# Maternal and Infant Risk Factors for Childhood Obesity

PRAMS
Pregnancy
Risk
Assessment
Monitoring
System

# Maternal and Infant Risk Factors for Childhood Obesity


## Ohio Department of Health

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Ohio Department of Health



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# Introduction

Research has indicated that the mother's health and behaviors during pregnancy and after her infant is born play an important role in her child's risk of obesity.

Obesity among children has become a substantial problem in the United States. In the past 30 years, the prevalence of childhood obesity has tripled[1]. Twenty percent of U.S. children between six and 11 years of age were obese in 2008 compared with seven percent in 1980[1]. Almost 17 percent of children and adolescents were obese in 2009-2010[2]. Children who are overweight or obese at an early age are more likely to develop chronic health problems as they age, including hypertension, diabetes, and bone and joint problems[1, 3]. Overweight and obese children are also more likely to become overweight or obese adults. This risk is even higher if either parent is overweight or obese[3].

The causes of childhood obesity are many and incompletely understood. Factors such as environment, genetics, diet, and physical activity are interwoven and difficult to isolate[3]. Research has indicated that the mother's health and behaviors during pregnancy and after her infant is born play an important role in her child's risk of obesity. For example, maternal diet and pre-pregnancy obesity can influence the risk of obesity for the child. Conditions such as gestational diabetes are more common among overweight or obese mothers and can result in an infant who is large for gestational age, which puts the child at risk for obesity in the future[4]. Daily smoking during pregnancy has been shown to be associated with childhood obesity. Smoking during pregnancy is known to reduce fetal growth, and studies have suggested that babies with fetal growth retardation have an increased risk of obesity later in life[5]. Socioeconomic status (SES) is also significant; with a great deal of research indicating that low childhood SES increases the risk of obesity for the child later in life[6].

Obesity is a major concern in Ohio as well. Data from 1998-2000 indicate that the estimated annual medical cost of obesity in Ohio was $3,304 million[7]. A report by the Ohio Department of Health looking at the health of third-grade children in 2009-2010 found that more than one-third were overweight or obese[8]. According to the 2010 Behavioral Risk Factor Surveillance System (BRFSS), 58.7 percent of adult women in Ohio were overweight

or obese. Thus, many Ohio women are overweight or obese when they become pregnant, putting themselves and their infant at risk for chronic health problems and increasing the chance that the child will be obese later in life.

Identifying a specific intervention to reduce childhood obesity is difficult given the complex interaction of environment, genetics, and behaviors. However, research has helped identify conditions and behaviors that increase the risk of obesity. This descriptive report looks at the maternal and infant characteristics and risk factors associated with childhood obesity using data from the Pregnancy Risk Assessment Monitoring System (PRAMS) survey. Determining groups of women that are disproportionately affected will allow programs and interventions to be targeted to those most at risk, and hopefully decrease the prevalence of obesity among Ohio's children.

# Executive Summary

- Forty-seven percent of Ohio mothers reported being overweight or obese just prior to pregnancy in 2009-2010.
  - Black, non-Hispanic mothers were more likely to have a high pre-pregnancy BMI than white, non-Hispanic mothers.
  - More than 60 percent of overweight and obese mothers gain more weight during pregnancy than is recommended.
- Prevalence of Gestational Diabetes Mellitus (GDM) is higher among overweight and obese women.
- Nearly 12 percent of overweight or obese mothers have an infant who is large for gestational age (LGA) at birth.
- Breastfeeding initiation increased significantly among Ohio mothers from 2000 to 2010 (OR=1.06, 95% CI 1.04-1.07).
  - The percentage still breastfeeding between two and six months after delivery was much lower than the percentage who initiated breastfeeding among all Ohio mothers.
- The prevalence of smoking before pregnancy and during pregnancy saw no considerable change from 2000 to 2010.
  - Smoking during pregnancy was much more prevalent among women on Medicaid, young mothers, and those with 12 or less years of education.
- Ninety-seven percent of mothers ate at least one serving of vegetables per day during pregnancy and 94 percent ate at least one serving of fruit per day.
  - Mothers less than 20 years of age and those that smoked during pregnancy were less likely to eat fruits and vegetables during pregnancy.
- More mothers reported exercising three or more days per week before pregnancy than during pregnancy (38 percent and 22 percent, respectively).
  - Most disparities were evident when looking at exercise before pregnancy. Mothers not on Medicaid and those with greater than 12 years of education were more likely to exercise three or more days each week.
- Low socioeconomic status (SES) can lead to health disparities very early in life. Children growing up in a low SES household are at higher risk for health problems, including obesity.
  - White, non-Hispanic mothers were more likely to have more than 12 years of education than black, non-Hispanic mothers.
  - Mothers living in metropolitan and suburban counties were also more likely to have more than 12 years of education than those living in rural or Appalachian counties.
  - Annual household income was lower for mothers living in Appalachian counties.

# Maternal and Infant Risk Factors for Childhood Obesity

# Pre-Pregnancy Body Mass Index

Body Mass Index, or BMI, is calculated using an individual's height and weight (kg/m$^2$) and is considered to be a reliable method to screen for weight problems for most adults. The standard weight categories provided by the Centers for Disease Control and Prevention (CDC) are listed below.

| BMI | Weight Status |
|---|---|
| Less than 18.5 | Underweight |
| 18.5 – 24.9 | Normal |
| 25.0 – 29.9 | Overweight |
| 30.0 and above | Obese |

According to the BRFSS in 2010, 26.8 percent of adult women in the United States were obese. This percentage was higher among Ohio women, with 29.1 percent of women reporting that they were obese. Research has indicated that high maternal BMI is associated with an increased risk that the child will be obese by four years of age[9]. Encouraging women to reach and maintain a healthy weight before pregnancy is an important part of reducing childhood obesity. The PRAMS survey asks mothers to record their pre-pregnancy weight and height. These self-reported numbers are used to calculate the pre-pregnancy BMI of each mother. Data from Ohio PRAMS from 2009-2010 indicate that 46.9 percent of mothers reported being overweight or obese prior to pregnancy (see Table 1). Self–reported weight is known to be underestimated in PRAMS. To decrease the effect of this bias, the mother's pre-pregnancy weight and height on the birth certificate were included, along with PRAMS data. To assess this data, an additional analysis was run where mothers were considered overweight or obese if their pre-pregnancy BMI was greater than 24.9 kg/m$^2$ in the PRAMS survey or in the birth certificate. In this case the percent who were overweight or obese prior to pregnancy in 2009-2010 increased to 53 percent.

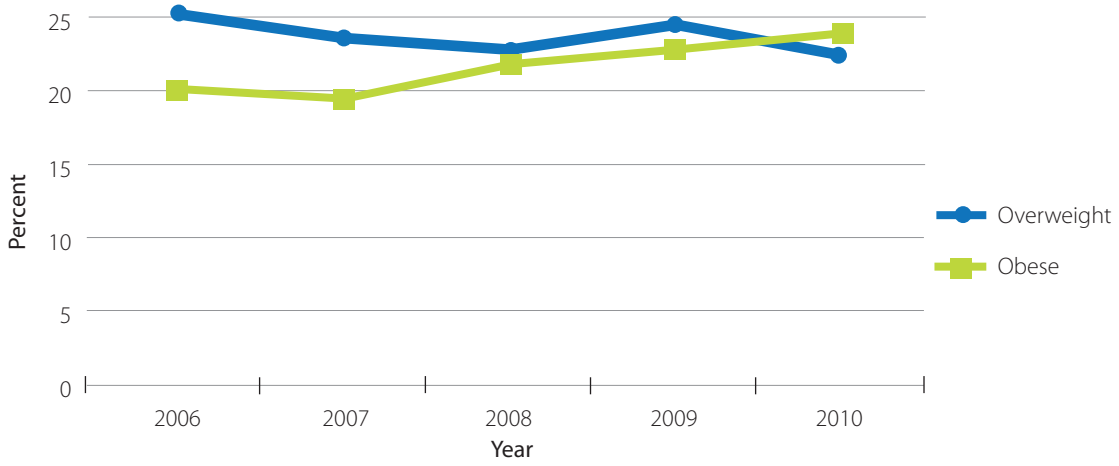
Table 1: Self-Reported Maternal Pre-pregnancy BMI, Ohio, 2009-2010

| BMI Category | Percent | 95% CI* |
|---|---|---|
| Underweight (<18.5) | 4.5 | 3.6-5.7 |
| Normal (18.5-24.9) | 47.0 | 44.5-49.6 |
| Overweight (25.0-29.9) | 24.4 | 22.2-26.6 |
| Obese (30.0 +) | 24.1 | 22.0-26.4 |

*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*
**CI stands for Confidence Interval. See Technical Notes for detailed definition.*

The prevalence of Ohio mothers with a high pre-pregnancy BMI has remained stable in recent years. As shown in Figure 1, the percentage of women who were overweight before pregnancy appears to have decreased slightly (from 25 percent to 23 percent) from 2006 to 2010, while the percentage who were obese before pregnancy rose from 20 percent to 23 percent.

