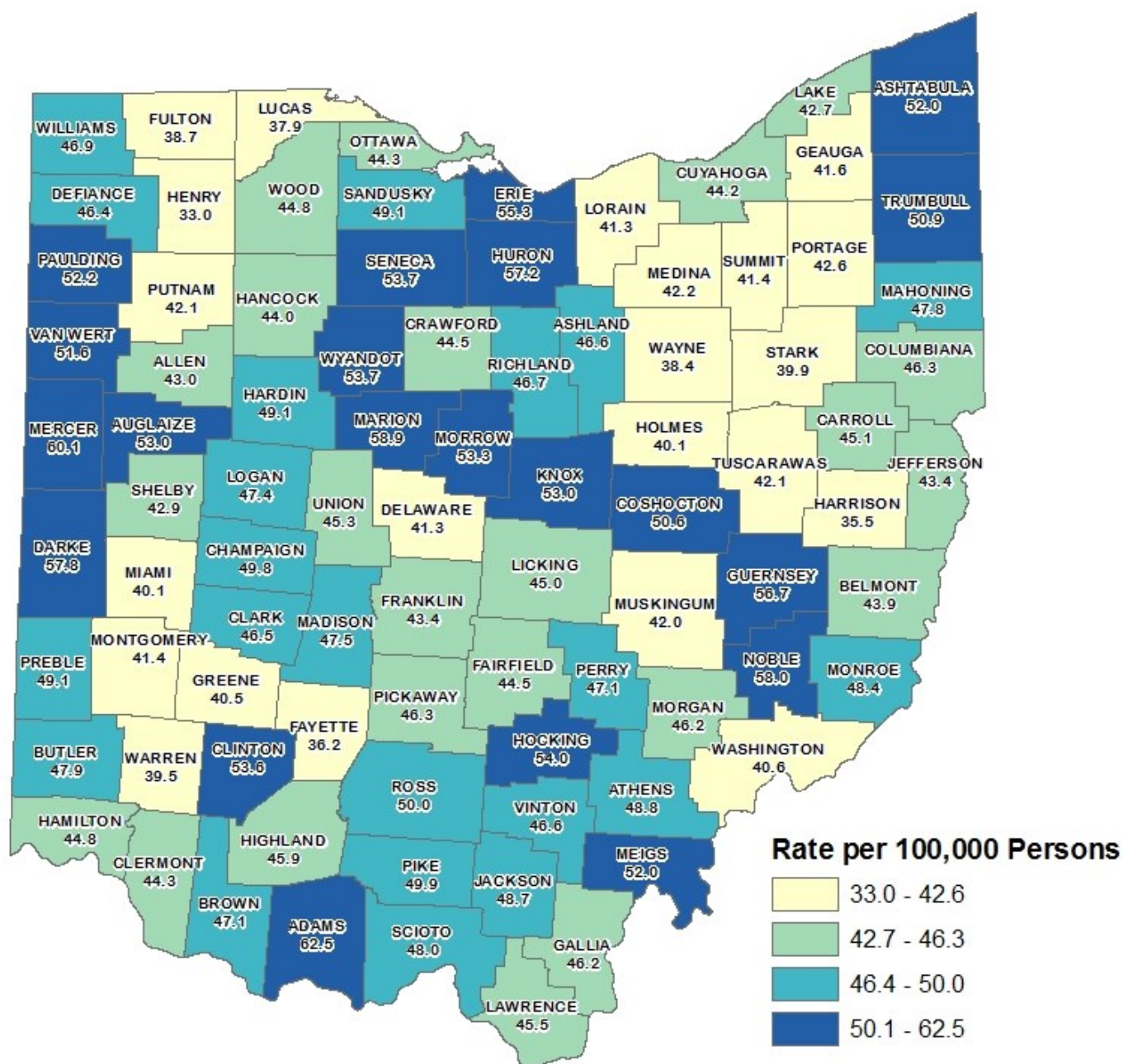Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014.

Did You Know?

Colon and rectum cancer incidence rates are increasing among persons less than 50 years and decreasing among persons 50 years and older. Young-onset colon and rectum cancer most often occurs in the distal colon or rectum and often presents at a more advanced stage.

Colon & Rectum Cancer Incidence and Mortality by County of Residence

Figure 4 (page 4) and Figure 5 (page 5) present 2007–2011 average annual age-adjusted colon and rectum cancer incidence and mortality rates, respectively, by county of residence. County-specific incidence rates in Ohio ranged from 33.0 to 62.5 per 100,000 persons (Figure 4). Mortality rates ranged from 11.6 to 30.9 per 100,000 persons (Figure 5). The majority of the counties with the highest incidence and mortality rates were rural. Noble, Guernsey, Marion and Hocking counties were among the top 10 highest counties for both incidence and mortality. Data used to generate these maps can be found in Tables 6 and 7, on pages 17 and 18 of this document, respectively.

Figure 4: Colon & Rectum Cancer: Average Annual Age-adjusted Incidence Rates per 100,000 Persons, by County of Residence in Ohio, 2007-2011

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014.

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

Figure 5: Colon & Rectum Cancer: Average Annual Age-adjusted Mortality Rates per 100,000 Persons, by County of Residence in Ohio, 2007-2011

