

Cancers Associated with Overweight and Obesity, Ohio, 1996-2009



Overweight and obesity have greatly increased over the past three decades in the United States. Results from the 2009-2010 National Health and Nutrition Examination Survey (NHANES) show that 68.7 percent of U.S. adults ages 20 years and older are overweight or obese, and among children and teens ages 2 to 19 years, 17 percent are estimated to be obese. Analyses from NHANES also indicate obesity prevalence is highest among blacks, Hispanic women, men ages 60 years and older and women ages 40 to 59 years.

Overweight, obesity and lack of physical activity are associated with increased risks of several life-threatening diseases such as Type 2 diabetes, cardiovascular disease and many sites/types of cancer. One-third of the more than 500,000 cancer deaths that occur each year in the United States can be attributed to poor diet and physical inactivity, which are risk factors for overweight and obesity.

Epidemiologic and molecular studies in various countries and different settings have provided supporting evidence of a causal relationship between excess adiposity (fat storage) and cancer risk. Adipose tissues are highly metabolically active tissues that produce an array of hormones, growth factors and signaling molecules fueling inflammation and cellular proliferation that may lead to cancer.

Purpose of Report and Highlighted Cancer Sites/Types

The purpose of this report is to provide data and information about the cancers associated with overweight and obesity, including a summary of cancer incidence and mortality rates over time. Also included are physical activity and overweight/obesity trends in Ohio; patterns of obesity over time by county; overweight and obesity-related risk factors; physical activity and healthy eating goals from the *Ohio Comprehensive Cancer Control Plan 2011-2014*; and guidelines on nutrition and physical activity for cancer prevention. This report highlights the eight cancer sites/types the National Cancer Institute (NCI) associates with overweight and obesity:

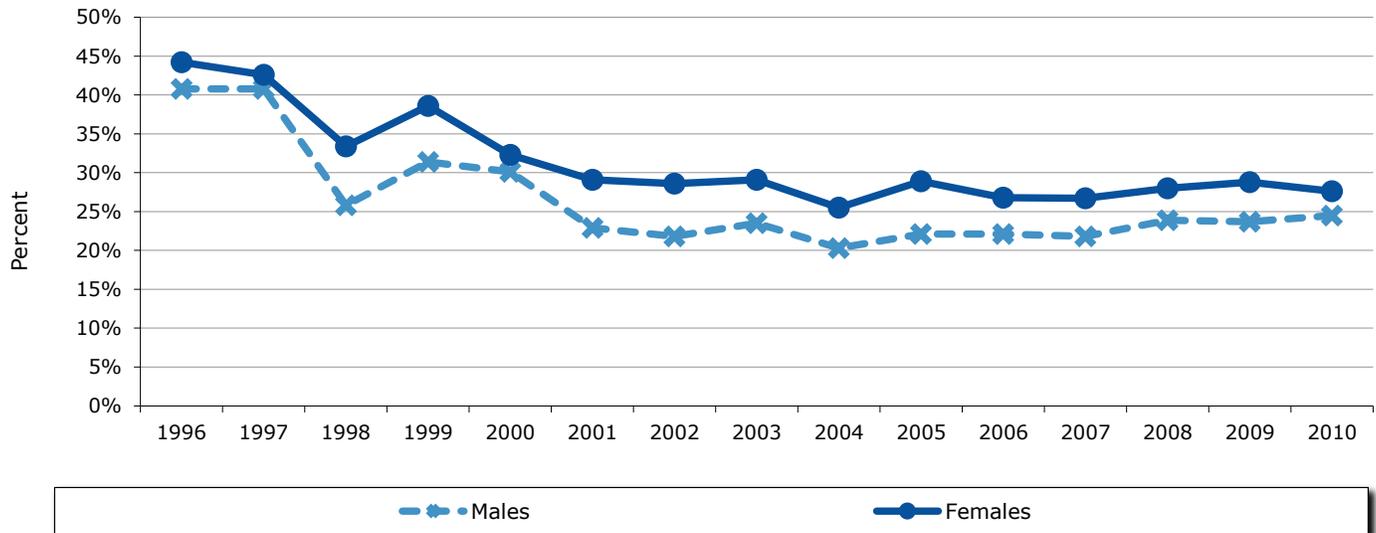
- **Adenocarcinoma of the Esophagus**
- **Colon and Rectum**
- **Endometrial (Corpus Uterus)**
- **Postmenopausal Female Breast**
- **Gallbladder**
- **Kidney**
- **Pancreas**
- **Thyroid**

In addition, overweight and obesity *may* increase the risk of several other sites/types of cancer (e.g. prostate, other male genitals, ovarian, non-Hodgkin's lymphoma, leukemia, liver and hemangioma). These sites/types of cancer are not described in this report.

It is important to note that although obesity rates in Ohio and the United States have continued to increase, current incidence and mortality trends for the cancers associated with overweight and obesity may not reflect this increase. In fact, trends for many of these cancers have decreased or remained relatively stable in Ohio. These downward and stable cancer trends in Ohio may be an indication of progress in prevention, screening, early detection and treatment of cancer; however, it is important to monitor these trends over time to determine if overweight and obesity will have an impact in Ohio in the future.

Physical Activity and Overweight and Obesity in Ohio

Figure 1: Estimated Prevalence of Adults (Age 18+) Who Do Not Participate in any Leisure-time Physical Activity, by Gender in Ohio, 1996-2010¹



Source: 1996-2010 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2012.

¹ Lack of physical activity is determined by answering "no" to any leisure-time physical activity within the past 30 days.

Lack of physical activity is a risk factor for overweight and obesity, which may, in turn, increase the risk of developing certain cancers. In 2010, an estimated 26.1 percent of Ohio adults were physically inactive, and approximately two-thirds (65.7 percent) were overweight or obese, according to the Ohio Behavioral Risk Factor Surveillance System (data not shown). It is important to monitor trends in the prevalence of physical inactivity and overweight/obesity to identify any potential association with trends in cancer incidence and mortality rates over time.

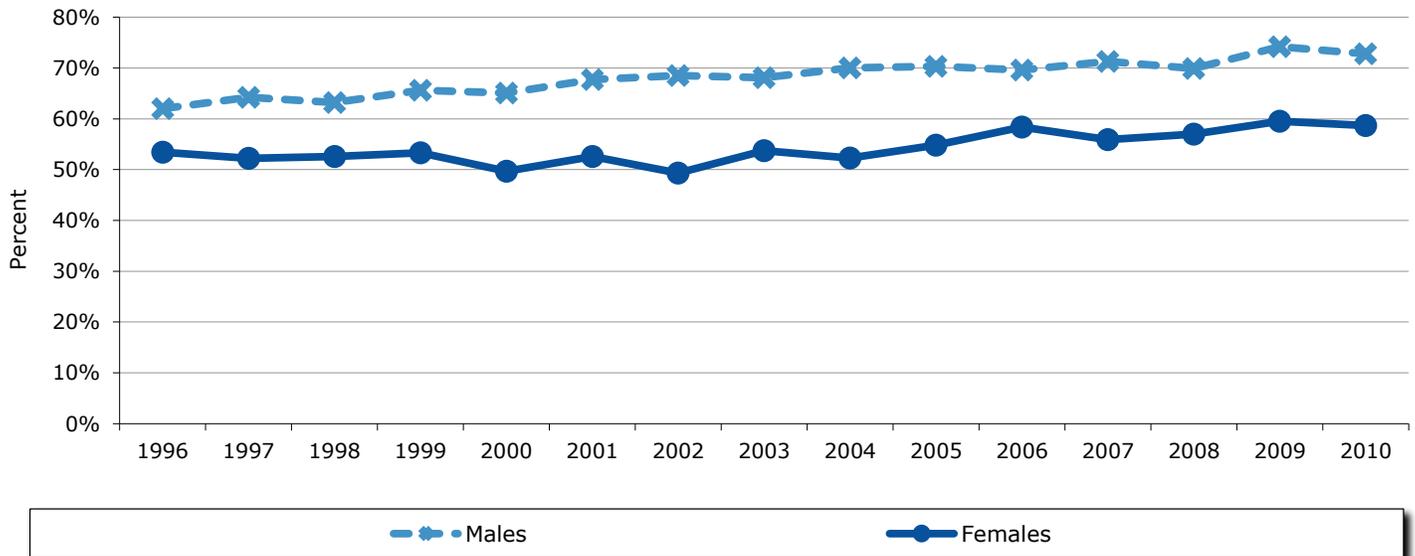
As shown in Figure 1, the estimated prevalence of Ohio adults who did not participate in any leisure-time physical activity in the past 30 days decreased from 1996 to 2001, but then remained relatively stable through 2010 for both males and females. Females had a higher prevalence of physical inactivity each year from 1996 through 2010, compared with males. Figures 2 and 3 on page 3 present trends in the prevalence of overweight and obesity combined among Ohio adults by gender (male, female) and race (white, black), respectively, from 1996 to 2010. The prevalence of overweight/obesity was found to increase from 1996 to 2010 for all gender and race groups, with males and blacks having the greatest increase of 11 percentage points over the time period. Males and blacks also had a higher prevalence of overweight/obesity each year from 1996 to 2010, compared with females and whites, respectively.

Definition of Overweight and Obesity

Overweight and obesity are usually characterized by body mass index (BMI), which usually correlates with percent of body fat. The Centers for Disease Control and Prevention (CDC) defines a BMI of 25.0 to 29.9 kg/m² as overweight, and a BMI equal to or greater than 30.0 kg/m² as obese in adults. For children and adolescents less than 20 years of age, the definitions of overweight and obesity are based on the CDC BMI-for-age growth charts. Children and adolescents (2-19 years) with a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex are considered overweight, whereas those with a BMI at or above the 95th percentile for children of the same age and sex are considered obese.