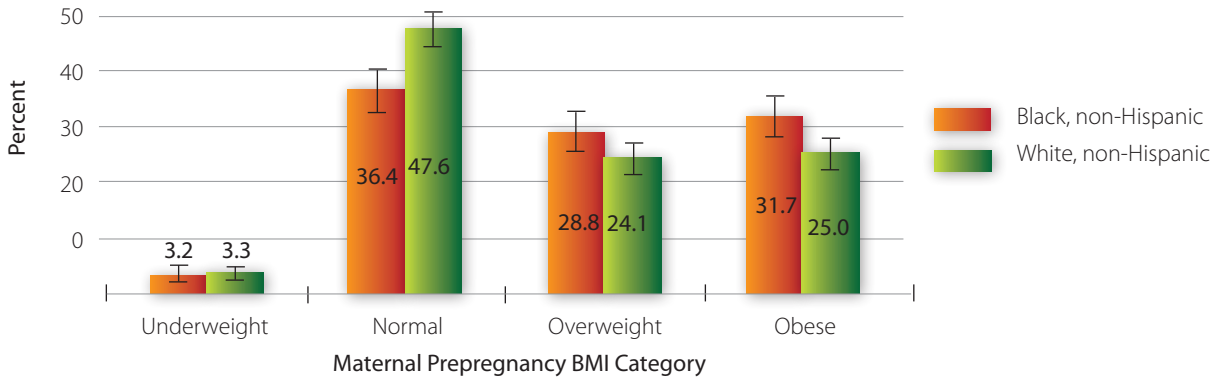
Figure 1: Mothers Who Were Overweight or Obese Prior to Pregnancy*
By Year, Ohio, 2006-2010




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*
** Overweight = BMI 25.0-29.9kg/m² , Obese = BMI >=30.0kg/m²*

High pre-pregnancy BMI is more prevalent among some Ohio women than others. Figure 2 illustrates the difference in maternal pre-pregnancy BMI category by race in Ohio. Thirty-six percent of black, non-Hispanic mothers reported being a normal weight before pregnancy while 47 percent of white, non-Hispanic women reported being normal weight. The percentage of mothers who were obese before pregnancy was higher among black, non-Hispanic women than white, non-Hispanic women (31.7 percent and 25.0 percent, respectively).

Figure 2: Maternal Pre-pregnancy BMI Category, By Race, Ohio, 2009-2010




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

Women who gain too much weight during pregnancy are at risk for obesity-related health conditions and are more likely to struggle with weight loss after delivery. Their infants are also more likely to have a high birth weight, increasing the risk of delivery complications. The Institute of Medicine (IOM) produced updated recommendations for maternal weight gain based on pre-pregnancy BMI in 2009. These recommendations are listed in Table 2.

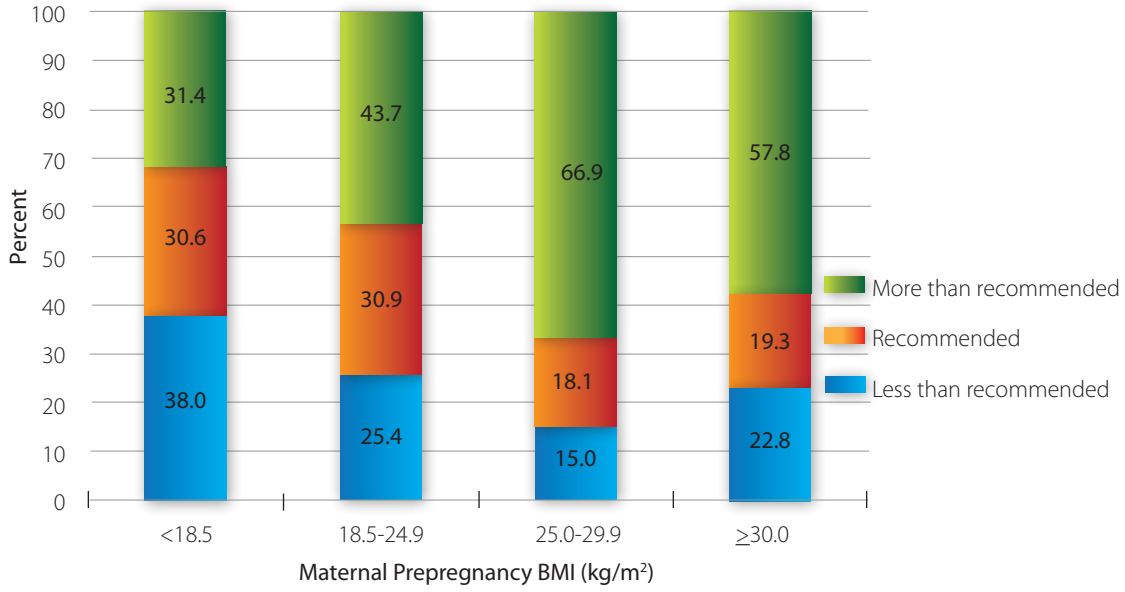
Table 2: IOM Maternal Weight Gain Recommendations (2009)

| Pre-pregnancy BMI | Total Weight Gain (lbs) |
|---|---|
| <18.5 (underweight) | 28-40 |
| 18.5-24.9 (normal) | 25-35 |
| 25.0-29.9 (overweight) | 15-25 |
| ≥30.0 (obese) | 11-20 |

*Source: Institute of Medicine, May 28, 2009*

Figure 3 looks at maternal weight gain among Ohio mothers according to pre-pregnancy BMI. The figure indicates that a high percentage of mothers who were overweight or obese prior to pregnancy gain more weight during pregnancy than is recommended. Overall, 50.7 percent of women in Ohio gained more weight during pregnancy than recommended.

Figure 3: Maternal Weight Gain During Pregnancy, By Pre-pregnancy BMI, Ohio, 2009-2010




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

# Gestational Diabetes Mellitus (GDM)

Pregnancies complicated by diabetes increase the risk of adverse outcomes for the infant; including high birth weight and obesity later in life. This is especially true when diabetes is not controlled properly[10]. As obesity has increased in the United States, so too has the prevalence of diabetes. It is estimated that diabetes mellitus affects between four and six percent of pregnancies nationally[10]. Most of these are gestational diabetes mellitus (GDM), which is first diagnosed during pregnancy. Women with GDM are unable to regulate blood sugar due to glucose intolerance, leading to high blood sugar[11]. Women diagnosed with GDM are more likely to develop type 2 diabetes in the years following the pregnancy. The risk of GDM has been shown to increase with increasing maternal age. Overweight and obese women are at higher risk for type 2 diabetes as well as GDM[11].

According to Ohio PRAMS 2009-2010, 10.1 percent of mothers were diagnosed with GDM and 1.8 percent of mothers were diagnosed with pre-pregnancy diabetes. Table 3 below shows that the percentage of mothers diagnosed with GDM was not substantially different by race or Medicaid status.