Rate per 100,000 Persons

	11.6 - 16.4
	16.5 - 18.2
	18.3 - 20.7
	20.8 - 30.9
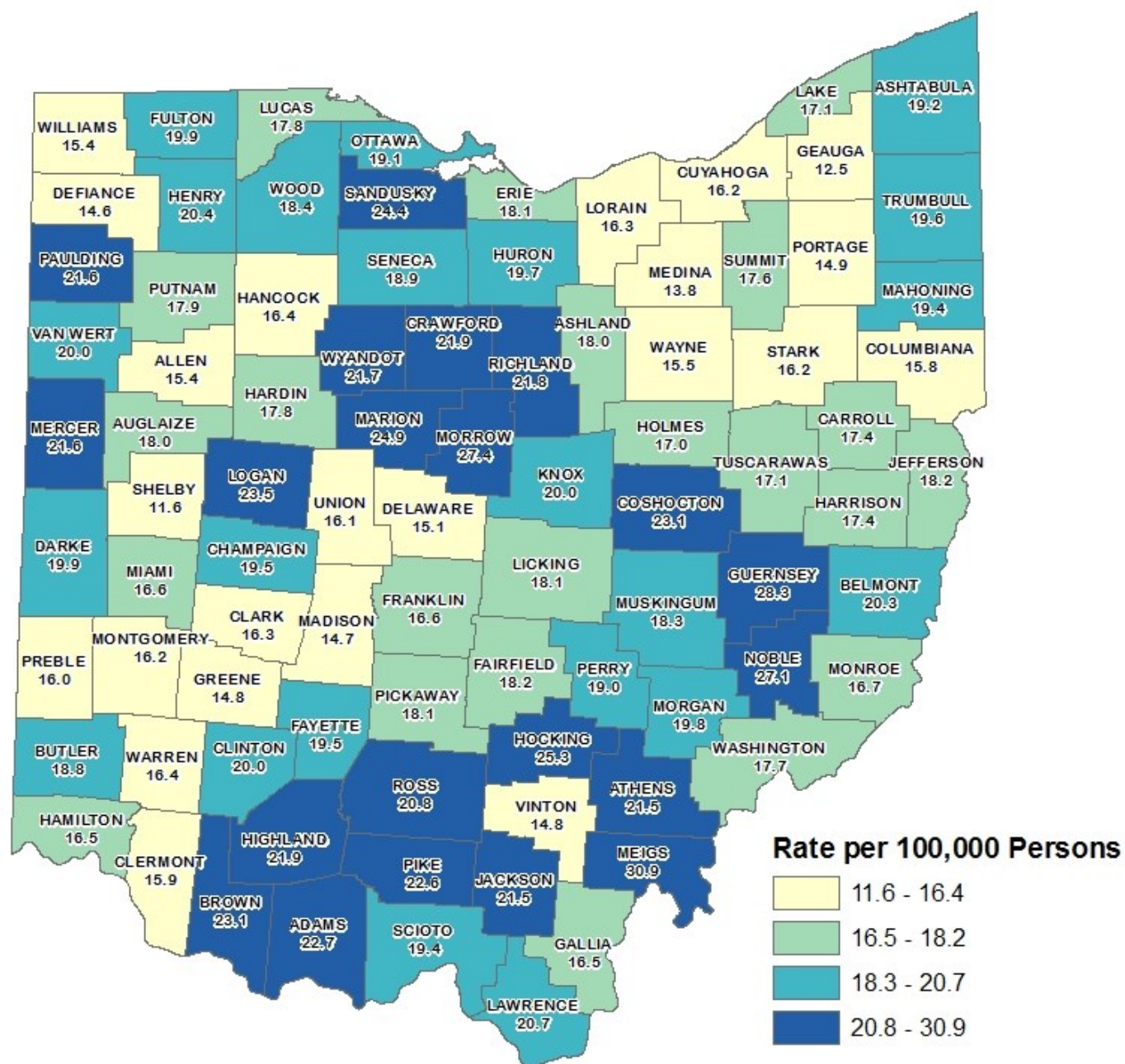
Source: The Office of Vital Statistics, Ohio Department of Health, 2014.

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

Colon & Rectum Cancer Incidence and Mortality Trends

Figure 6 shows incidence rates of colon and rectum cancer according to year of diagnosis (1996 through 2011) by sex-race group. For most years, black males had the highest incidence rate, while white females had the lowest incidence rate. For each sex-race group, incidence rates decreased from 1996 to 2011.

Figure 7 shows colon and rectum cancer mortality rates according to year of death (1996-2011) by sex-race group. For each year, black males had the highest mortality rate, while white females had the lowest mortality rate. Overall, there has been a decrease in colon and rectum cancer mortality rates among all sex-race groups from 1996 to 2011. The greatest decrease in mortality rates from 1996 to 2011 (45.3 percent) occurred among black females.
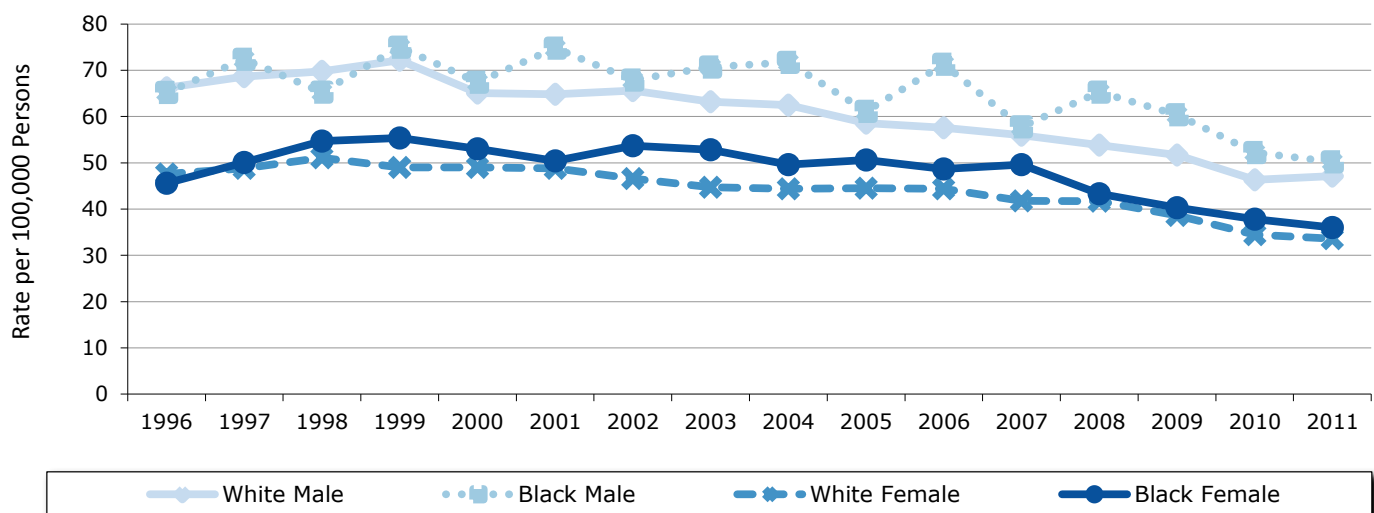
Figure 6: Colon & Rectum Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Persons, by Race and Sex in Ohio, 1996-2011

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014.

Figure 7: Colon & Rectum Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Persons, by Race and Sex in Ohio, 1996-2011
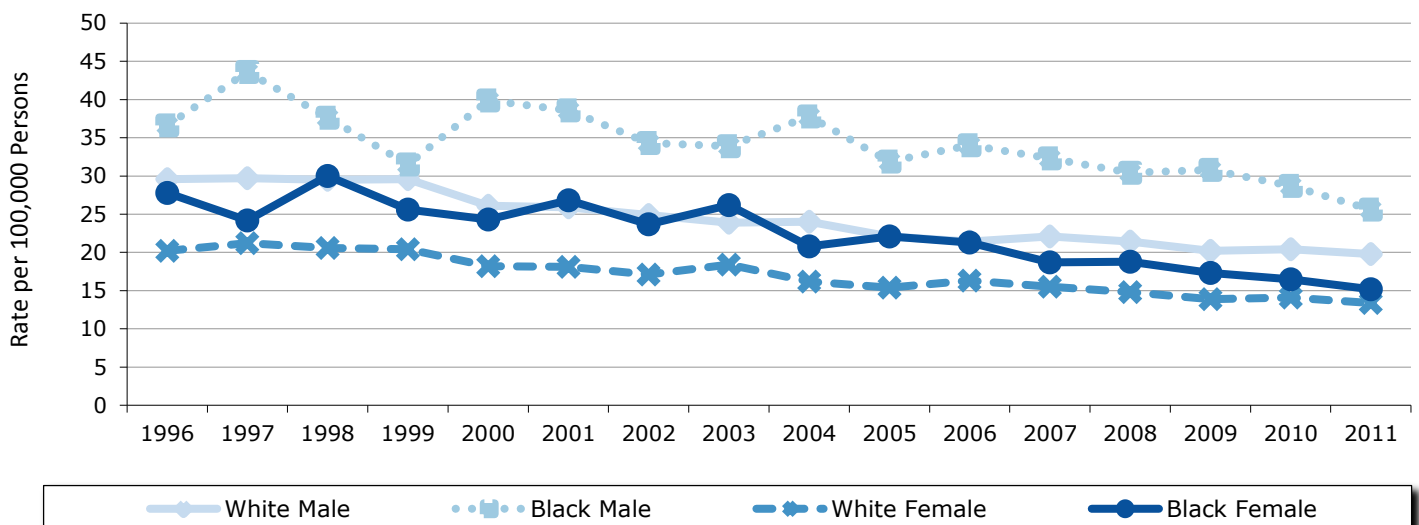
Source: The Office of Vital Statistics, Ohio Department of Health, 2014.