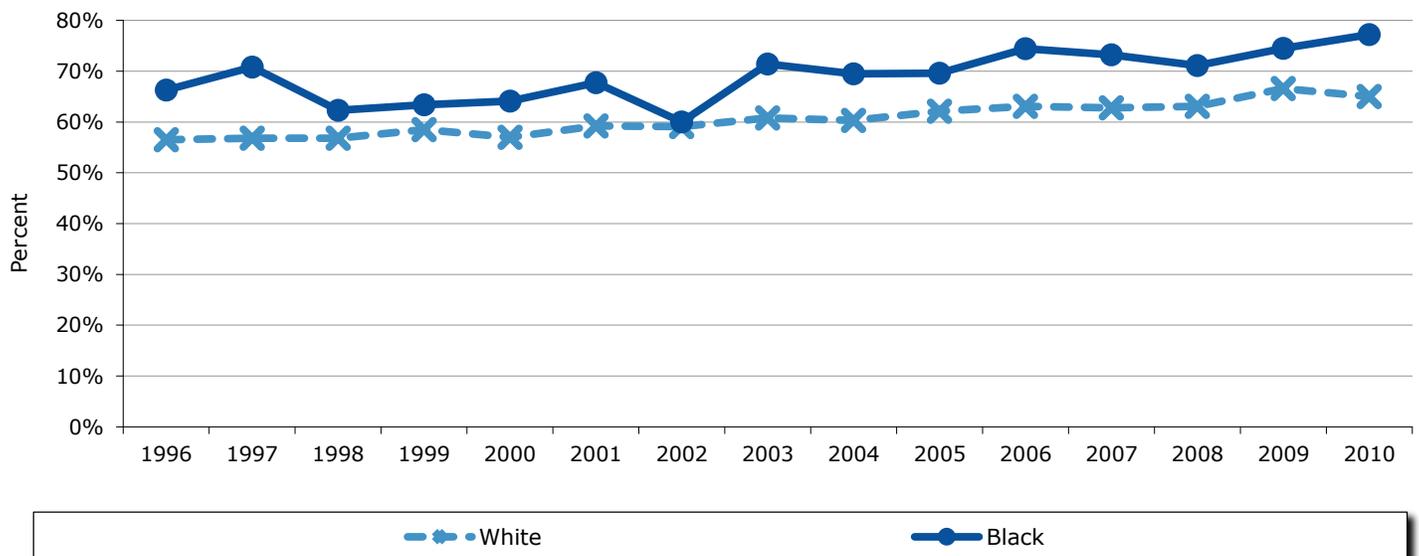
Physical Activity and Overweight and Obesity in Ohio

Figure 2: Estimated Prevalence of Adults (Age 18+) Who are Overweight and Obese, by Gender in Ohio, 1996-2010



Source: 1996-2010 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2012.

Figure 3: Estimated Prevalence of Adults (Age 18+) Who are Overweight and Obese, by Race in Ohio, 1996-2010



Source: 1996-2010 Ohio Behavioral Risk Factor Surveillance System, Ohio Department of Health, 2012.

Obesity by Year and County in Ohio, 2004-2009

The images in Figures 4 through 9 depict patterns of annual obesity prevalence estimates for Ohio's 88 counties from 2004 through 2009. Two large-scale trends are of note: an increase in obesity prevalence for all counties over time; and obesity prevalence concentrations in rural counties of the Southeast and Northwest regions of the state. Increases in Ohio's obesity prevalence over time parallel increases observed in the United States.

County obesity percentages are model-based estimates produced by the CDC. Percentages by county and year can be found in Table 2 on page 21 of this document. Map classification was determined by a statistical procedure that minimizes variation within classes and maximizes variation between classes for the six-year, county prevalence distribution.

Some studies have shown a relationship between obesity prevalence and socioeconomic status (SES) measured as educational attainment or income. However, this association has been found to differ by sex and race/ethnicity. The strongest association has been found among women, especially non-Hispanic white women, where obesity prevalence increases as income decreases. The relationship between obesity and SES may partially explain the geographic trends in obesity prevalence in Ohio.

Figures 4-9: Percent Obese Adults (Age 20+), by Year and County of Residence in Ohio, 2004-2009

Figure 4

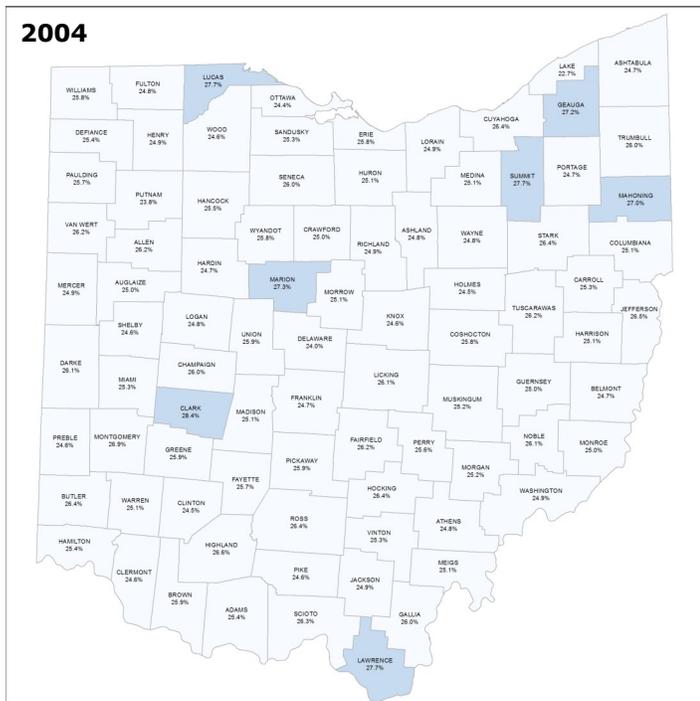
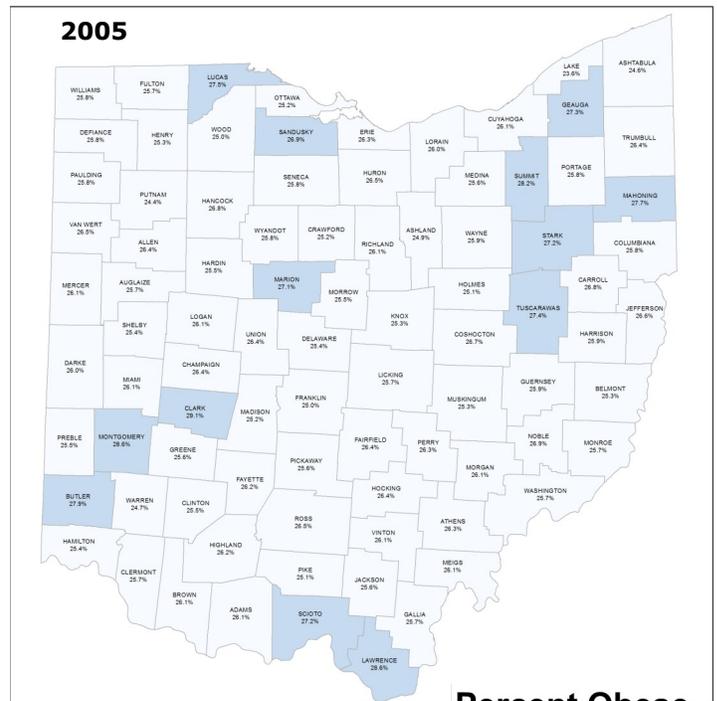
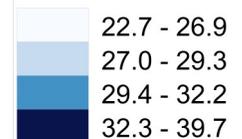


Figure 5



Percent Obese



Source: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation, 2011.

Figures 4-9: Percent Obese Adults (Age 20+), by Year and County of Residence in Ohio, 2004-2009 (continued)