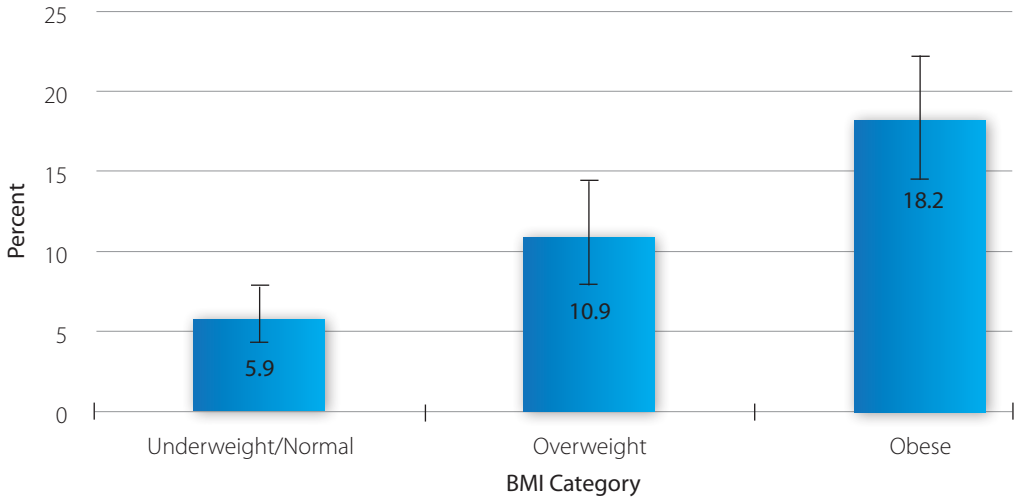
**Table 3: Mothers Who Were Diagnosed with GDM, Ohio, 2009-2010**

| Characteristic | Percent | 95% CI |
|---|---|---|
| Overall | 10.1 | 8.6-11.7 |
| Race | | |
| White, non-Hispanic | 9.8 | 8.1-11.8 |
| Black, non-Hispanic | 11.5 | 9.3-14.1 |
| Medicaid Status | | |
| Medicaid | 11.4 | 9.3-14.0 |
| No Medicaid | 8.8 | 7.0-10.9 |

*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

Being overweight or obese does appear to increase the risk of GDM in Ohio. Figure 4 indicates that the prevalence of GDM increases with increasing pre-pregnancy weight. Obese mothers were more likely to be diagnosed with GDM than underweight or normal weight mothers.

Figure 4: Mothers Who Were Diagnosed with GDM, By BMI Category, Ohio, 2009-2010




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

** BMI : Underweight (<18.5kg/m$^2$), Normal (18.5-24.9kg/m$^2$), Overweight (25.0-29.9kg/m$^2$), Obese (>=30.0kg/m$^2$)*

# Large for Gestational Age (LGA)

The National Institutes of Health defines LGA as an infant with a birth weight that exceeds the 90th percentile. Women who are overweight or obese or who have gestational diabetes have an increased risk of having a LGA infant[5]. The rising prevalence of obesity has led to an increase in LGA infants in the United States. Studies have found that the increase in infant birth weight is attributable to the increase in women's BMI over the past several decades[5]. Infants who are LGA are more likely to be overweight or obese in adolescence and adulthood, which in turn puts their offspring at risk for being LGA[5].

Table 4 looks at LGA infants in Ohio among mothers overall and by select maternal characteristics. While the disparities are not substantial, overweight and obese mothers do have a slightly higher risk of having an LGA infant.

**Table 4: Mothers Whose Infant Was LGA at Birth, By Select Maternal Characteristics, Ohio, 2009-2010**

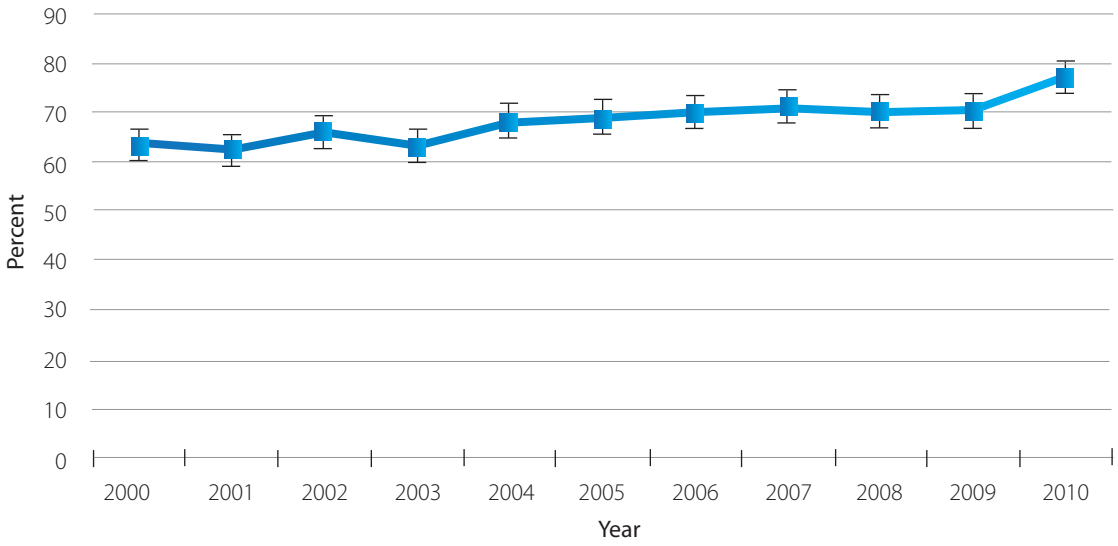
| Characteristic | Percent | 95% CI |
|---|---|---|
| Overall | 9.7 | 8.3-11.3 |
| Race | | |
| White, non-Hispanic | 10.2 | 8.5-12.2 |
| Black, non-Hispanic | 9.1 | 7.0-11.7 |
| Medicaid Status | | |
| Medicaid | 7.6 | 5.8-9.8 |
| No Medicaid | 11.7 | 9.6-14.2 |
| WIC Status | | |
| WIC | 8.3 | 6.4-10.7 |
| Non-WIC | 10.9 | 9.0-13.3 |
| Maternal Pre-Pregnancy BMI | | |
| Underweight/Normal | 7.0 | 5.3-9.1 |
| Overweight | 13.3 | 10.0-17.4 |
| Obese | 11.4 | 8.4-15.2 |

*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

## Breastfeeding

Breast milk provides optimal nutrition for the health and development of the infant[12]. The complexity of obesity can make determining the association between breastfeeding and childhood obesity difficult. For example, both low socioeconomic status and high pre-pregnancy BMI are known to be associated with decreased breastfeeding as well as childhood obesity[13]. While there are many potential confounders, it is well documented that breastfeeding seems to have a small effect on reducing childhood obesity[13]. Healthy People provides ten-year national objectives for improving the health of all Americans. The Healthy People 2020 goal for breastfeeding is for 81.9 percent of mothers to initiate breastfeeding. Ohio has so far fallen short of this target, with 77.1 percent of mothers ever breastfeeding in 2010. Figure 5 illustrates the change in mothers who ever breastfed from 2000 through 2010. Logistic regression analyses indicate that the increase over these years is statistically significant (OR = 1.06, 95% CI 1.04-1.07).