Colon & Rectum Cancer by Stage at Diagnosis

Figure 8 shows the proportion of colon and rectum cancers by stage at diagnosis and sex in Ohio and the United States from 2007-2011 (see page 15 for definitions of stage at diagnosis). In both Ohio and the United States, there were similar proportions of males and females diagnosed at each stage of colon and rectum cancer. There were slightly lower proportions of males and females diagnosed with localized, regional and distant stage colon and rectum cancer in Ohio compared to the United States. This may be due to higher proportions of unstaged/missing stage colon and rectum cancer cases among males and females in Ohio compared to the United States.

Figure 8: Colon & Rectum Cancer: Proportion of Cases (%) by Stage at Diagnosis and Sex in Ohio, and the U.S., 2007-2011
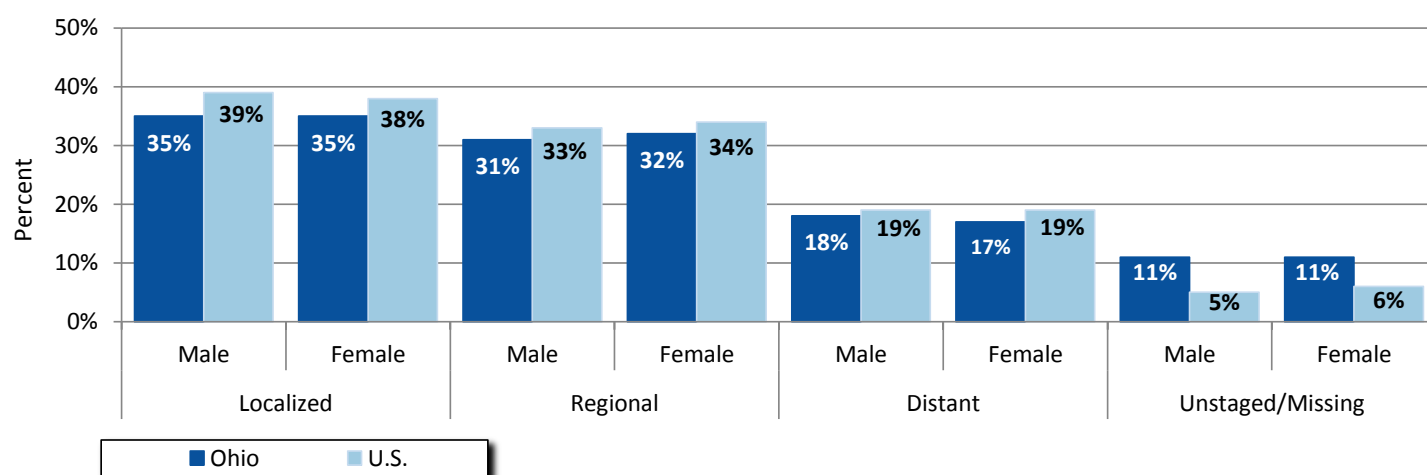
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2014.
Note: Percentages do not add to 100 percent because *in situ* cases are not shown.

Figure 9 shows the proportions of colon and rectum cancer cases diagnosed at each stage from 1996 to 2011. There has been a slight decrease in the proportions of colon and rectum cancers diagnosed *in situ* and regional stages, while there has been a slight increase in the proportion diagnosed localized and distant stages.

Figure 9: Colon & Rectum Cancer: Trends in Proportion of Cases (%) by Stage at Diagnosis in Ohio, 1996-2011
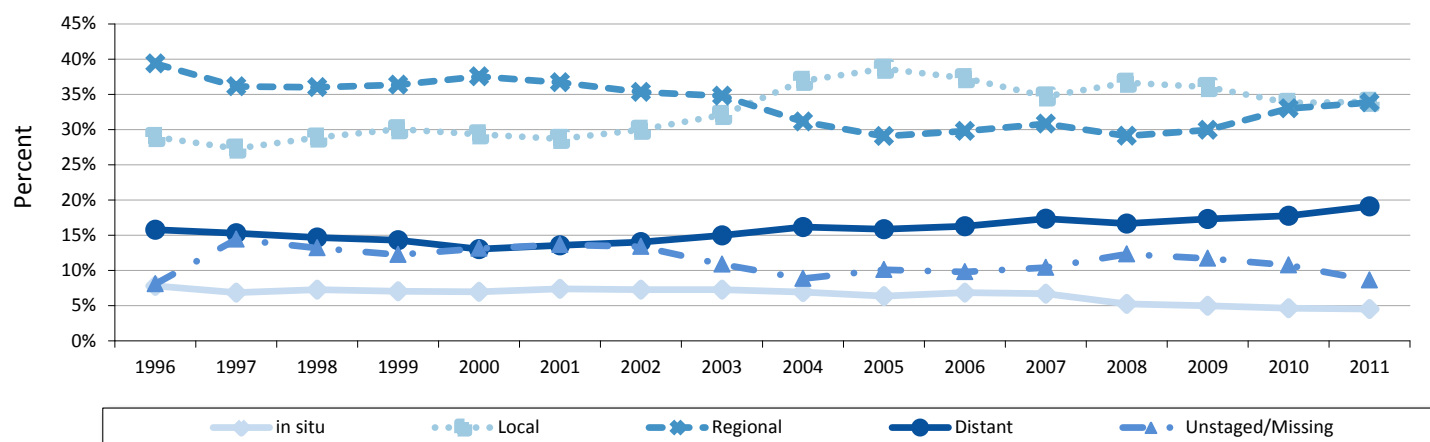
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014.