Figure 6

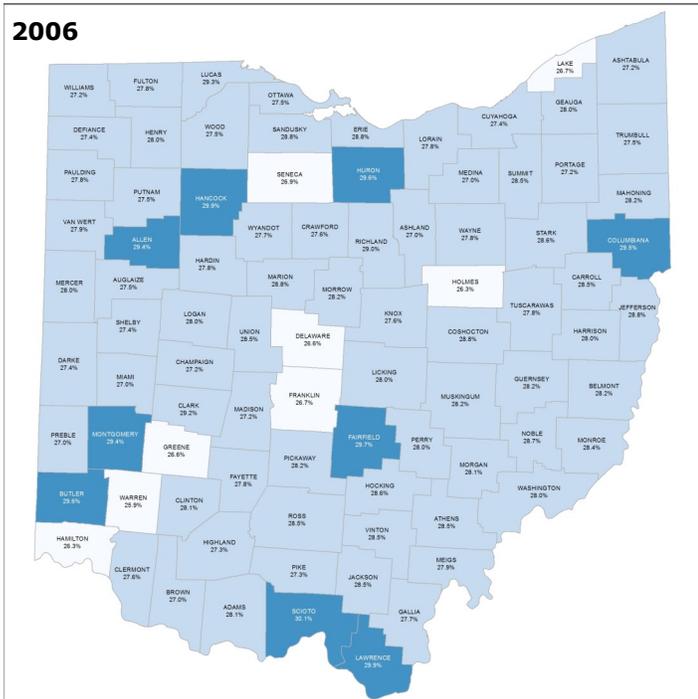


Figure 7

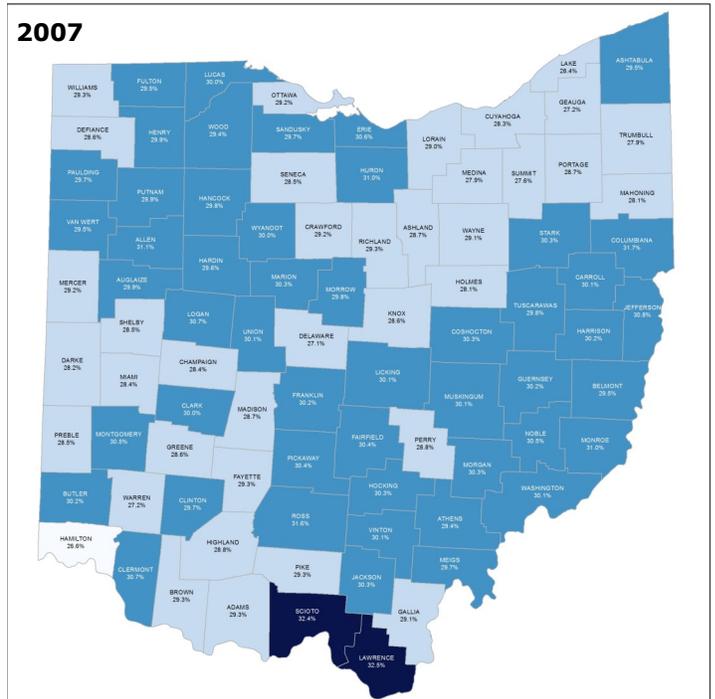


Figure 8

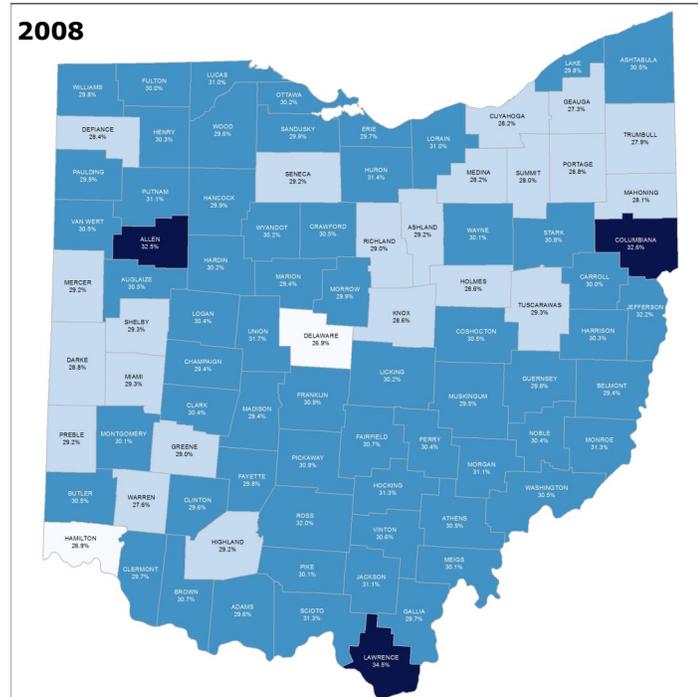
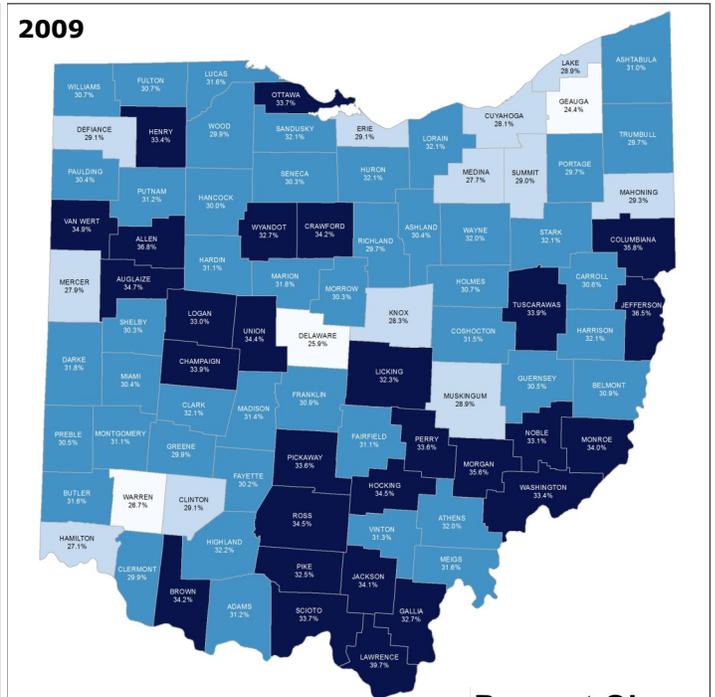
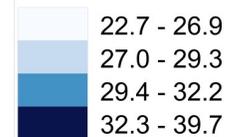


Figure 9



Source: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation, 2011.

Percent Obese



Trends in Incidence Rates of Overweight- and Obesity-related Cancers

Figures 10 through 17 on the following pages show incidence rates for the eight overweight- and obesity-related sites/types of cancer according to year of diagnosis (1996 through 2009) by gender-race group. Use caution when comparing Figures 10 through 17 due to variation in scales of incidence rates. Also note that increases/decreases in incidence rates over time may appear smaller when larger scales were used and larger when smaller scales were used.

- Incidence rates of adenocarcinoma esophageal cancer among white males increased from 1996 to 2009. White males also had the highest incidence rate each year, compared with the other gender-race groups (Figure 10).
- For colon and rectum cancer, in general, incidence rates slightly decreased, especially in more recent years, for each of the gender-race groups. Males had higher rates than females each year from 1996 to 2009, with black males and white females having the highest and lowest rates, respectively, for the majority of years (Figure 11).
- For pancreatic cancer, in general, incidence rates were relatively stable for all gender-race groups from 1996 to 2009, with the exception of an increase among black males. Black males had the highest rates for all but one year and white females had the lowest rates (Figure 12).
- Incidence rates increased from 1996 to 2009 for each of the gender-race groups for kidney and renal pelvis cancer, with males having higher rates than females each year (Figure 13).
- Thyroid cancer incidence rates increased from 1996 to 2009 for each gender-race group, and these increases were larger for females, who had higher rates than males for all but one year (Figure 14).
- For women ages 50 years and older, slight decreases in female breast cancer incidence rates were observed among white females, whose rates decreased to be similar to those among black females in 2003 and after (Figure 15).
- Incidence rates of corpus uterus cancer increased among black females from 1996 to 2009, but were stable for white females; although, incidence rates among white females remained higher than those among black females throughout the period (Figure 16).
- Incidence rates for gallbladder cancer were higher among females throughout the period. Although sporadic, incidence rates remained relatively stable from 1996 to 2009 (Figure 17).

In summary, incidence rates increased over the period from 1996 to 2009 for adenocarcinoma esophageal (among white males), pancreatic (among black males), kidney and renal pelvis (among all groups), thyroid (among all groups) and corpus uterus (among black females) cancers.

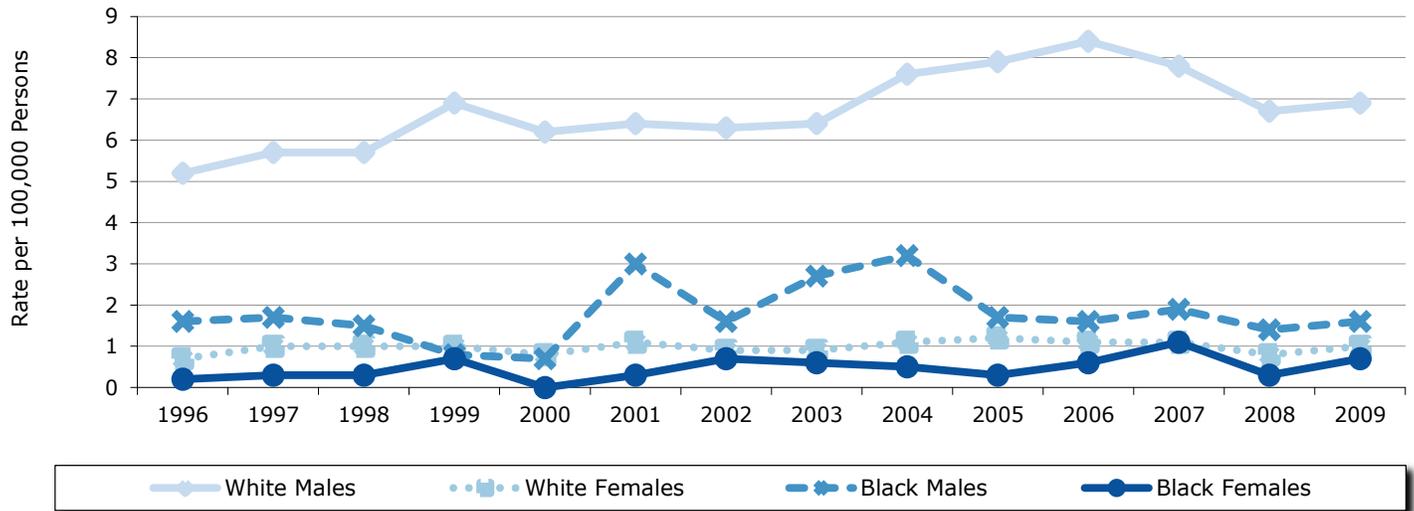
It is possible that the full impact of increases in overweight and obesity have not yet been observed in cancer incidence rates, at least in part because cancer risk may increase with increasing years of being overweight and/or obese. Because cancers have complex sets of interacting causal factors — with overweight and obesity being just one — it is difficult at this time to determine or predict the impact of overweight and obesity on cancer incidence in the future.

Did You Know?

According to the American Cancer Society, up to one-third of all cancer deaths — approximately 186,000 lives — could be saved every year if people maintained a BMI less than 25. In Ohio, approximately 8,000 deaths per year could be prevented by maintaining a healthy weight.

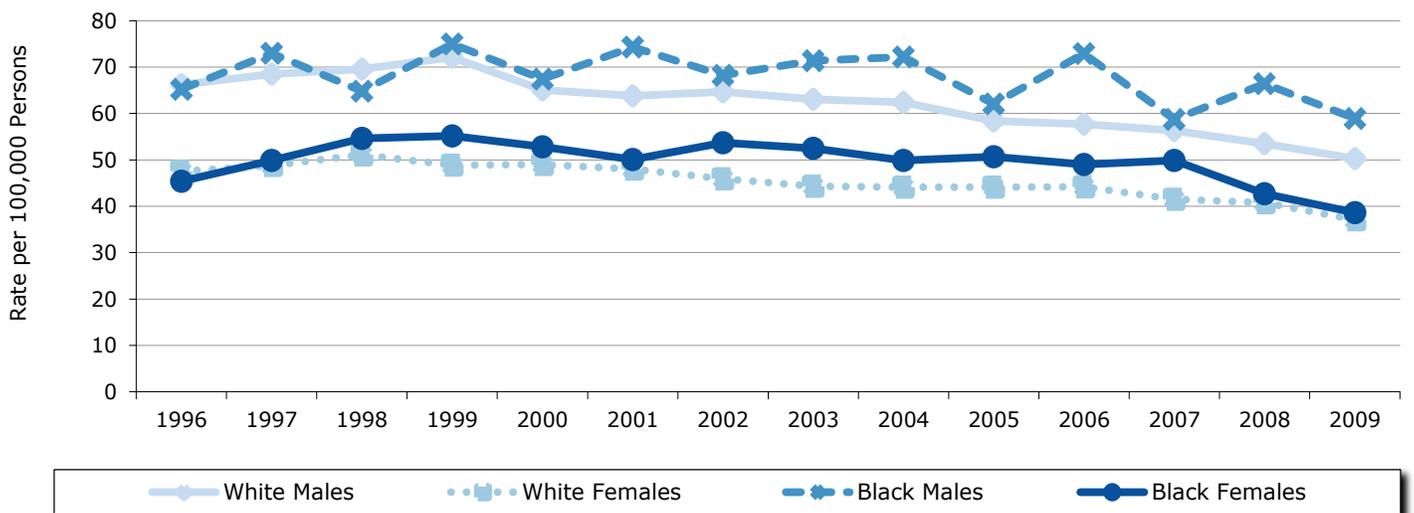
Trends in Incidence Rates of Overweight- and Obesity-related Cancers

Figure 10: Adenocarcinoma Esophageal Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2012.