Figure 5: Mothers Who Ever Breastfed Their Infant, By Year, Ohio, 2000-2010

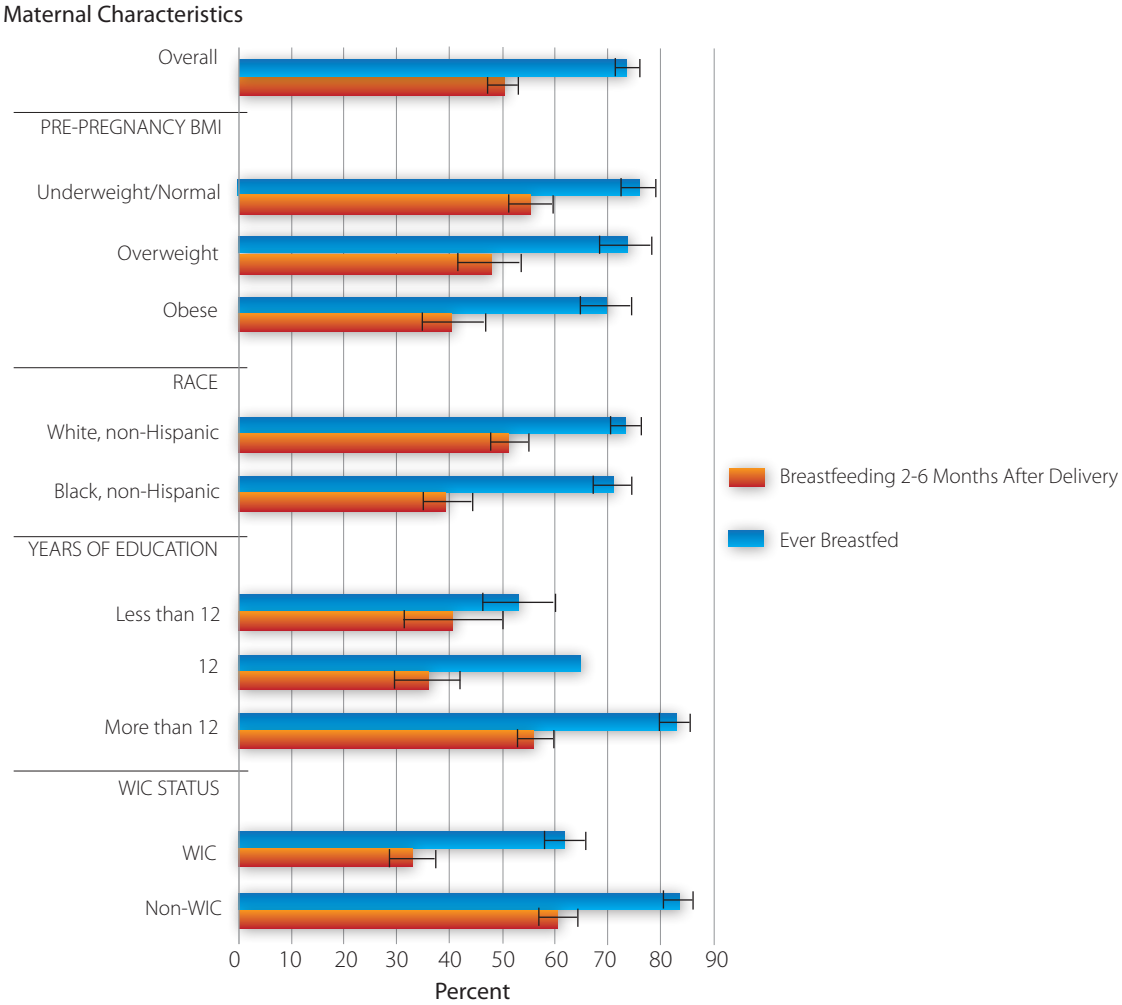



*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

The World Health Organization recommends exclusive breastfeeding for the first six months of life[12]. While the effect of confounding variables is not well understood, research has implicated that infants who continue breastfeeding seem to have a reduced risk of obesity in childhood[13].

Figure 6 compares the prevalence of Ohio mothers who ever breastfed with those who were still breastfeeding at the time the PRAMS survey was completed (between two and six months after delivery). Maternal characteristics known to be associated with breastfeeding initiation and duration were also included to identify potential disparities. Women of low SES (receiving WIC and with lower education) were much less likely to initiate breastfeeding and more likely to stop breastfeeding before the infant reached two to six months of age. However, according to 2009-2010 PRAMS data, 64.9 percent of mothers on WIC who spoke with a breastfeeding counselor initiated breastfeeding compared to 41.0 percent of WIC mothers who did not speak with a breastfeeding counselor. Black, non-Hispanic mothers and those who were overweight or obese before pregnancy had similar percentages of breastfeeding initiation as white, non-Hispanic and underweight or normal weight mothers but were more likely to stop breastfeeding by the time the PRAMS survey was completed two to six months after birth.

**Figure 6: Women Having a Live Birth Who Ever Breastfed and Who Were Still Breastfeeding 2-6 Months After Delivery, Ohio, 2009-2010**



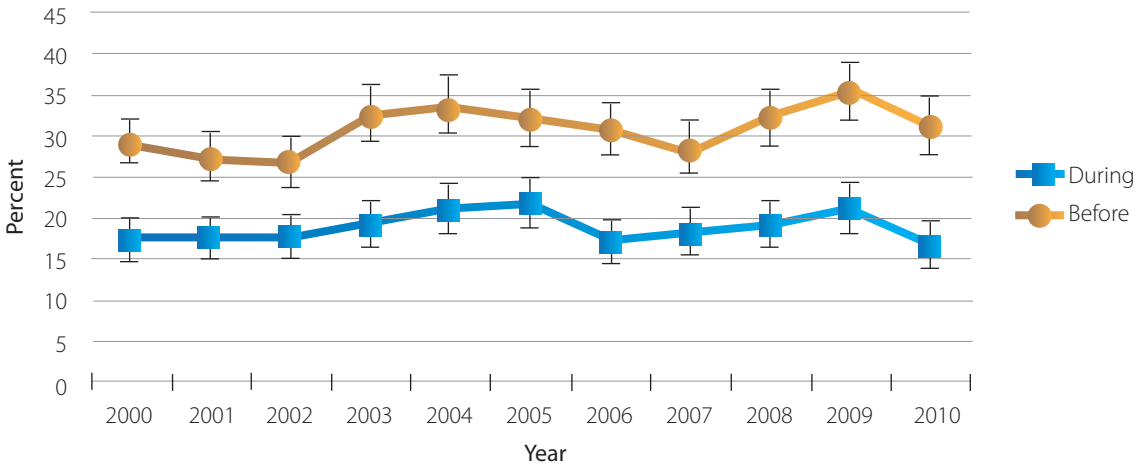

*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

## Cigarette Smoking

Poor fetal development is well documented among women who smoke[14]. The association between maternal smoking and childhood obesity has been demonstrated many times despite the fact that the details behind the relationship are not well understood[15]. Smoking during pregnancy increases the risk that the infant will be underweight at birth. These infants often gain weight quickly in the first year of life. One theory is that this "catch-up growth" leads to a higher BMI in childhood[15]. One study found that while babies born to mothers who smoked weighed less at birth, they were significantly more likely to be overweight or obese by the time they reached adolescence[16]. Secondhand smoke exposure has also been linked to obesity in adulthood. Recent studies have shown that individuals exposed to secondhand smoke had a higher BMI than those not exposed to cigarette smoke[17]. According to 2009-2010 Ohio PRAMS, 13.2 percent (95% CI 11.5-15.1) of mothers reported that smoking was allowed in their home.

The Centers for Disease Control and Prevention has found that the rate of smoking among women in the United States has remained steady over the last five years. BRFSS data from 2010 indicate that 15.8 percent of adult women in the United States are smokers. Ohio fares worse than the national figures in BRFSS, with 22.1 percent of adult women smoking in 2010. The PRAMS survey asks women if they smoked cigarettes in the three months before becoming pregnant. In 2010, 31.1 percent of women with a recent live birth reported smoking in the three months before pregnancy. The percentage of women who smoked in the three months before pregnancy and in the last three months of pregnancy did not change significantly from 2000 to 2010, as shown in Figure 7 below.