Figure 10: Colon & Rectum Cancer: Proportion of Cancer Cases Diagnosed Late (Regional & Distant) Stage in Ohio by County, 2007-2011
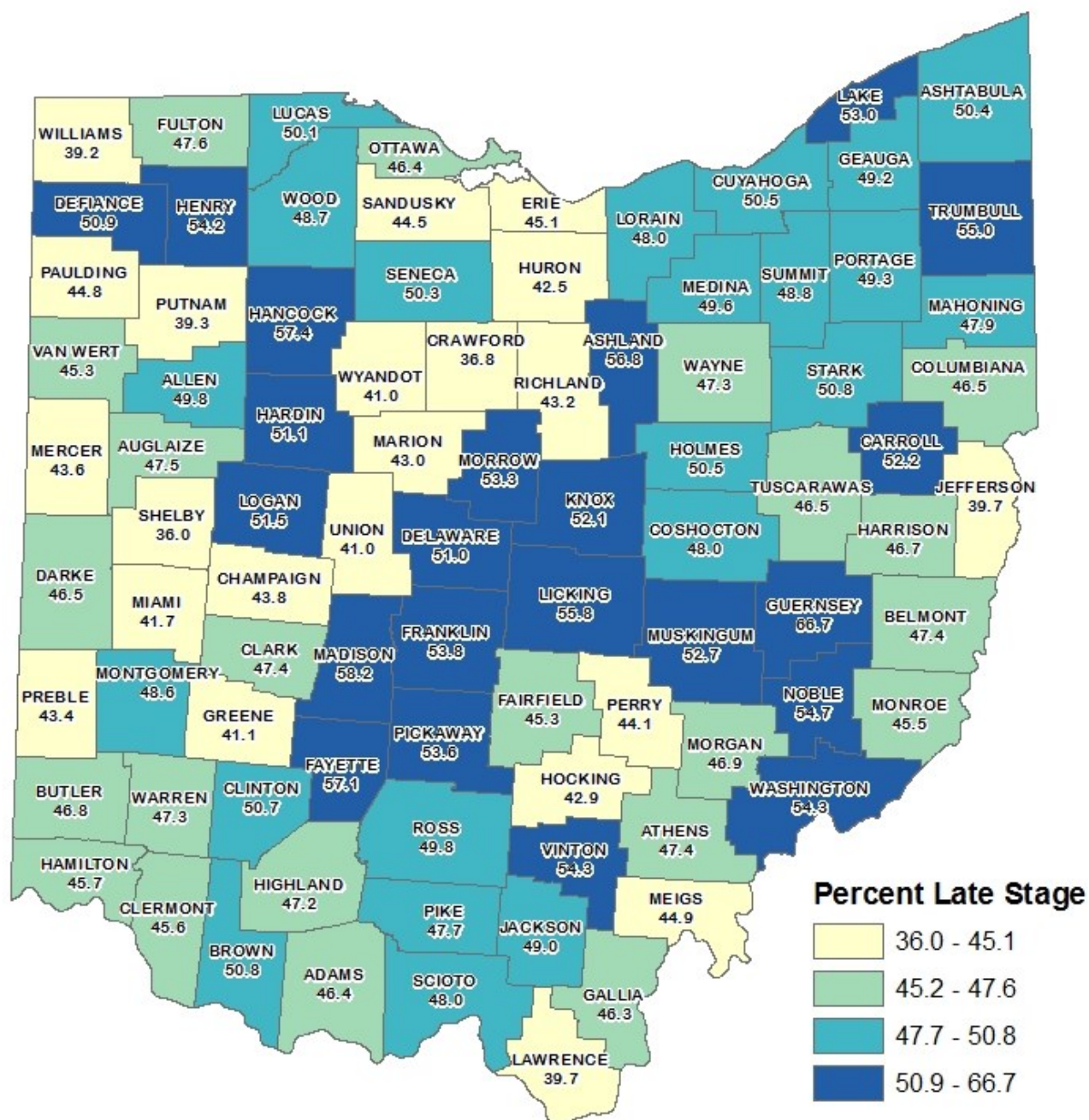
Source: The Office of Vital Statistics, Ohio Department of Health, 2014.

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

Figure 10 (page 8) presents the proportion of colon and rectum cancer cases diagnosed late (i.e., regional and distant) stage by county of residence from 2007–2011. County-specific proportions of late stage diagnoses in Ohio ranged from 36.0 to 66.7 percent. High proportions of late stage diagnoses were found in predominately rural counties and central Ohio. Data used to generate these maps, as well as additional data on percent early (i.e., *in situ* and localized) stage at diagnosis by county of residence, can be found in Table 8 on page 19.

Did You Know?

In addition to providing the best opportunity to detect colon and rectum cancer at an early stage, colonoscopy and flexible sigmoidoscopy prevent some colon and rectum cancers by detecting and removing polyps before they become cancer.

Colon & Rectum Cancer Survival Probability

Table 2: Colon & Rectum Cancer: Five-year Survival Probability (%) by Stage at Diagnosis, Sex and Race in the U.S., 2004-2010

Stage	Males	Females	White	Black
All Stages	65.0%	64.5%	65.4%	57.7%
Localized	89.9%	89.8%	90.0%	86.7%
Regional	70.4%	70.7%	71.1%	64.4%
Distant	12.4%	13.3%	13.4%	9.2%
Unstaged/ Missing	36.2%	30.7%	30.6%	36.9%

Source: Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2014.

Table 2 shows the U.S. five-year colon and rectum cancer survival probability from 2004-2010 by stage at diagnosis, sex and race. For all stages combined, males and females had similar five-year survival probabilities (65.0 percent and 64.5 percent, respectively); whereas, the survival probability among blacks (57.7 percent) was nearly 8 percent lower than the probability among whites (65.4 percent). Survival probability decreased with advancing stage for all sex and race groups.

Colon & Rectum Cancer Incidence by Anatomical Site

Figure 11: Colon & Rectum Cancer: Average Annual Number of Cases (N) and Age-adjusted Incidence Rates per 100,000 Persons, by Anatomical Site in Ohio, 2007-2011

Hepatic Flexure
N = 167
Rate = 1.3

Transverse Colon
N = 359
Rate = 2.8

Splenic Flexure
N = 107
Rate = 0.8

Ascending Colon
N = 810
Rate = 6.2

Descending Colon
N = 253
Rate = 1.9

Cecum
N = 954
Rate = 7.2

Appendix
N = 103
Rate = 0.8

Sigmoid Colon
N = 1,066
Rate = 8.1

Rectum
N = 1,195
Rate = 9.0

Rectosigmoid Junction
N = 373
Rate = 2.9
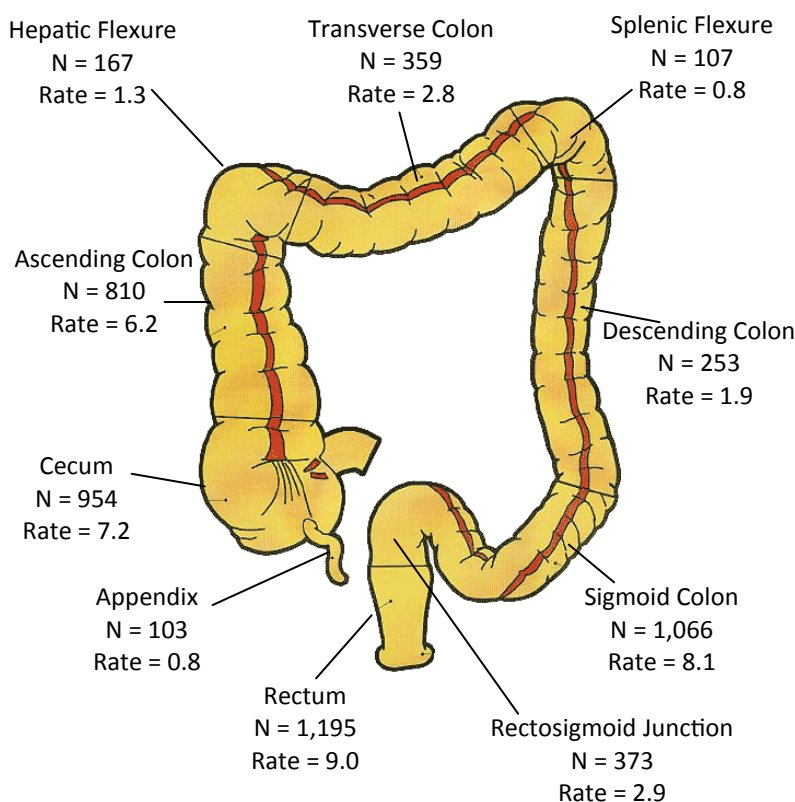
Photo adapted and used with permission from the Colon & Rectum Surgery Associates, Ltd, Minneapolis, MN, November 2006.