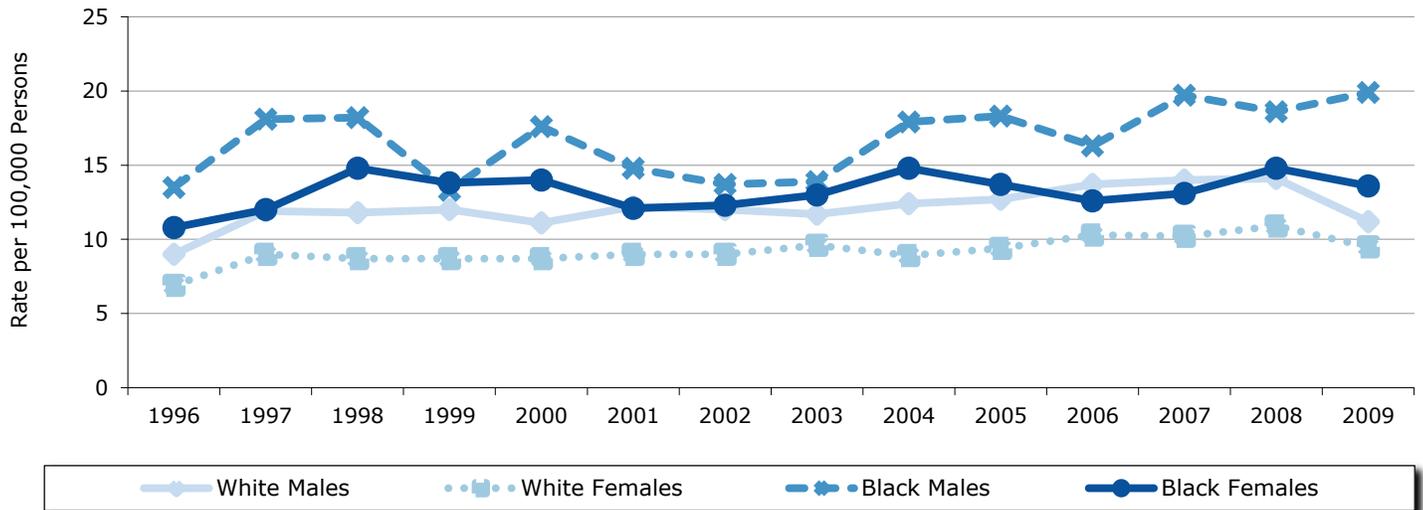
Figure 11: Colon and Rectum Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2012.

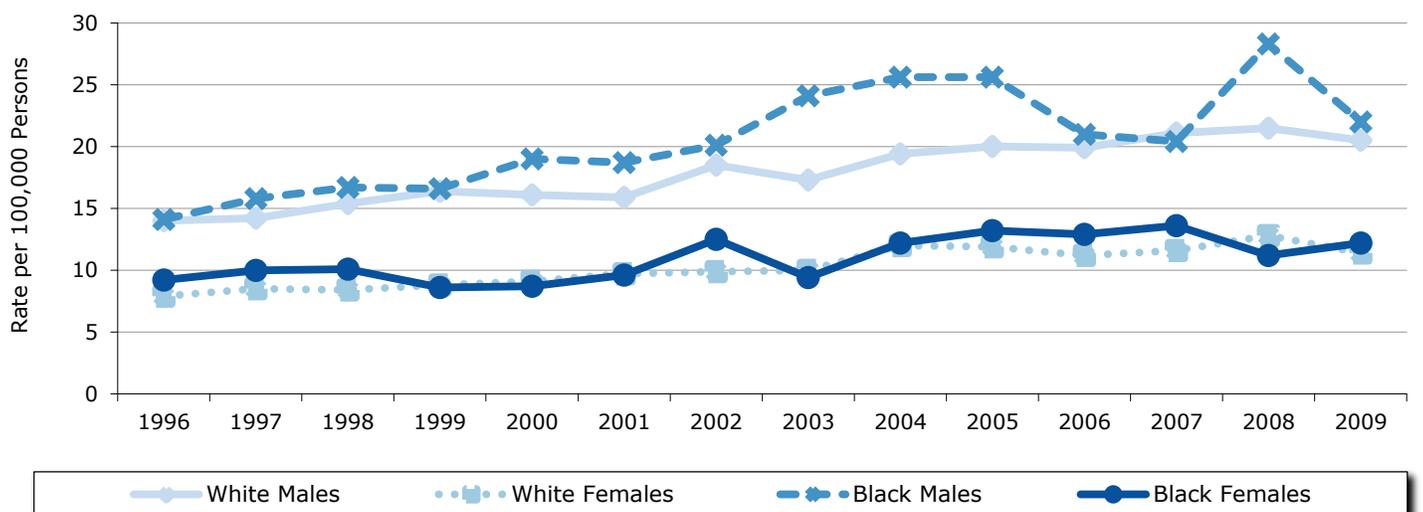
Trends in Incidence Rates of Overweight- and Obesity-related Cancers

Figure 12: Pancreatic Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2012.

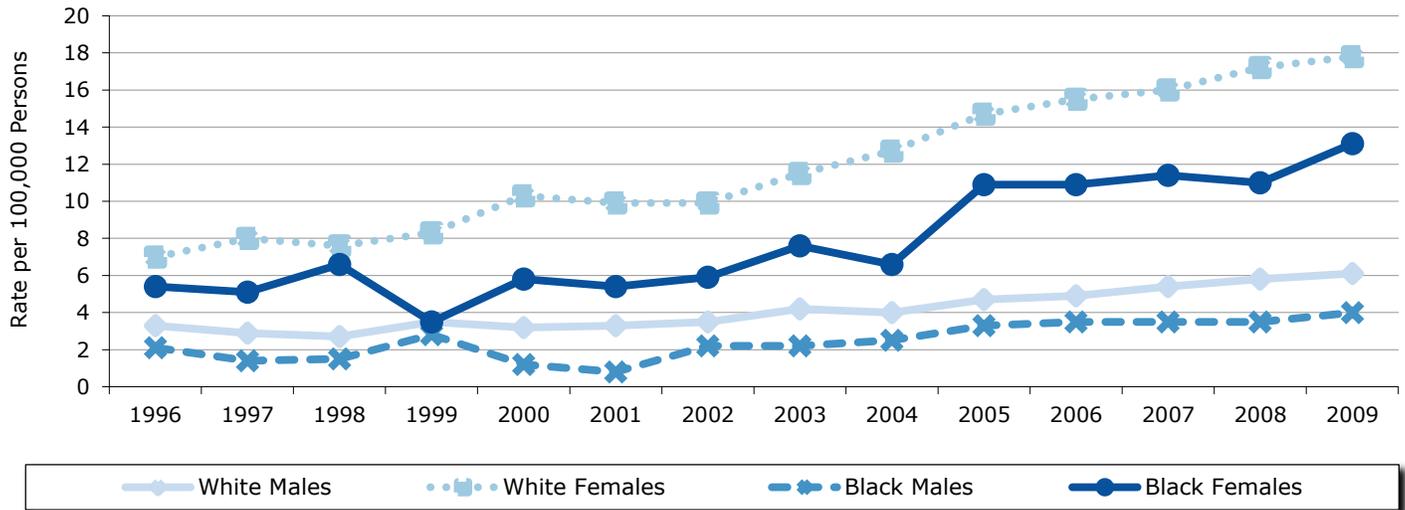
Figure 13: Kidney and Renal Pelvis Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2012.

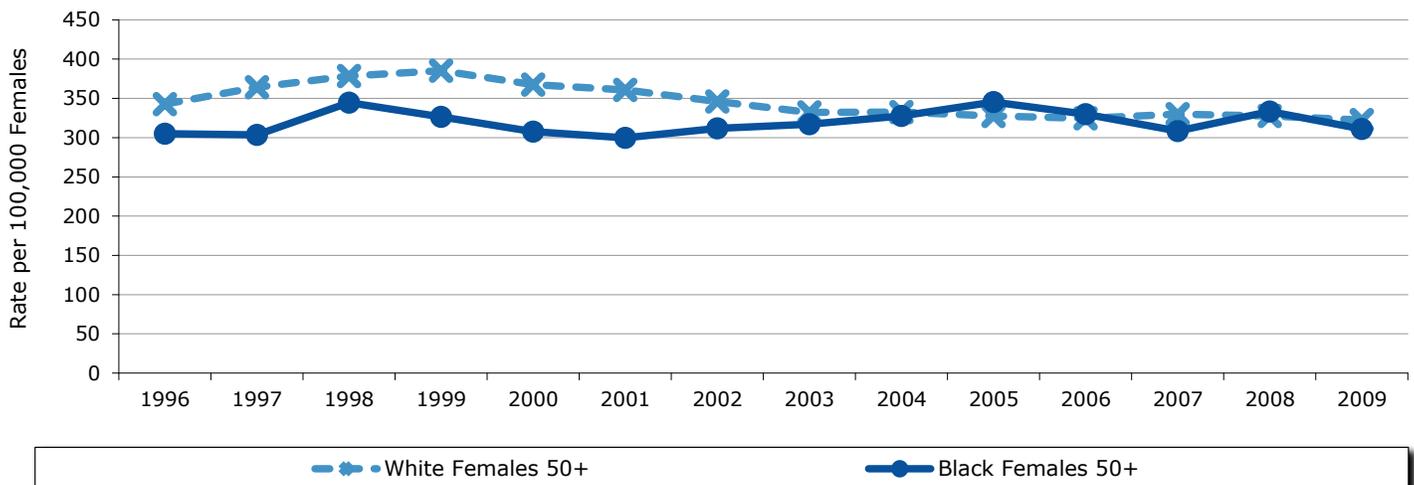
Trends in Incidence Rates of Overweight- and Obesity-related Cancers

Figure 14: Thyroid Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2012.

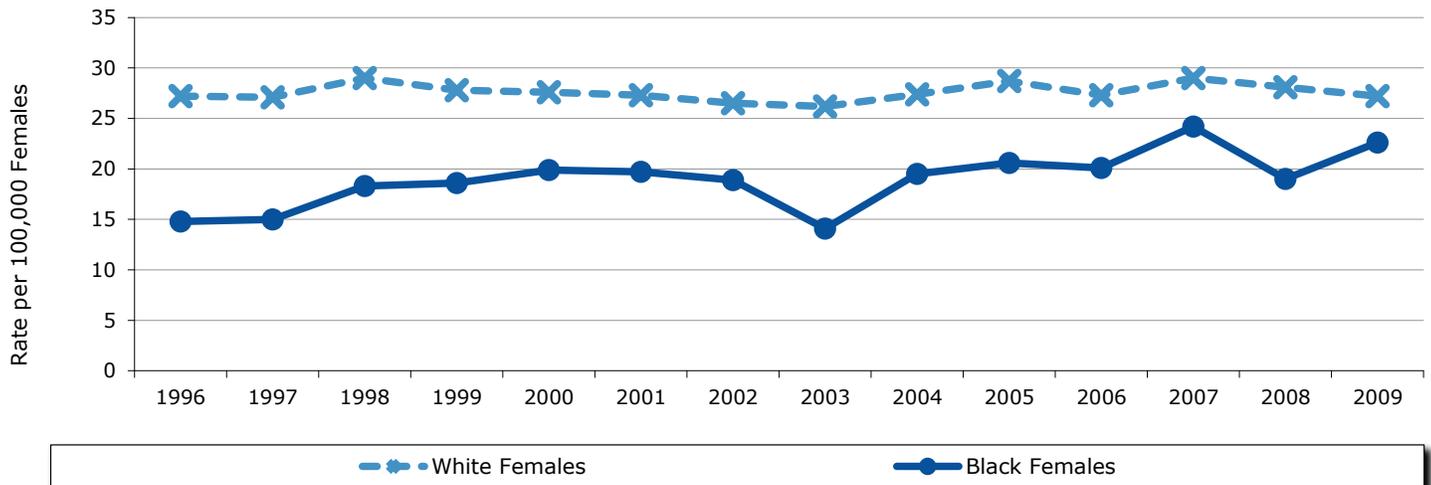
Figure 15: Female Breast Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Females Age 50 and Older, by Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2012.