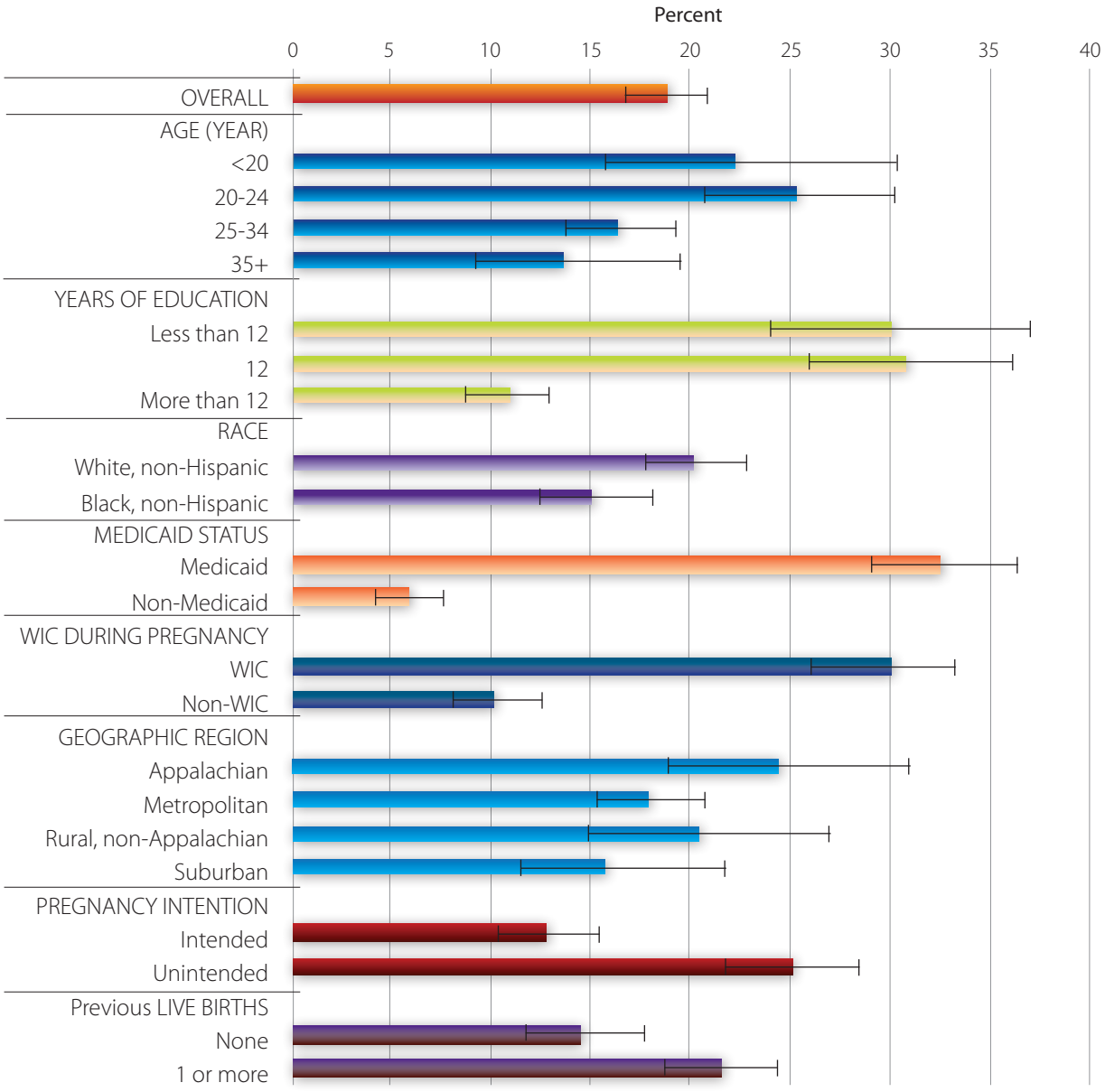
**Figure 7: Mothers Who Smoked in the 3 Months Before Pregnancy and Who Smoked During the Last 3 Months of Pregnancy, By Year, Ohio, 2000-2010**




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

Cigarette smoking is more prevalent among certain groups of women. For example, women who are white and those with little income and education are more likely to use tobacco[14]. Disparities are evident when looking at Ohio mothers who smoked during the last three months of pregnancy (Figure 8). Mothers who received Medicaid were approximately five times more likely to smoke during pregnancy than mothers without Medicaid. Young mothers as well as those with 12 or less years of education were also more likely to smoke in the last three months of pregnancy.

Figure 8: Mothers Who Smoked During the Last 3 Months of Pregnancy, By Select Maternal Characteristics, Ohio, 2009-2010



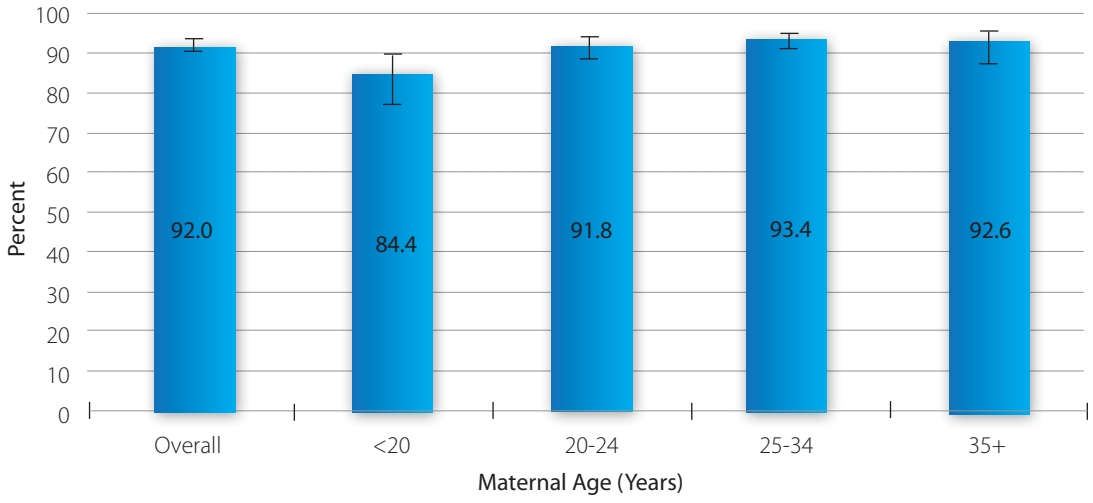

*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

# Daily Fruit and Vegetable Intake During Pregnancy

A diet including adequate amounts of fruits and vegetables promotes healthy weight and prevents chronic health conditions. A balanced, healthy diet that includes fruits and vegetables is important during pregnancy to prevent excessive weight gain and provide the optimal environment for the baby to grow and develop. Consuming fruits and vegetables continues to be important during the child's first few years, as studies have found that children whose mothers eat the recommended amount of fruits and vegetables daily are more likely to eat more fruits and vegetables themselves[18].

The National Institutes of Health recommends that women receive five servings of fruit and vegetables each day. 2009 BRFSS data show that 24.6 percent of adult women in Ohio consumed at least five servings of fruit and vegetables each day. This is slightly less than the 2009 BRFSS national figure, which indicates that 27.7 percent of adult women in the United States eat at least five servings of fruit and vegetables each day. A report completed by the CDC in 2010 found that the prevalence of fruit and vegetable consumption in the United States has not improved in recent years, although fruit consumption was generally higher than vegetable consumption[19]. According to Ohio PRAMS data from 2009-2010, 92 percent of mothers reported eating at least one fruit and one vegetable serving daily during the last three months of pregnancy. Mothers less than 20 years of age were slightly less likely to eat fruit and vegetables during pregnancy, as shown in Figure 9 below.