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014.
Note: Cancer of the large intestine, not otherwise specified is not included in the figure above (475 cases).

Figure 11 shows Ohio colon and rectum cancer incidence rates according to specific anatomic site. The highest incidence rates were observed for cancers of the rectum (9.0 per 100,000 persons) and sigmoid colon (8.1 per 100,000 persons). In Ohio, approximately 42 percent of invasive colon and rectum cancers occurred in the rectum and sigmoid colon. The next highest incidence rates were for cancers of the cecum (7.2 per 100,000 person) and ascending colon (6.2 per 100,000 persons), followed by the rectosigmoid junction (2.9 per 100,000 persons) and transverse colon (2.8 per 100,000 persons). The remaining specific anatomic sites (descending colon, splenic flexure, hepatic flexure and appendix) had incidence rates of 1.9 or fewer per 100,000 persons. Incidence rates of colon and rectum cancer according to specific anatomic site in Ohio are similar to those observed for the United States. (Please note that cancer of the large intestine, not otherwise specified is not included in Figure 11; thus, counts by anatomic site do not add up to the total count for colon and rectum cancer).

Colon & Rectum 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 colon and rectum cancer:

- **Age:** The risk of colon and rectum cancer increases after 50 years of age. Most cases of colon and rectum cancer are diagnosed among people 50 years and older.

- **Family history of colon and rectum cancer:** Having a parent, brother, sister or child with colon and rectum cancer doubles a person's risk.

- **Personal history:** Having a personal history of inflammatory bowel disease increases risk.

- **Inherited risk:** The risk of colon and rectum cancer is increased when certain gene changes linked to familial adenomatous polyposis (FAP) or hereditary nonpolyposis colon cancer (HNPCC or Lynch Syndrome) are inherited.

- **Alcohol:** Drinking three or more alcoholic beverages per day increases risk. Drinking alcohol is also linked to the risk of forming large colon and rectum adenomas (benign tumors).

- **Cigarette smoking:** Cigarette smoking is linked to an increased risk of colon and rectum cancer and death from colon and rectum cancer. Smoking cigarettes is also linked to an increased risk of forming colon and rectum adenomas. Cigarette smokers who have had surgery to remove colon and rectum adenomas are at an increased risk for the adenomas to recur (come back).

- **Obesity:** Obesity is linked to an increased risk of colon and rectum cancer and death from colon and rectum cancer.

Colon & Rectum Cancer Protective Factors

The NCI has identified the following protective factors that decrease the risk of colon and rectum cancer:

- **Physical activity:** A lifestyle that includes regular physical activity is linked to a decreased risk.

- **Aspirin:** Taking aspirin every day for at least five years decreases the risk of colon and rectum cancer and the risk of death from colon and rectum cancer.

- **Combination hormone replacement therapy:** Studies have shown that combination hormone replacement therapy (HRT) that includes both estrogen and progestin lowers the risk of invasive colon and rectum cancer in postmenopausal women. However, combination HRT does not lower the risk of dying from colon and rectum cancer.

- **Polyp removal:** Most colon and rectum polyps are adenomas, which may develop into cancer. Removing colon and rectum polyps that are larger than one centimeter may lower the risk of colon and rectum cancer. It is not known if removing smaller polyps lowers the risk of colon and rectum cancer.

Colon & Rectum Cancer Signs and Symptoms

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

*   Change in bowel habits such as diarrhea, constipation or narrowing of the stool that lasts for more than a few days
*   Rectal bleeding or blood in the stool
*   Feeling that your bowel does not empty completely
*   Cramping or steady abdominal (stomach area) pain
*   Weakness and excessive fatigue
*   Decreased appetite and weight loss
*   Having nausea or vomiting

Any of these symptoms may be caused by cancer or by other, less serious health problems.

Colon & Rectum Cancer Screening

The following are approved screening tests for colon and rectum cancer:

*   **Colonoscopy:** A colonoscope, a slender, flexible, hollow, lighted tube about the thickness of a finger, is inserted through the rectum and into the colon to visually examine the inside of the entire colon. If a polyp is found, the physician may remove it by laser or by passing a wire loop through the colonoscope to cut the polyp from the wall of the colon using an electric current.
*   **Flexible Sigmoidoscopy:** A sigmoidoscope, an instrument similar to a colonoscope but shorter, is inserted through the rectum and into the colon to view the inside of the rectum and the lower portion of the colon. If a polyp is present, the patient is referred for a colonoscopy so that the colon can be examined further.
*   **Fecal Occult Blood Test (FOBT):** A FOBT is a stool sample analysis used to detect very small quantities of blood in feces that may be indicative of the presence of colon and rectum polyps or cancers. Positive tests should be followed up by a colonoscopy.
*   **Double-contrast Barium Enema:** This procedure allows complete radiological examination of the colon by X-ray. Barium sulfate is propelled into the colon through the rectum and is allowed to spread throughout the colon to partially fill and open it. The colon is then filled with air so that it can expand and increase the quality of X-rays that are taken. If a polyp or other abnormality is seen, the patient is referred for a colonoscopy so that the colon can be examined further.
*   **CT Colonography (Virtual Colonoscopy):** A computed tomography (CT) scan of the colon and rectum is an X-ray test that produces detailed cross-sectional images to allow a health care provider to look for polyps or cancer. If polyps or other suspicious areas are detected, this test should be followed up by a colonoscopy.
*   **Fecal Immunochemical Test**: This test, also called an immunochemical fecal occult blood test (iFOBT), is used to detect hidden blood in the stool. This test reacts to part of the hemoglobin molecule, which is found on red blood cells. If results are positive, a colonoscopy is required to investigate further.
*   **Cologuard:** This test, approved for use by the Food and Drug Administration in August 2014, is a physician-prescribed stool DNA test for colon and rectum cancer that patients can use at home. Cologuard is intended for the qualitative detection of colon and rectum tumor-associated DNA markers and for the presence of occult hemoglobin in human stool. If results are positive, a colonoscopy is required to investigate further.

Table 3 presents the colon and rectum cancer screening recommendations from the American Cancer Society (ACS) and USPSTF for persons at average risk. Both organizations recommend cancer screening beginning at 50 years; however, the USPSTF does not recommend screening past 75 years.