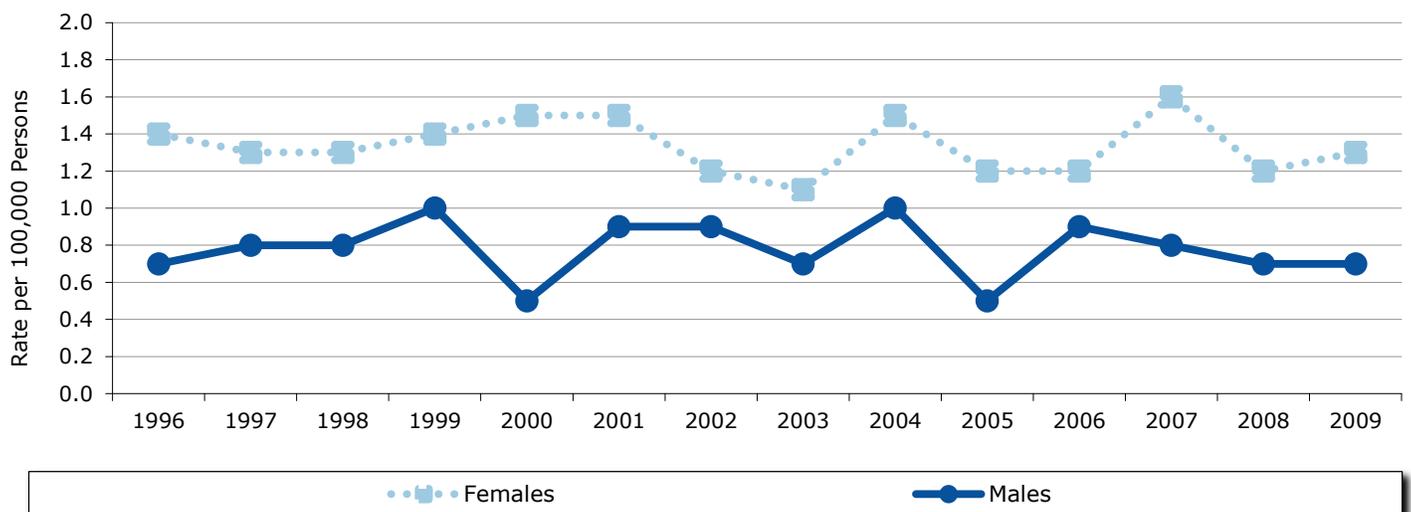
Trends in Incidence Rates of Overweight- and Obesity-related Cancers

Figure 16: Corpus Uterus Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Females, by Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2012.

Figure 17: Gallbladder Cancer: Trends in Annual Age-adjusted Incidence Rates per 100,000 Persons, by Gender in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2012.

Trends in Mortality Rates of Overweight- and Obesity-related Cancers

Figures 18 through 25 on the following pages show mortality rates for the eight overweight and obesity-related sites/types of cancer according to year of diagnosis (1996 through 2009) by gender-race group. Use caution when comparing these figures due to variation in scales of mortality rates. Also note that increases/decreases in mortality rates over time may appear smaller when larger scales were used and larger when smaller scales were used.

- White and black males had higher esophageal cancer mortality rates than white and black females for each of the 14 years. Mortality rates remained relatively constant from 1996 to 2009 for all gender-race groups with the exception of a decrease among black males (Figure 18).
- From 1996 to 2009, colon and rectum cancer mortality rates decreased, especially in more recent years, for each of the gender-race groups. Black males had the highest rates for each of the 14 years (Figure 19).
- Pancreatic cancer mortality rates remained relatively stable from 1996 to 2009 for all gender-race groups except for black males, whose rates were variable during the time period. Black males had the highest rates for all years but one, and white females had the lowest rates for each year (Figure 20).
- Males of both races had higher kidney and renal pelvis cancer mortality rates than females for each of the 14 years. Mortality rates remained relatively stable for all gender-race groups, with the exception of greater variability among black males (Figure 21).
- Thyroid cancer mortality rates were relatively stable among males and females from 1996 to 2009; however, rates were higher for males for most years (Figure 22).
- While post-menopausal (age 50+) female breast cancer mortality rates were higher among black females, mortality rates decreased over the time period for both white and black females (Figure 23).
- Mortality rates for corpus uterus cancer increased slightly among black females from 2003 to 2008, and remained relatively stable for white females for each of the 14 years (Figure 24).
- Gallbladder cancer mortality rates decreased for both males and females; however, rates were higher among females for most years (Figure 25).

In summary, mortality rates for these cancer sites/types increased over the period 1996 to 2009 for only corpus uterus cancer among black females in more recent years.

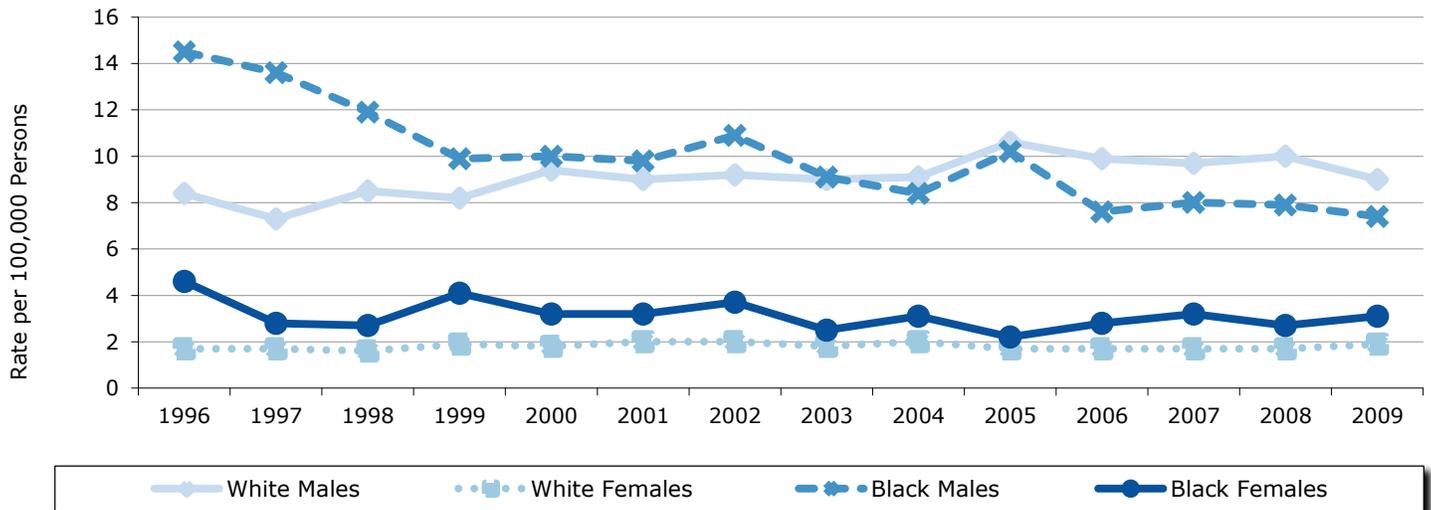
Overall, the mortality rates for most cancers seem to be stable or declining. Several factors such as differences in treatments, other illnesses/comorbidities and lifestyle behaviors may make it difficult to predict the impact of overweight and obesity on cancer mortality. Moreover, the available research available is limited. Thus, additional studies on the long-term impact of overweight and obesity on cancer mortality are needed.

Did You Know?

Evidence from over 40 studies suggests that overweight and obesity affect survival probability, cancer progression, recurrence and site-specific mortality for those diagnosed with cancers of the female breast, colon and rectum and prostate. However, due to methodological concerns of these studies, the evidence is not yet conclusive. Further research is needed to assess the long-term impact of overweight and obesity among the growing population of cancer survivors. Although we know that fat tissue affects hormones, cancer-related growth factors and cytokines, more research is also needed to better understand the mechanisms of action linking overweight and obesity to cancer prognosis.

Trends in Mortality Rates of Overweight- and Obesity-related Cancers

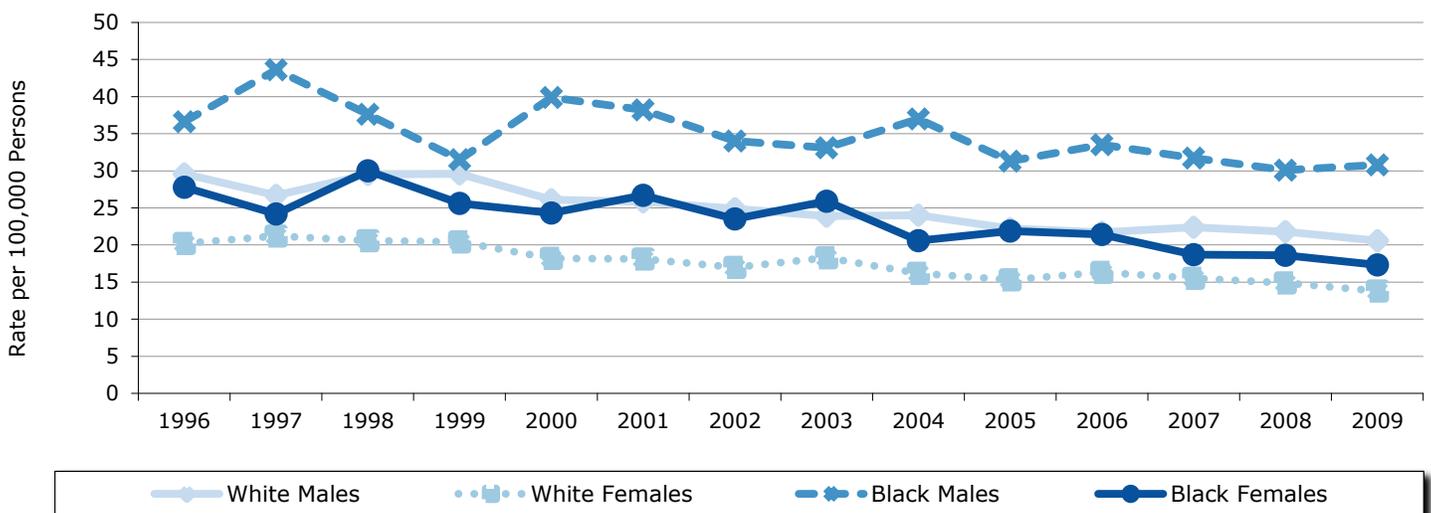
Figure 18: Esophageal Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009¹



Source: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012.