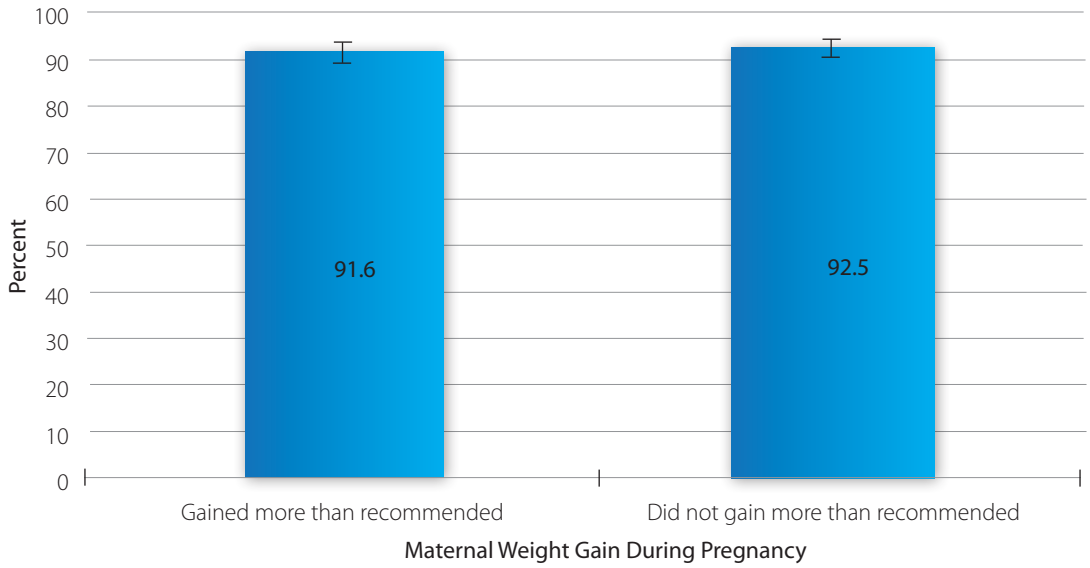
Figure 9: Mothers Who Consumed at Least One Serving of Fruit and One Serving of Vegetables Per Day During the Last 3 Months of Pregnancy, By Maternal Age, Ohio, 2009-2010




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

Figure 10 shows the percentage of women who ate at least one serving of fruit and vegetables by maternal weight gain during pregnancy. No difference was found when comparing those who gained more weight than recommended with those who did not gain more than recommended.

Figure 10: Mothers Who Consumed at Least One Serving of Fruit and Vegetables Per Day During Pregnancy, By Maternal Weight Gain, Ohio, 2009-2010




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

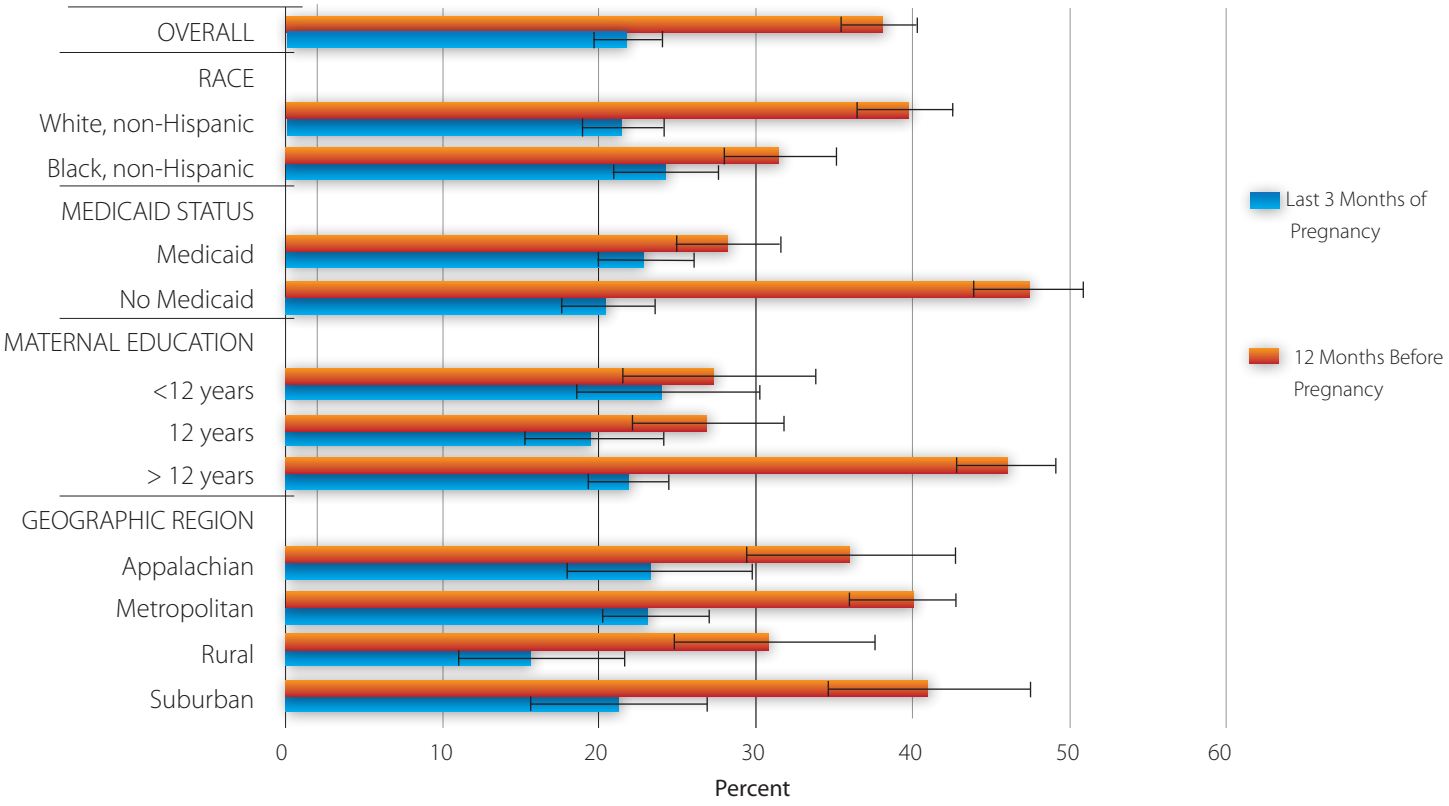
## Physical Activity Before and During Pregnancy

Regular exercise is crucial to combat obesity and is especially important for women in their childbearing years. Women who are physically active are less likely to have pregnancy complications associated with obesity including gestational diabetes, preeclampsia, and cesarean delivery. Exercise also reduces the risk of pregnancy weight retention in the postpartum period[20]. It has been well-documented that children of overweight and obese women are more likely to be overweight or obese themselves. While many factors contribute to this, recent research suggests that physical activity before and during pregnancy improves the health of the mother while decreasing the risk that her infant will eventually be obese[20].

The American College of Obstetricians and Gynecologists recommends that healthy women with a low-risk pregnancy participate in 30 minutes of physical activity on most, if not all, days of the week. Data from the BRFSS in 2009 indicate that 76.3 percent of adult women in Ohio exercised at least three days each week. The national BRFSS figure for 2009 was similar, with 75 percent of women reporting this amount of exercise.

The Ohio PRAMS survey asks mothers how often they participated in any physical activities for at least 30 minutes in the three months before becoming pregnant and in the last three months of pregnancy. Mothers who reported exercising three or more days per week in 2009-2010 are shown in Figure 11 on the next page by selected maternal characteristics. More mothers reported adequate exercise before pregnancy than during pregnancy (38 percent and 21.7 percent respectively). As Figure 11 indicates, mothers not on Medicaid and those with more than 12 years of education had the highest prevalence of exercise three or more days per week in the three months before pregnancy. There was a sharp decrease in exercise during the last 3 months of pregnancy within these groups however. It is interesting to note that the disparities seen when looking at exercise before pregnancy seem to disappear when looking at exercise during the last 3 months of pregnancy. The reasons for this are unclear, and further analysis is needed to determine why this occurred.