Table 3: American Cancer Society (ACS) and U.S. Preventive Services Task Force (USPSTF) Recommendations for the Early Detection of Colon and Rectum Cancer in Average Risk, Asymptomatic People

ACS		USPSTF	
Age	**Test or Procedure**	**Age**	**Test or Procedure**
50+	**Tests that Find Polyps and Cancer[1]** Flexible sigmoidoscopy every 5 years[2], or Colonoscopy every 10 years, or Double-contrast barium enema every 5 years[2], or CT colonography (virtual colonscopy) every 5 years[2] **Tests that Primarily Find Cancer** Fecal occult blood test (FOBT) every year[2,3], or Fecal immunochemical test (FIT) every year[2,3]	50-75[4]	Screening colonoscopy every 10 years, or Sigmoidoscopy every 5 years, with high-sensitivity FOBT every 3 years, or Screening with high-sensitivity FOBT every year

Source: Table created by the Ohio Department of Health and The Ohio State University, 2014.
1. The tests that are designed to find both early cancer and polyps are preferred if these tests are available and a person is willing to have one of these more invasive tests.
2. All positive tests should be followed up with a colonoscopy.
3. For FOBT or FIT to be a screening test, the take-home, multiple-sample method should be used.
4. Colon and rectum cancer screening is not recommended for adults 76 to 85 years old, although there may be considerations that support screening in an individual patient. Screening is not recommended for adults >85 years old. These recommendations don't apply to individuals with specific inherited syndromes (Lynch Syndrome or Familial Adenomatous Polyposis) or those with inflammatory bowel disease.

This summary of recommendations is based on information available at: ACS website (http://www.cancer.org/healthy/findcancerearly/cancerscreeningguidelines/american-cancersociety-guidelines-for-the-early-detection-of-cancer) and USPSTF website (http://www.uspreventiveservicestaskforce.org) as of November 7, 2014.

Did You Know?

"80 x 18" is a National Colon and Rectum Cancer Roundtable initiative in which dozens of organizations have partnered with the ACS and the Centers for Disease Control and Prevention to eliminate colon and rectum cancer as a major public health problem. Together, these organizations are working toward the shared goal of 80 percent of adults 50 years and older being regularly screened for colon and rectum cancer by 2018.

Table 4: Prevalence of Colon & Rectum Cancer Screening among Adults 50-75 Years, by Screening Test, Ohio, 2012

	Prevalence	95% Confidence Interval
Fecal occult blood test (FOBT) in last year	9.2%	8.2% - 10.0%
Last test[1] was flexible sigmoidoscopy within 5 years	3.5%	2.6% - 4.6%
Last test[1] was colonoscopy within 10 years	59.5%	57.8% - 61.2%
FOBT in last year **and/or** Flexible sigmoidoscopy within 5 years plus FOBT within last 3 years **and/or** Colonoscopy within last 10 years[2]	63.5%	61.8% - 65.1%

Source: 2012 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2014.
1. Last test among people who have ever had a flexible sigmoidoscopy or colonoscopy.
2. Current screening guidelines by the USPSTF.

The prevalence of colon and rectum cancer screening among adults 50-75 years is presented by screening test in Table 4. In 2012, nearly one in 10 Ohio adults (9.2 percent) in this age group reported having had an FOBT in the last year. Among adults 50-75 years who ever had a flexible sigmoidoscopy or colonoscopy, three in five (59.5 percent) reported that their last screening test was a colonoscopy within the last 10 years. Table 4 also shows that 63.5 percent of Ohioans 50-75 years met the USPSTF guidelines for colon and rectum cancer screening. The prevalence of meeting these USPSTF guidelines is categorized by demographics in Table 5. Males, whites, those 50-54 years and those who have less than a high school education were least likely to meet USPSTF guidelines.

Table 5: Prevalence of Adults Age 50-75 Meeting U.S. Preventive Services Task Force (USPSTF) Screening Guidelines, by Sex, Race/Ethnicity, Age Group and Education, Ohio, 2012[1]

		Prevalence	95% Confidence Interval
Overall		63.5%	61.8 % - 65.1%
Sex	Male	61.2%	58.5% - 63.8%
	Female	65.5%	63.5% - 67.6%
Race/Ethnicity	White, Non-Hispanic	63.4%	61.7% - 65.2%
	Black, Non-Hispanic	64.6%	58.2% - 71.0%
Age Group	50 - 54	47.0%	43.3% - 50.7%
	55 - 59	61.7%	58.3% - 65.2%
	60 - 64	70.6%	67.4% - 73.8%
	65+	75.2%	72.8% - 77.6%
Education	Less than high school	55.0%	48.6% - 61.5%
	High school	61.4%	58.8% - 64.0%
	Some college	64.3%	61.1% - 67.4%
	College graduate	70.2%	67.3% - 73.1%

Source: 2012 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2014.
1. USPSTF screening guidelines are fecal occult blood test (FOBT) within past year and/or flexible sigmoidoscopy within last five years plus FOBT within last three years and/or colonoscopy within last 10 years.

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 U.S. 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., 2007-2011). 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 1996-2011 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 2012 bridged-race postcensal population estimates for April 1, 2010-July 1, 2011 (U.S. Census Bureau and National Center for Health Statistics, 2013).

Incidence: The number of cases diagnosed during a specified time period (e.g., 2007-2011). Colon and rectum cancer cases were defined as follows: International Classification of Diseases for Oncology, Third Edition (ICD-O-3), C180-C189, C199, C209 and C260, excluding 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., 2007-2011). Colon and rectum cancer deaths were defined as follows: International Statistical Classification of Diseases and Related Health Problems, Tenth Edition (ICD-10), codes C180-C209, C260.

Rate: The number of cases or deaths per unit of population (e.g., per 100,000 persons) during a specified time period (e.g., 2007-2011). 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 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 localized, regional, distant and unstaged/missing stage 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 SEER 18 areas for diagnosis years 2004-2010. Probabilities are based on follow-up of patients into 2011.

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. Information concerning clinical trials for colon and rectum cancer is available on the following websites:

- **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/colon-and-rectal
  http://www.cancer.gov/cancertopics/pdq/prevention/colorectal/Patient/page3

- **American Cancer Society:**
  http://www.cancer.org/cancer/colonandrectumcancer/index

Table 6: Colon and Rectum Cancer: Average Annual Number of Invasive Cancer Cases and Age-adjusted Incidence Rates per 100,000 Persons, by County of Residence and Sex, Ohio, 2007-2011