¹Note: Figure 18 is for all esophageal cancers, not limited to adenocarcinomas.

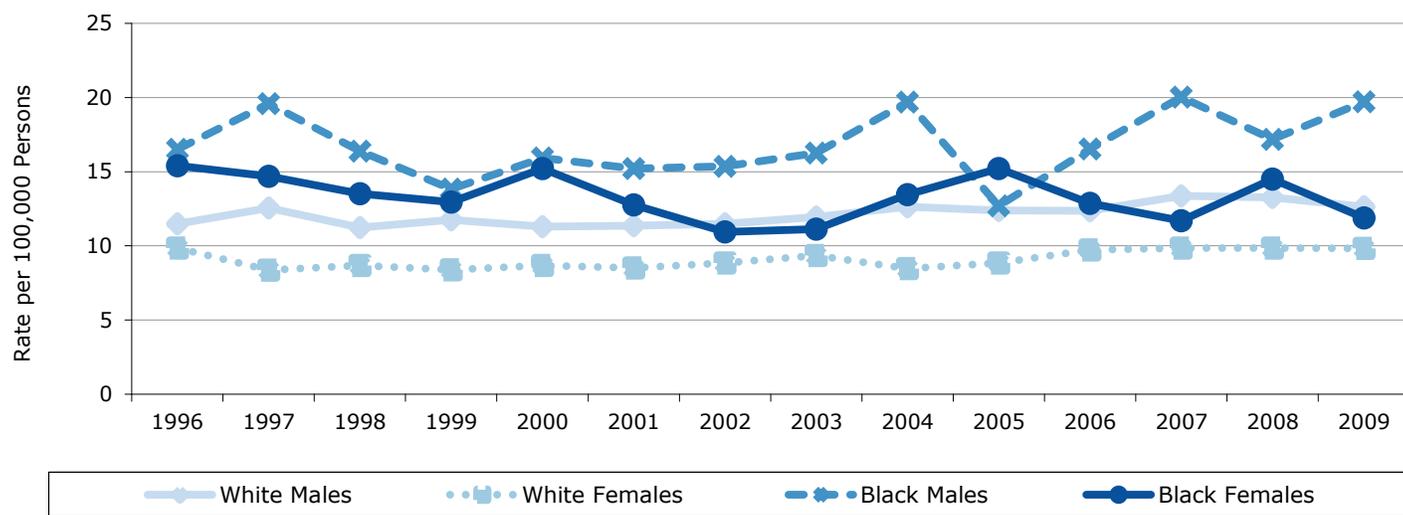
Figure 19: Colon and Rectum Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012.

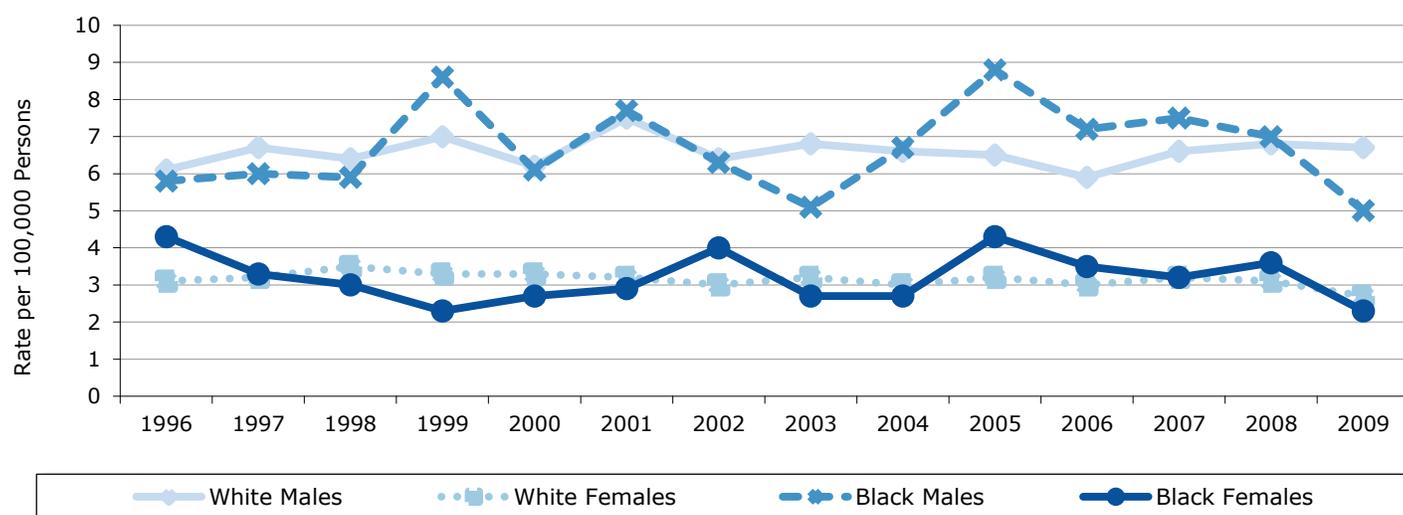
Trends in Mortality Rates of Overweight- and Obesity-related Cancers

Figure 20: Pancreatic Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012.

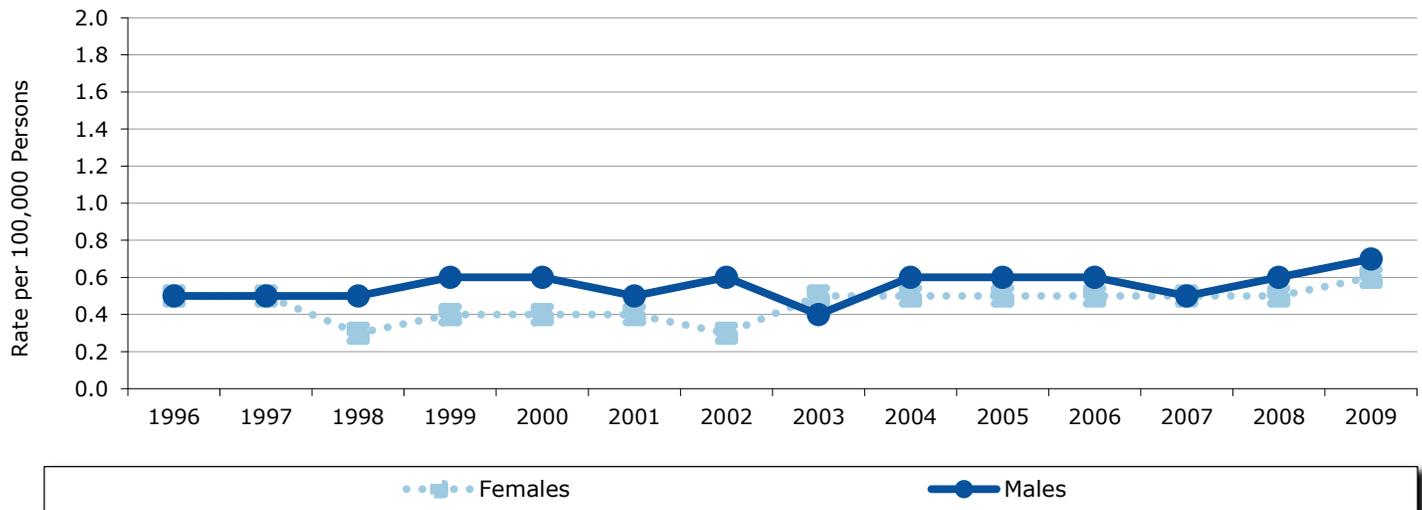
Figure 21: Kidney and Renal Pelvis Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Persons, by Gender and Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012.

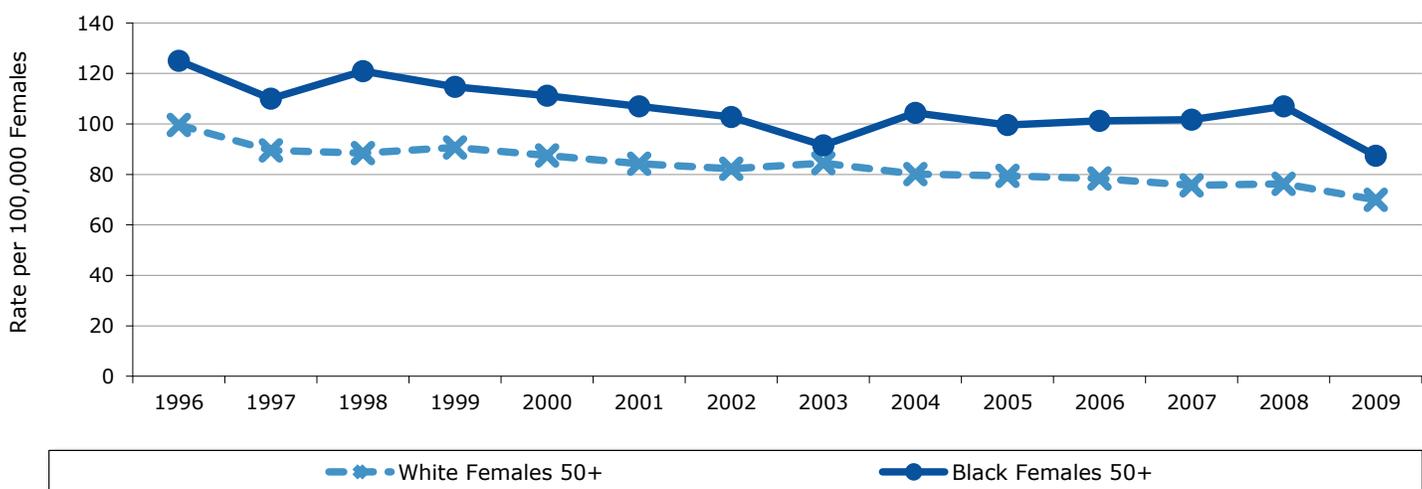
Trends in Mortality Rates of Overweight- and Obesity-related Cancers

Figure 22: Thyroid Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Persons, by Gender in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012.