Figure 11: Mothers Who Exercised At Least 3 Days Per Week Before and During Pregnancy, Ohio, 2009-2010



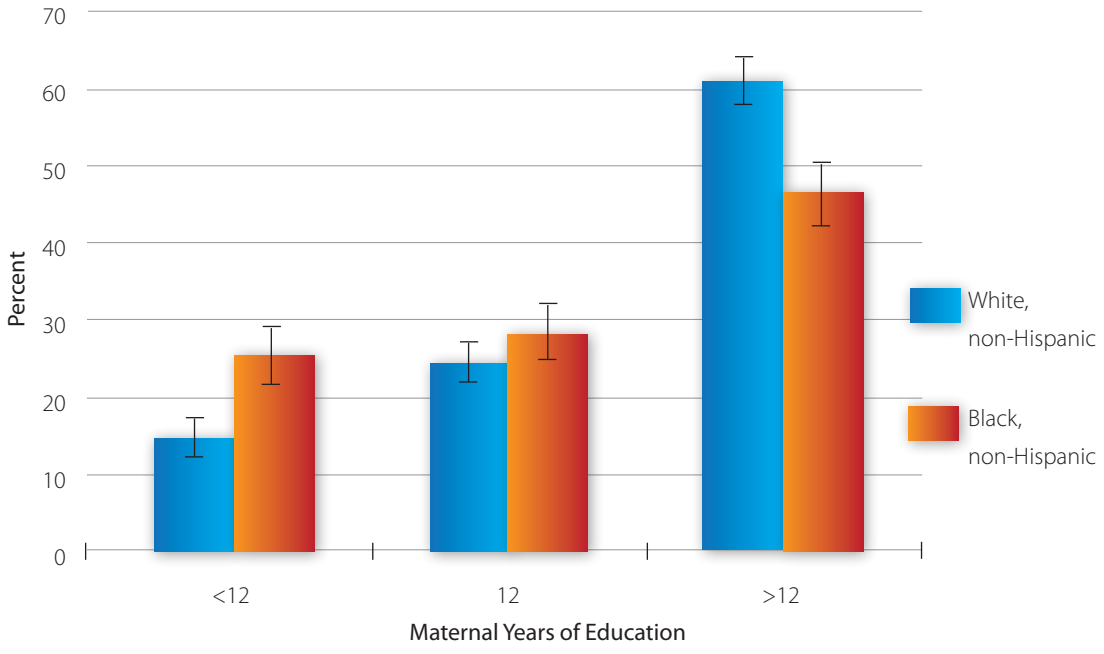

*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

# Maternal Education

Low SES can lead to health disparities very early in life. Infant mortality, low birth weight, obesity, and high infant weight gain are all more likely in low SES groups[4]. Identifying the effects of SES on maternal and infant health is important in order to create effective programs and policies to improve health for those at risk. SES is challenging to assess since it is not defined by a standard set of measures. Education is commonly used as a proxy for SES. The mother's education generally reflects overall wealth and earning potential. Household income is also a good measure of financial security. While both play a significant role in determining health and SES, they do not always paint a complete picture. There are many potential confounders, including geographic location and racial disparities.

Previous studies have indicated an inverse relationship between maternal education and childhood obesity[21]. As seen in earlier sections of this report, low education and other indicators of lower SES (such as Medicaid or WIC participation) are all associated with risk factors for childhood obesity. A study using data from the National Health and Nutrition Examination Survey found that children living in households where a parent has a college degree are less likely to be obese than children living in households with lower parental education, although inconsistencies among racial and ethnic groups do exist[22]. Figure 12 below illustrates the differences in education by race in Ohio. White, non-Hispanic mothers are more likely to have greater than 12 years of education than black, non-Hispanic mothers.

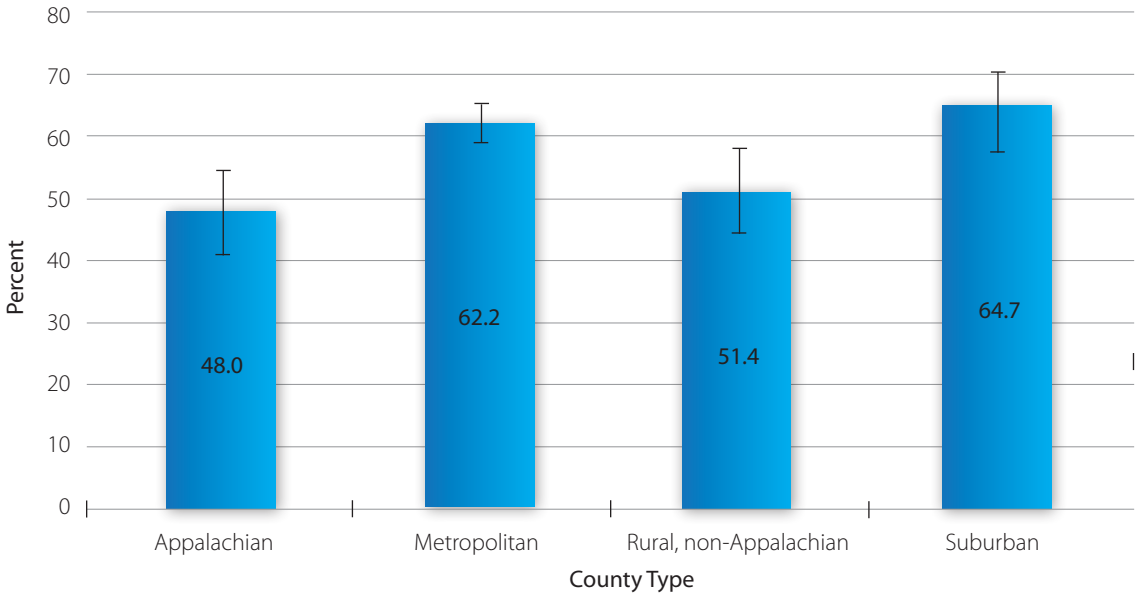
Figure 12: Maternal Education, By Race, Ohio, 2009-2010




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

Mothers living in certain regions of Ohio are more likely to obtain education beyond high school than others. Figure 13 shows that mothers living in metropolitan or suburban counties are more likely to have greater than 12 years of education than those living in rural or Appalachian areas.

Figure 13: Mothers With More Than 12 Years of Education, By County Type, Ohio, 2009-2010

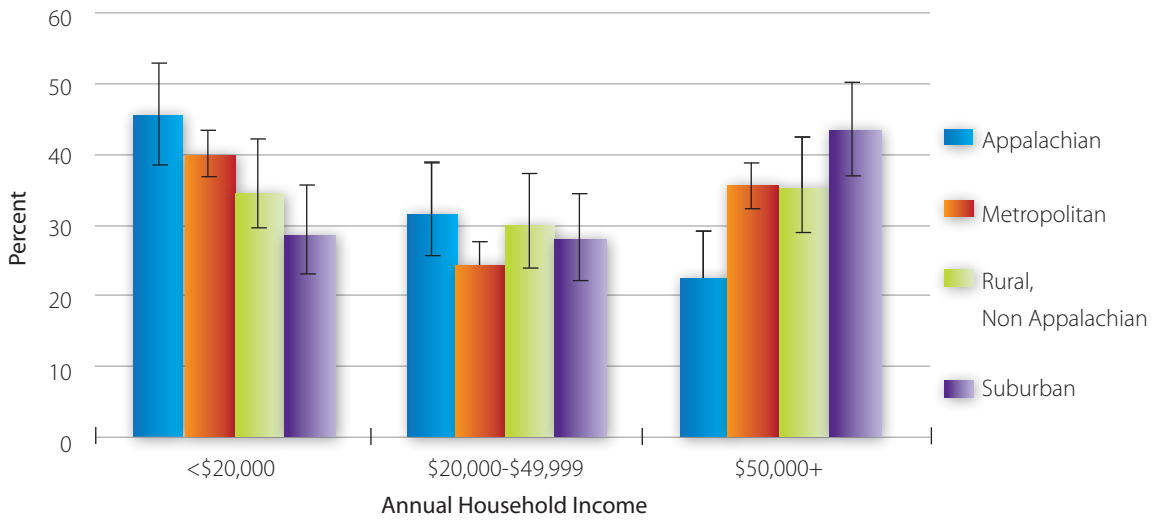



*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

# Household Income

Household income may also have an effect on the level of education obtained as tuition and time away from work for post-secondary schooling can be barriers. The PRAMS questionnaire asks mothers about their total household income in the 12 months before the baby was born. It is important to note that the number of individuals living in the household was not taken into account for this analysis, and would affect the poverty level of the household. Further analysis incorporating the federal poverty level thresholds would provide a more complete picture of poverty among Ohio mothers. Ohio has distinct differences in household income by geographic region. As shown in Figure 14, the annual household income for mothers living in Appalachian counties is lower than those living in suburban parts of the state.