	Male		Female		Total			Male		Female		Total	
	Cases	Rate	Cases	Rate	Cases	Rate		Cases	Rate	Cases	Rate	Cases	Rate
Ohio	**2,974**	**51.8**	**2,888**	**38.9**	**5,862**	**44.5**	Lawrence	17	49.0	17	41.1	34	45.5
U.S.		**50.6**		**38.2**		**43.7**	Licking	41	52.0	39	39.7	80	45.0
Adams	12	69.0	10	55.6	22	62.5	Logan	14	56.3	12	40.7	25	47.4
Allen	25	46.9	28	40.0	53	43.0	Lorain	75	48.7	69	36.1	144	41.3
Ashland	14	48.3	16	44.4	30	46.6	Lucas	92	44.9	92	32.8	183	37.9
Ashtabula	35	61.6	31	43.0	66	52.0	Madison	11	53.8	10	44.1	21	47.5
Athens	12	51.9	14	45.9	26	48.8	Mahoning	80	56.8	81	41.1	161	47.8
Auglaize	14	56.0	16	48.4	30	53.0	Marion	25	73.8	21	48.4	46	58.9
Belmont	23	53.6	20	36.1	42	43.9	Medina	36	42.8	43	41.8	79	42.2
Brown	13	54.6	11	41.4	24	47.1	Meigs	8	65.2	7	43.5	15	52.0
Butler	87	53.7	86	43.2	173	47.9	Mercer	19	82.5	12	44.2	30	60.1
Carroll	8	45.3	9	44.9	17	45.1	Miami	27	49.2	22	32.8	49	40.1
Champaign	12	58.1	11	43.1	23	49.8	Monroe	4	42.2	6	54.2	10	48.4
Clark	39	51.2	41	42.8	80	46.5	Montgomery	129	47.2	140	37.2	269	41.4
Clermont	48	52.7	41	37.6	89	44.3	Morgan	4	36.9	6	52.4	9	46.2
Clinton	13	61.5	12	45.5	25	53.6	Morrow	11	58.9	10	47.0	21	53.3
Columbiana	32	50.2	34	43.6	66	46.3	Muskingum	21	48.2	22	37.2	43	42.0
Coshocton	14	68.9	10	35.7	23	50.6	Noble	6	39.0	7	81.6	13	58.0
Crawford	12	47.9	14	42.7	26	44.5	Ottawa	14	50.0	13	40.1	27	44.3
Cuyahoga	351	52.6	358	38.2	709	44.2	Paulding	7	62.0	5	42.9	12	52.2
Darke	18	59.1	21	57.9	38	57.8	Perry	12	68.2	6	30.2	18	47.1
Defiance	11	52.8	10	40.7	21	46.4	Pickaway	13	43.8	15	47.1	27	46.3
Delaware	33	50.0	28	34.3	61	41.3	Pike	10	65.6	7	37.5	17	49.9
Erie	27	56.8	30	53.6	58	55.3	Portage	37	47.0	34	38.6	71	42.6
Fairfield	32	47.1	34	41.3	66	44.5	Preble	14	60.7	11	39.4	25	49.1
Fayette	7	45.2	5	28.7	12	36.2	Putnam	7	42.4	9	40.4	17	42.1
Franklin	221	50.6	223	38.1	443	43.4	Richland	38	54.2	36	40.8	74	46.7
Fulton	10	47.8	9	31.9	19	38.7	Ross	26	64.7	17	37.5	43	50.0
Gallia	9	53.0	9	40.5	18	46.2	Sandusky	20	58.4	18	41.3	37	49.1
Geauga	26	51.3	21	32.8	47	41.6	Scioto	26	63.5	19	36.0	46	48.0
Greene	32	40.8	39	39.0	71	40.5	Seneca	19	63.5	17	44.9	36	53.7
Guernsey	13	62.7	14	53.4	28	56.7	Shelby	14	57.4	9	30.1	23	42.9
Hamilton	194	51.9	205	39.5	399	44.8	Stark	99	47.4	92	34.2	190	39.9
Hancock	18	48.3	19	39.4	37	44.0	Summit	139	49.9	130	35.2	269	41.4
Hardin	10	65.2	7	36.7	17	49.1	Trumbull	70	57.1	74	46.5	145	50.9
Harrison	5	43.3	3	27.3	8	35.5	Tuscarawas	26	49.6	25	37.0	51	42.1
Henry	5	33.7	6	33.1	11	33.0	Union	9	44.4	11	45.9	20	45.3
Highland	12	51.7	12	41.9	24	45.9	Van Wert	10	58.8	10	45.4	20	51.6
Hocking	11	73.8	7	38.2	18	54.0	Vinton	3	49.4	4	45.0	7	46.6
Holmes	9	47.9	7	33.5	16	40.1	Warren	41	45.3	37	34.1	77	39.5
Huron	21	72.3	16	45.2	37	57.2	Washington	18	48.2	15	34.6	33	40.6
Jackson	9	57.2	10	44.5	19	48.7	Wayne	25	43.4	25	34.2	50	38.4
Jefferson	19	46.3	23	40.5	42	43.4	Wayne	25	43.4	25	34.2	50	38.4
Jefferson	19	46.3	23	40.5	42	43.4	Williams	10	45.8	13	46.4	22	46.9
Knox	21	66.1	16	42.4	37	53.0	Wood	34	58.9	23	33.1	57	44.8
Lake	67	53.4	58	34.7	125	42.7	Wyandot	9	71.2	6	38.0	15	53.7

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2014.
Note: Low county numbers and rates may reflect underreporting for that county.

Table 7: Colon and Rectum Cancer: Average Annual Number of Cancer Deaths and Age-adjusted Mortality Rates per 100,000 Persons, by County of Residence and Sex, Ohio, 2007-2011

	Male		Female		Total	
	Cases	Rate	Cases	Rate	Cases	Rate
Ohio	**1,188**	**21.3**	**1,134**	**14.5**	**2,323**	**17.5**
U.S.		**19.1**		**13.5**		**15.9**
Adams	4	27.6	3	17.7	8	22.7
Allen	10	18.5	9	13.5	19	15.4
Ashland	6	19.3	7	17.2	12	18.0
Ashtabula	12	22.2	13	16.9	24	19.2
Athens	6	24.9	5	18.2	11	21.5
Auglaize	5	21.2	6	15.3	11	18.0
Belmont	10	24.0	10	17.0	20	20.3
Brown	7	31.3	4	16.3	11	23.1
Butler	35	23.2	31	15.4	66	18.8
Carroll	4	23.2	3	12.1	7	17.4
Champaign	4	21.2	5	17.9	9	19.5
Clark	14	18.4	15	14.3	29	16.3
Clermont	18	20.8	13	12.0	31	15.9
Clinton	5	25.2	4	15.3	9	20.0
Columbiana	11	17.9	11	14.2	22	15.8
Coshocton	5	26.2	5	20.9	10	23.1
Crawford	5	20.4	9	24.1	13	21.9
Cuyahoga	129	19.7	134	13.7	264	16.2
Darke	5	17.1	9	21.7	14	19.9
Defiance	4	18.2	3	11.6	7	14.6
Delaware	11	17.6	10	12.8	21	15.1
Erie	9	19.4	11	17.4	20	18.1
Fairfield	14	21.9	12	15.1	26	18.2
Fayette	4	22.7	3	15.7	7	19.5
Franklin	83	20.1	84	14.0	167	16.6
Fulton	5	22.1	5	17.0	10	19.9
Gallia	3	20.7	3	14.7	6	16.5
Geauga	9	16.8	7	8.9	16	12.5
Greene	13	17.5	13	12.3	26	14.8
Guernsey	7	33.9	7	24.2	14	28.3
Hamilton	82	21.7	74	12.8	156	16.5
Hancock	7	19.4	7	14.5	14	16.4
Hardin	3	20.1	3	15.1	6	17.8
Harrison	2	23.2	2	12.4	4	17.4
Henry	4	25.3	3	16.1	7	20.4
Highland	6	28.9	5	16.4	10	21.9
Hocking	5	35.5	3	16.2	8	25.3
Holmes	4	21.0	3	14.1	7	17.0
Huron	7	23.3	6	16.6	13	19.7
Jackson	5	34.5	3	15.0	8	21.5
Jefferson	9	22.4	9	15.4	19	18.2
Knox	6	20.7	8	19.6	14	20.0
Lake	27	21.2	24	14.0	51	17.1