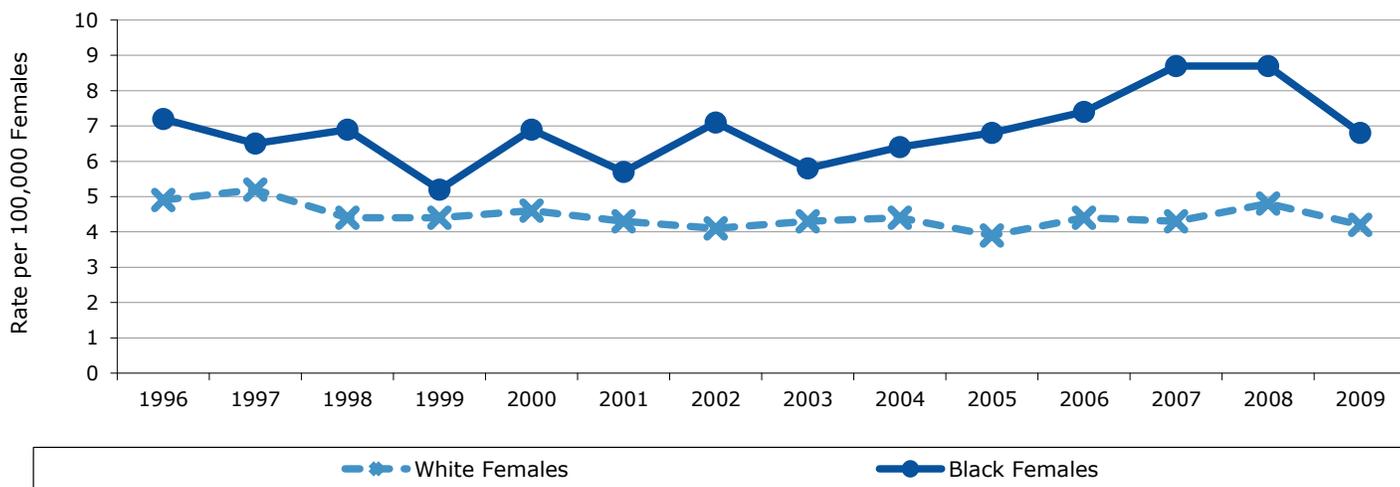
Figure 23: Female Breast Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Females Age 50 and Older, by Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012.

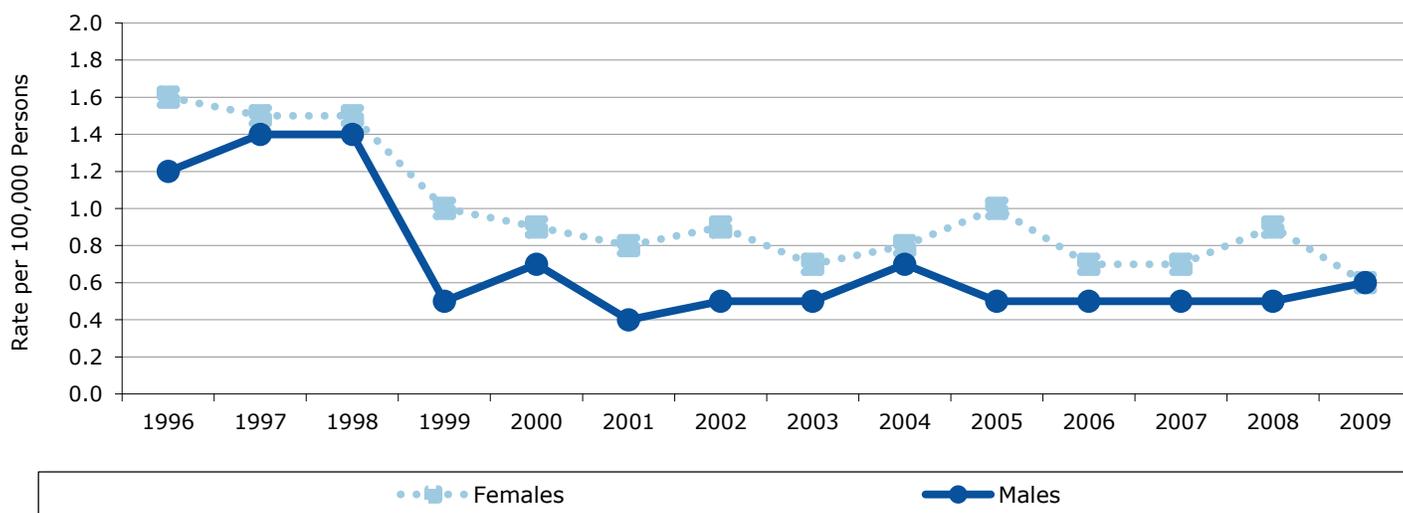
Trends in Mortality Rates of Overweight- and Obesity-related Cancers

Figure 24: Corpus Uterus Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Females, by Race in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012.

Figure 25: Gallbladder Cancer: Trends in Annual Age-adjusted Mortality Rates per 100,000 Persons, by Gender in Ohio, 1996-2009



Source: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012.

Overweight and Obesity-related Risk Factors

According to the Mayo Clinic, overweight and obesity usually results from a combination of causes and contributing factors, including:

- **Genetics:** Genes may affect the amount of body fat stored and where that fat is distributed. Genetics may also play a role in how efficiently the body converts food into energy and how the body burns calories during exercise.
- **Family Lifestyle:** Family members tend to have similar eating, lifestyle and activity habits. If one or both of your parents are obese, your risk of being obese is increased.
- **Medications:** Some medications, including some antidepressants, anti-seizure medications, diabetes medications, antipsychotic medications, steroids and beta blockers, can lead to weight gain if they are not compensated through diet or physical activity.
- **Illness:** Being overweight and obese can sometimes be traced to a medical cause, such as Prader-Willi syndrome, Cushing's syndrome, polycystic ovary syndrome and other diseases and conditions.
- **Physical Inactivity:** With little to no physical activity and a sedentary lifestyle, taking in more calories than you burn off through exercise and normal daily activities can occur.
- **Unhealthy diet and eating habits:** Consumption of high-calorie dense foods, high dietary fat and low fiber, as well as eating oversized portions, can contribute to weight gain.
- **Lack of sleep:** Lack of adequate sleep each night can cause changes in hormones that increase appetite, which may also cause craving of foods high in calories and carbohydrates, contributing to weight gain.
- **Quitting smoking:** Quitting smoking is often associated with weight gain. And for some, it can lead to a weight gain of as much as several pounds a week for several months, which can result in overweight or obesity. In the long run, however, quitting smoking is still a greater benefit to your health than continuing to smoke.
- **Age:** Overweight and obesity can occur at any age, even in young children, but risk increases with age.
- **Pregnancy:** During pregnancy a woman's weight necessarily increases. Some women may find this weight difficult to lose after giving birth.
- **Social and economic issues:** Certain social and economic issues may be linked to being overweight and obese. Having safe areas to exercise, understanding healthy ways of cooking and having the resources to buy healthier foods all play a role.

It is important to note that many of these risk factors can be counteracted through diet and physical activity.

Physical Activity and Nutrition

The **Ohio Comprehensive Cancer Control Plan 2011-2014** (the Plan) is a strategic plan to reduce the cancer burden in Ohio. It 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. The Plan addresses all aspects of the cancer prevention and control continuum including data and surveillance, primary prevention, screening and early detection, treatment, quality of life and end-of-life care and advocacy.

The Plan states that unhealthy diets and physical inactivity, which are risk factors for overweight and obesity, may account for about 25-30 percent of the cancer deaths in men and 20 percent of cancer deaths in women. Overweight and obese children are at increased risk for cancer, especially because they are more likely to become overweight and obese as adults. Currently, about one out of every three children in the United States is overweight or obese, and fruit/vegetable consumption and physical activity levels are below recommended levels. Also, studies indicate obesity disproportionately affects minorities. Therefore, it is imperative that efforts be made to improve the diets and physical activity levels of adults and children in order to reduce obesity and prevent cancer. Outlined below are Primary Prevention Goals 4 and 5 of the Plan:

GOAL 4: Increase the Proportion of Adults and Children who Engage in Recommended Physical Activity Levels

Objective 4.1: By December 31, 2014, increase the proportion of Ohio adults age 18 and older who engage in at least 30 minutes of moderate to vigorous physical activity five or more days of the week to at least 54%.

Measure: 2009 Baseline = 49%; December 31, 2014 Target = 54%

Objective 4.2: By December 31, 2014, decrease the proportion of Ohio adults age 18 and older who engaged in no leisure-time physical activity in the preceding month to at least 23%.

Measure: 2009 Baseline = 26%; December 31, 2014 Target = 23%

Objective 4.3: By December 31, 2014, increase the proportion of children in grades 9-12 who engage in physical activity for a total of at least 60 minutes per day 7 days of the week to at least 30%.

Measure: 2010 Baseline = 25%; December 31, 2014 Target = 30%

Examples of Moderate and Vigorous Physical Activity

Moderate-intensity activities and sports include walking, dancing, bicycling, yoga, volleyball, golf, baseball, gardening and occupational walking or lifting

Vigorous-intensity activities and sports include jogging or running, circuit weight training, swimming, jumping rope, soccer, basketball, carpentry and heavy manual labor

Source: These examples are adapted from the American Cancer Society Examples of Moderate and Vigorous Physical Activity

Physical Activity and Nutrition

GOAL 5: Increase the Proportion of Adults and Children Who Engage in Healthy Eating Behaviors

Objective 5.1: By December 31, 2014, increase the proportion of adults aged 18 and over who consume fruits and vegetables five or more times per day to at least 26%.

Measure: 2009 Baseline = 21%; December 31, 2014 Target= 26%

Objective 5.2: By December 31, 2014, increase the proportion of children in grades 9-12 who ate fruits two or more times per day and ate vegetables three or more times per day during the past seven days to at least 12%.

Measure: 2011 Baseline = 7%; December 31, 2014 Target =12%

Guidelines on Nutrition and Physical Activity for Cancer Prevention

Achieve and maintain a healthy weight throughout life

- Engage in regular physical activity and limit consumption of high-calorie foods and beverages as key strategies for maintaining a healthy weight.

Adopt a physically active lifestyle

- Adults should engage in at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activity each week, or an equivalent combination, preferably spread throughout the week.
- Children and adolescents should engage in at least 1 hour of moderate or vigorous intensity activity each day, with vigorous intensity activity occurring at least 3 days each week.
- Limit sedentary behavior such as sitting, lying down, watching television or other forms of screen-based entertainment.

Consume a healthy diet, with an emphasis on plant foods

- Limit consumption of processed meat and red meat.
- Eat at least 2.5 cups of vegetables and fruits each day.
- Choose whole grains instead of refined grain products.

If you drink alcoholic beverages, limit consumption

- Drink no more than 1 drink per day for women or 2 per day for men.