Figure 14: Annual Household Income of Ohio Mothers, By County Type, Ohio, 2009-2010




*Source: Ohio Pregnancy Risk Assessment Monitoring System, Ohio Department of Health*

## Summary and Conclusion

The number of overweight and obese children in the United States has increased dramatically over the last several decades. This is a serious concern as obese children are at greater risk for chronic health problems as they age. While the direct causes of childhood obesity are complex, a mother's health and behaviors have been shown to play a role in her child's risk for obesity.

The prevalence of obesity in Ohio has increased in recent years. Nearly half of Ohio mothers reported being overweight or obese just prior to pregnancy in 2009-2010. The prevalence of overweight and obesity is greater among black, non-Hispanic mothers than white, non-Hispanic mothers. Because these mothers are more likely to live in lower income areas, access to fresh, healthy food may be limited. The processed, high-calorie food that is available is inexpensive, but contains little nutrition and likely contributes to obesity within this population.

About half of Ohio mothers gain more weight than is recommended during pregnancy. Many of the women who gain too much were overweight or obese before becoming pregnant. It is important for health care providers to encourage all women of reproductive age to maintain a healthy weight before becoming pregnant. Health care providers should educate pregnant women about appropriate weight gain and provide strategies to avoid gaining too much during pregnancy.

Infants born to mothers with GDM or those born LGA have been shown to have an increased risk for obesity in childhood. The risk of GDM and having an LGA infant seems to be greatest for women who were overweight or obese before pregnancy. No significant racial disparities were noted with GDM or LGA. Managing chronic health conditions and encouraging these women to attain a healthy weight before becoming pregnant is important to decrease the risk of GDM and LGA infants.

Breastfeeding provides ideal nutrition for the infant and has been shown to play a role in reducing the risk of childhood obesity. The prevalence of breastfeeding initiation in Ohio has steadily increased from 2000 to 2010, but still falls short of national goals. While nearly 75 percent of Ohio mothers initiated breastfeeding, the percentage still breastfeeding several months after delivery was much lower. Black, non-Hispanic mothers and those with lower SES were more likely to stop breastfeeding within the first few months after delivery. Hospitals, birth centers, and health clinics should provide clear messages to support and encourage breastfeeding. This education should reach diverse groups of women, especially those with low SES. This analysis of PRAMS data did find that women receiving WIC who spoke with a breastfeeding counselor were more likely to initiate breastfeeding than WIC mothers who did not speak with a counselor. This indicates that counseling and education about breastfeeding for pregnant mothers receiving WIC may increase the likelihood of breastfeeding.

Perinatal cigarette smoking leads to poor fetal development and an increased risk of childhood obesity along with many other negative health impacts. The prevalence of smoking in Ohio is higher than national figures and smoking before and during pregnancy did not change significantly from 2000 to 2010. Smoking during pregnancy is more prevalent among young, white, low-income, low education, and Medicaid-enrolled women. Evidence-based smoking cessation programs should be implemented in clinics and hospitals where these women are patients in order to effectively reduce smoking before and during pregnancy.

No significant disparities were found when looking at maternal fruit and vegetable consumption, although analysis for this topic is limited since mothers are only asked about how many servings of each they consumed each day. There were some disparities when looking at physical activity before pregnancy. Women who received Medicaid and those with low education were much less likely to exercise at least three days per week before pregnancy. Further analysis is needed to determine the reasons for this, but low SES mothers may have trouble accessing exercise facilities and may be more likely to live in an area where it is unsafe to exercise outdoors. The disparities seen when looking at exercise before pregnancy seem to disappear when looking at exercise during the last three months of pregnancy. Additional analysis is needed to understand this, but exercise may become difficult for many women in the late stages of pregnancy, when increasing size and symptoms such as swollen feet or ankles make movement uncomfortable.

According to 2006-2010 data from the U.S. Census, about 14 percent of Ohio residents lived in poverty[23]. Poverty rates were higher in rural and Appalachian counties. Women and children with low SES have an increased risk of poor health outcomes, including obesity. Limited access to nutritious food and safe places to exercise can create challenges in maintaining a healthy lifestyle. The prevalence of smoking was also higher in these areas, and fewer women reported breastfeeding. Mothers living in Appalachian counties reported having a lower household income than mothers living in other county types. In addition, higher education was more prevalent in metropolitan and suburban counties. Women able to pursue an education may move to urban areas for that purpose and stay in urban areas after graduation, where jobs are located. Proximity to colleges and universities may also make enrolling in college courses easier for women living in metropolitan and suburban counties.

Childhood obesity has become increasingly prevalent throughout the United States, including Ohio. Identifying risk factors as well as the populations most likely to be obese is important to target programs and interventions effectively. Encouraging women of reproductive age to maintain a healthy weight, be physically active, eat a healthy diet, and avoid cigarette smoking are all important steps in reducing the risk of obesity for children.

## Data Source and Limitations

PRAMS was initiated by the Centers for Disease Control and Prevention (CDC) in 1987 to reduce infant mortality and low birth weight. Ohio has participated in this survey since 1999. PRAMS is a randomly sampled ongoing mail survey with telephone follow-up that assesses the behaviors and experiences of the mother before, during and shortly after pregnancy. The goal of PRAMS in Ohio is to gain a better understanding of maternal risk factors to improve the health of women and infants. Because it is a survey, PRAMS results are susceptible to several biases. The first is non-response, or refusal to participate. Second is measurement, which includes social desirability (answering a question the way the individual believes will be viewed favorably) and recall bias (inability to remember correctly). Third is non-coverage bias, or the inability to reach certain high-risk populations. Additionally, the data are self-reported and not verified by a physician or through medical records. PRAMS data are also limited to women who have recently had a live birth and therefore cannot be extrapolated to all women who become pregnant in Ohio. However, PRAMS is a useful data source because it was developed specifically to assess the health outcomes and behaviors of women of reproductive age.

# Technical Notes

For purposes of this descriptive report, variables were examined independently without control for covariates and/or potential confounders. It is possible that application of methods to statistically control for covariates would alter the prevalence measures reported here.

Bars in the figures represent 95 percent confidence intervals (CI) and have been reported to assist in interpretation of the data. However, no formal statistical tests were conducted for this report and only point estimates have been compared and contrasted in describing these results.

A 95 percent CI is a range that conveys information about the precision of a survey estimate. Specifically, if the sampling was repeated numerous times and the CI was recalculated from each sample by the same method, 95 percent of the CIs would contain the true population value. A wide CI suggests that the estimate is unstable.

County types are as defined by the 2010 Ohio Family Health Survey and are grouped as follows:

| County Type | Counties |
|---|---|
| Metropolitan | Allen, Butler, Cuyahoga, Franklin, Hamilton, Lorain, Lucas, Montgomery, Richland, Summit, Stark |
| Suburban | Auglaize, Clark, Delaware, Fairfield, Fulton, Geauga, Greene, Madison, Medina, Miami, Lake, Licking, Pickaway, Portage, Union, Wood |
| Rural, non-Appalachian | Ashland, Champaign, Clinton, Crawford, Darke, Defiance, Erie, Fayette, Hancock, Hardin, Henry, Huron, Knox, Logan, Marion, Mercer, Morrow, Ottawa, Paulding, Preble, Putnam, Sandusky, Seneca, Shelby, Van Wert, Warren, Wayne, Williams, Wyandot |
| Appalachian | Adams, Ashtabula, Athens, Brown, Belmont, Carroll, Clermont, Columbiana, Coshocton, Gallia, Guernsey, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Lawrence, Mahoning, Meigs, Monroe, Morgan, Muskingum, Noble, Perry, Pike, Ross, Scioto, Trumbull, Tuscarawas, Vinton, Washington |

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Notes

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