	Male		Female		Total	
	Cases	Rate	Cases	Rate	Cases	Rate
Lawrence	7	19.5	8	20.1	15	20.7
Licking	18	24.7	13	13.5	31	18.1
Logan	7	31.2	5	17.0	13	23.5
Lorain	29	19.9	28	14.0	57	16.3
Lucas	44	21.4	46	14.9	90	17.8
Madison	4	19.9	3	11.6	7	14.7
Mahoning	36	25.3	32	15.4	68	19.4
Marion	11	33.8	8	18.3	19	24.9
Medina	13	16.7	11	11.2	24	13.8
Meigs	5	38.3	4	25.1	8	30.9
Mercer	5	25.0	5	19.2	11	21.6
Miami	11	21.1	9	13.2	21	16.6
Monroe	2	20.6	2	14.6	4	16.7
Montgomery	52	19.0	56	14.0	108	16.2
Morgan	2	16.5	2	21.9	4	19.8
Morrow	5	31.1	5	23.8	10	27.4
Muskingum	10	22.9	9	14.6	19	18.3
Noble	2	28.8	2	26.3	5	27.1
Ottawa	6	22.1	5	17.4	11	19.1
Paulding	3	22.8	2	18.8	5	21.6
Perry	5	30.9	2	10.1	7	19.0
Pickaway	6	21.7	5	14.8	11	18.1
Pike	5	31.9	3	14.5	7	22.6
Portage	14	20.6	10	10.9	24	14.9
Preble	4	18.0	4	13.9	8	16.0
Putnam	4	20.8	4	14.8	7	17.9
Richland	17	25.4	18	19.3	35	21.8
Ross	10	27.2	7	15.4	18	20.8
Sandusky	9	29.3	10	19.9	19	24.4
Scioto	11	26.9	8	13.6	18	19.4
Seneca	6	21.0	7	16.6	13	18.9
Shelby	4	16.2	3	8.2	6	11.6
Stark	41	20.0	39	13.4	80	16.2
Summit	57	20.7	60	15.2	117	17.6
Trumbull	29	23.5	28	17.0	57	19.6
Tuscarawas	10	19.4	11	15.4	21	17.1
Union	3	19.0	3	14.2	6	16.1
Van Wert	3	23.7	4	17.7	8	20.0
Vinton	1	15.7	1	13.9	2	14.8
Warren	16	18.5	15	14.5	31	16.4
Washington	8	22.7	6	13.8	14	17.7
Wayne	12	21.0	9	11.6	20	15.5
Williams	4	17.5	4	13.1	7	15.4
Wood	13	23.9	11	14.7	24	18.4
Wyandot	3	27.2	3	17.7	6	21.7

Source: The Office of Vital Statistics, Ohio Department of Health, 2014; National Center for Health Statistics, 2014.

Table 8: Colon and Rectum Cancer: Percentage of New Cases by County of Residence and Stage at Diagnosis in Ohio, 2007-2011

	Early Stage %	Late Stage %	Unstaged/ Missing %	Average Annual Cases		Early Stage %	Late Stage %	Unstaged/ Missing %	Average Annual Cases
Ohio	**40%**	**49%**	**11%**	**6,188**	Lawrence	52%	40%	9%	40
U.S.	**43%**	**52%**	**5%**		Licking	34%	56%	10%	83
Adams	44%	46%	10%	22	Logan	40%	52%	8%	26
Allen	42%	50%	8%	56	Lorain	41%	48%	11%	159
Ashland	36%	57%	7%	32	Lucas	39%	50%	11%	194
Ashtabula	38%	50%	11%	69	Madison	35%	58%	6%	22
Athens	44%	47%	9%	27	Mahoning	35%	48%	17%	167
Auglaize	42%	48%	11%	32	Marion	46%	43%	11%	49
Belmont	46%	47%	7%	46	Medina	44%	50%	7%	83
Brown	34%	51%	15%	26	Meigs	47%	45%	8%	16
Butler	42%	47%	12%	181	Mercer	46%	44%	10%	33
Carroll	38%	52%	10%	18	Miami	44%	42%	15%	51
Champaign	41%	44%	15%	24	Monroe	51%	45%	4%	11
Clark	43%	47%	10%	84	Montgomery	39%	49%	12%	277
Clermont	45%	46%	9%	93	Morgan	39%	47%	14%	10
Clinton	40%	51%	9%	27	Morrow	36%	53%	10%	21
Columbiana	39%	47%	14%	69	Muskingum	38%	53%	10%	44
Coshocton	43%	48%	9%	25	Noble	34%	55%	11%	13
Crawford	51%	37%	12%	30	Ottawa	45%	46%	9%	28
Cuyahoga	40%	51%	9%	744	Paulding	39%	45%	16%	13
Darke	42%	46%	12%	40	Perry	47%	44%	9%	19
Defiance	42%	51%	7%	23	Pickaway	36%	54%	11%	28
Delaware	39%	51%	10%	62	Pike	42%	48%	10%	17
Erie	45%	45%	10%	61	Portage	44%	49%	6%	75
Fairfield	43%	45%	11%	68	Preble	44%	43%	12%	26
Fayette	35%	57%	8%	13	Putnam	47%	39%	13%	18
Franklin	35%	54%	11%	457	Richland	49%	43%	8%	96
Fulton	40%	48%	12%	21	Ross	36%	50%	15%	44
Gallia	44%	46%	9%	19	Sandusky	46%	44%	10%	42
Geauga	42%	49%	9%	50	Scioto	43%	48%	9%	49
Greene	40%	41%	19%	76	Seneca	42%	50%	8%	38
Guernsey	22%	67%	11%	28	Shelby	53%	36%	11%	27
Hamilton	42%	46%	12%	416	Stark	38%	51%	11%	211
Hancock	32%	57%	10%	38	Summit	41%	49%	10%	285
Hardin	39%	51%	10%	18	Trumbull	38%	55%	7%	149
Harrison	49%	47%	4%	9	Tuscarawas	41%	47%	12%	57
Henry	29%	54%	17%	12	Union	50%	41%	9%	21
Highland	41%	47%	11%	25	Van Wert	41%	45%	14%	21
Hocking	35%	43%	22%	18	Vinton	34%	54%	11%	7
Holmes	34%	51%	15%	19	Warren	44%	47%	9%	81
Huron	41%	43%	17%	40	Washington	42%	54%	4%	35
Jackson	42%	49%	9%	20	Wayne	43%	47%	10%	55
Jefferson	46%	40%	15%	48	Williams	56%	39%	5%	25
Knox	41%	52%	7%	38	Wood	42%	49%	9%	60
Lake	33%	53%	14%	129	Wyandot	45%	41%	14%	16

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2014; Surveillance, Epidemiology and End Results Program, National Cancer Institute, 2014.

Note: 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.

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Healthy Ohio website: http://www.healthy.ohio.gov

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