Source: These guidelines are adapted from the American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention

Sources of Data and Additional Information

Ohio Cancer Incidence Surveillance System:

http://www.odh.ohio.gov/healthstats/ocisshs/ci_surv1.aspx

National Cancer Institute: <http://www.cancer.gov/cancertopics/factsheet/Risk/obesity>

American Cancer Society:

<http://www.cancer.org/healthy/eathealthygetactive/acsguidelinesonnutritionphysicalactivityforcancerprevention/acs-guidelines-on-nutrition-and-physical-activity-for-cancer-prevention-guidelines>

Centers for Disease Control & Prevention: <http://www.cdc.gov/obesity/index.html>

National Health and Nutrition Examination Survey: <http://www.cdc.gov/nchs/nhanes.htm>

Ohio Comprehensive Cancer Control Plan:

http://www.ohiocancercontrol.org/aws/OPCC/asset_manager/get_file/48184/the_ohio_comprehensive_cancer_control_plan_2011-14s.pdf

Eheman C, Henley, SJ, et al. **Annual report to the nation on the status of cancer, 1975–2008, featuring cancers associated with excess weight and lack of sufficient physical activity.** *Cancer* March 28, 2012 <http://onlinelibrary.wiley.com/doi/10.1002/cncr.27514/pdf>

Mayo Clinic: <http://www.mayoclinic.com/health/obesity/DS00314/DSECTION=risk-factors>

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Wang, Y., & Beydoun, M. A. (2007). **The obesity epidemic in the United States—gender, age, socioeconomic, racial/ethnic, and geographic characteristics: a systematic review and meta-regression analysis.** *Epidemiologic reviews*, 29(1), 6-28.

Cancer Incidence and Mortality Site and Histology Codes

Table 1: Cancer Incidence Site and Histology Codes (ICD-O-3) and Mortality Codes (ICD-10)

Cancer Site/Type	Incidence ICD-O-3 Site and Histology Code(s)	Mortality ICD-10 Codes
Esophagus *	C150-C159, histologies 8050, 8140-8147, 8160-8162, 8180-8221, 8250-8507, 8514, 8520-8551, 8560, 8570-8574, 8576, 8940-8941	C150-C159
Colon and Rectum	C180-C189; C199; C209; C260	C180-C209; C260
Gallbladder	C239	C230
Pancreas	C250-C259	C250-C259
Breast	C500-C509	C500-C509
Corpus Uterus	C540-C549; C559	C540-C559
Kidney and Renal Pelvis	C649; C659	C640-C659
Thyroid	C739	C730-C739

Source of Table: Ohio Cancer Incidence Surveillance System and the Office of Vital Statistics, Ohio Department of Health, 2012. ICD-O-3 codes adapted from the International Classifications of Diseases for Oncology, Third Edition, World Health Organization, Geneva, 2000. ICD-10 codes are adapted from the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, World Health Organization, Geneva, 1992. For ICD-O-3 codes, histology types 9590-9989 are excluded for all cancer sites except where indicated.

*Esophageal cancer incidence codes are for adenocarcinomas only. Esophageal cancer mortality codes are for all esophageal cancers, not limited to adenocarcinomas.

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...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 and summed to give an overall age-adjusted rate. Rates are presented as the number of cases per 100,000 persons per year. Age-adjustment allows for the comparison of rates between populations with different age distributions.

Body Mass Index (BMI)—A number calculated from a person's weight and height. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems.

	BMI	Weight Status
$\text{BMI} = \frac{\text{weight (kg)}}{(\text{height (m)})^2} \quad \text{or} \quad \left(\frac{\text{weight (lbs)}}{(\text{height (ins)})^2} \right) \times 703$	Below 18.5	Underweight
	18.5 – 24.9	Normal Weight
	25.0 – 29.9	Overweight
	30.0 and Above	Obese

Incidence—The number of cases diagnosed during a specified time period (e.g., 2009). The cancer cases in this document were defined using the International Classification of Diseases for Oncology, Third Edition (ICD-O-3).

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/unknown 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., 2009). The deaths in this document were defined using International Statistical Classification of Diseases and Related Health Problems, Tenth Edition (ICD-10).

Prevalence—The proportion of people with a certain disease or characteristic at a given time.

Rate—The number of cases or deaths per unit of population (e.g., per 100,000 persons), over a specified time period (e.g. 2009). Rates may be unstable and are not presented when the case count for a given year is less than five. The 1996-2009 rates were calculated using bridged-race intercensal population estimates for July 1, 1996-1999 and vintage 2009 postcensal population estimates for July 1, 2000-2009 (U.S. Census Bureau, 2011).

Table 2: Percent Obese Adults (Age 20+), by Year and County of Residence in Ohio, 2004-2009

	2004	2005	2006	2007	2008	2009		2004	2005	2006	2007	2008	2009
Adams	25.4	26.1	28.1	29.3	29.6	31.2	Licking	26.1	25.7	28.0	30.1	30.2	32.3
Allen	26.2	26.4	29.4	31.1	32.5	36.8	Logan	24.8	26.1	28.0	30.7	30.4	33.0
Ashland	24.8	24.9	27.0	28.7	29.2	30.4	Lorain	24.9	26.0	27.8	29.0	31.0	32.1
Ashtabula	24.7	24.6	27.2	29.5	30.5	31.0	Lucas	27.7	27.5	29.3	30.0	31.0	31.6
Athens	24.8	26.3	28.5	29.4	30.9	32.0	Madison	25.1	25.2	27.2	28.7	29.4	31.4
Auglaize	25.0	25.7	27.5	29.9	30.5	34.7	Mahoning	27.0	27.7	28.2	28.1	28.1	29.3
Belmont	24.7	25.3	28.2	29.5	29.4	30.9	Marion	27.3	27.1	28.8	30.3	29.4	31.8
Brown	25.9	26.1	27.0	29.3	30.7	34.2	Medina	25.1	25.6	27.0	27.9	28.2	27.7
Butler	26.4	27.9	29.6	30.2	30.5	31.6	Meigs	25.1	26.1	27.9	29.7	30.1	31.6
Carroll	25.3	26.8	28.5	30.1	30.0	30.6	Mercer	24.9	26.1	28.0	29.2	29.2	27.9
Champaign	26.0	26.4	27.2	28.4	29.4	33.9	Miami	25.3	26.1	27.0	28.4	29.3	30.4
Clark	28.4	29.1	29.2	30.0	30.4	32.1	Monroe	25.0	25.7	28.4	31.0	31.3	34.0
Clermont	24.6	25.7	27.6	30.7	29.7	29.9	Montgomery	26.9	28.6	29.4	30.5	30.1	31.1
Clinton	24.5	25.5	28.1	29.7	29.6	29.1	Morgan	25.2	26.1	28.1	30.3	31.1	35.6
Columbiana	25.1	25.8	29.5	31.7	32.6	35.8	Morrow	25.1	25.5	28.2	29.8	29.9	30.3
Coshocton	25.8	26.7	28.8	30.3	30.5	31.5	Muskingum	25.2	25.3	28.2	30.1	29.5	28.9
Crawford	25.0	25.2	27.6	29.2	30.5	34.2	Noble	26.1	26.9	28.7	30.5	30.4	33.1
Cuyahoga	26.4	26.1	27.4	28.3	28.2	28.1	Ottawa	24.4	25.2	27.5	29.2	30.2	33.7
Darke	26.1	26.0	27.4	28.2	28.8	31.8	Paulding	25.7	25.8	27.8	29.7	29.9	30.4
Defiance	25.4	25.8	27.4	28.6	28.4	29.1	Perry	25.6	26.3	28.0	28.8	30.4	33.6
Delaware	24.0	25.4	26.6	27.1	26.9	25.9	Pickaway	25.9	25.6	28.2	30.4	30.9	33.6
Erie	25.8	26.3	28.8	30.6	29.7	29.1	Pike	24.6	25.1	27.3	29.3	30.1	32.5
Fairfield	26.2	26.4	29.7	30.4	30.7	31.1	Portage	24.7	25.8	27.2	28.7	28.8	29.7
Fayette	25.7	26.2	27.8	29.3	29.8	30.2	Preble	24.6	25.5	27.0	28.5	29.2	30.5
Franklin	24.7	25.0	26.7	30.2	30.9	30.9	Putnam	23.8	24.4	27.5	29.9	31.1	31.2
Fulton	24.8	25.7	27.8	29.5	30.0	30.7	Richland	24.9	26.1	29.0	29.3	29.0	29.7
Gallia	26.0	25.7	27.7	29.1	29.7	32.7	Ross	26.4	26.5	28.5	31.6	32.0	34.5
Geauga	27.2	27.3	28.0	27.2	27.3	24.4	Sandusky	25.3	26.9	28.8	29.7	29.9	32.1
Greene	25.9	25.6	26.6	28.6	29.0	29.9	Scioto	26.3	27.2	30.1	32.4	31.3	33.7
Guernsey	25.0	25.9	28.2	30.2	29.8	30.5	Seneca	26.0	25.8	26.9	28.5	29.2	30.3
Hamilton	25.4	25.4	26.3	26.6	26.9	27.1	Shelby	24.6	25.4	27.4	28.5	29.3	30.3
Hancock	25.5	26.8	29.9	29.8	29.9	30.0	Stark	26.4	27.2	28.6	30.3	30.8	32.1
Hardin	24.7	25.5	27.8	29.6	30.2	31.1	Summit	27.7	28.2	28.5	27.6	28.0	29.0
Harrison	25.1	25.9	28.0	30.2	30.3	32.1	Trumbull	26.0	26.4	27.5	27.9	27.9	29.7
Henry	24.9	25.3	28.0	29.9	30.3	33.4	Tuscarawas	26.2	27.4	27.8	29.8	29.3	33.9
Highland	26.6	26.2	27.3	28.8	29.2	32.2	Union	25.9	26.4	28.5	30.1	31.7	34.4
Hocking	26.4	26.4	28.6	30.3	31.3	34.5	Van Wert	26.2	26.5	27.9	29.5	30.5	34.9
Holmes	24.5	25.1	26.3	28.1	28.6	30.7	Vinton	25.3	26.1	28.5	30.1	30.6	31.3
Huron	25.1	26.5	29.6	31.0	31.4	32.1	Warren	25.1	24.7	25.9	27.2	27.6	26.7
Jackson	24.9	25.6	28.5	30.3	31.1	34.1	Washington	24.9	25.7	28.0	30.1	30.5	33.4
Jefferson	26.5	26.6	28.8	30.8	32.2	36.5	Wayne	24.8	25.9	27.8	29.1	30.1	32.0
Knox	24.6	25.3	27.6	28.6	28.6	28.3	Williams	25.8	25.8	27.2	29.3	29.8	30.7
Lake	22.7	23.6	26.7	28.4	29.8	28.9	Wood	24.6	25.0	27.5	29.4	29.6	29.9
Lawrence	27.7	28.6	29.9	32.5	34.5	39.7	Wyandot	25.8	25.8	27.7	30.0	30.2	32.7

Source: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation, 2011.

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