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The purpose of this study was to examine if environmental factors were related to gestational weight gain in Portage County, Ohio women enrolled in the Supplemental Nutrition Program for Women, Infants, and Children (WIC). A paper based questionnaire was completed by female WIC participants 18 years of age or older in the second trimester of pregnancy or greater or by postpartum women within a six month delivery period (n=100). Means and standard deviations were used to describe differences in education, race, age, parity, pregnancy intention, breastfeeding history, diet, pre-pregnancy BMI, smoking status, sleep patterning, physical activity, gestational weight gain classification, federal poverty line percentage, food security classification, and SNAP recipient classification among participants. A Kruskal-Wallis Test and Backwards Regression were performed for all significant analyses. This study demonstrated demographic, pregnancy history and intention, lifestyle patterns, anthropometrics, and socioeconomic variables had little effect on a woman’s gestational weight gain classification (inadequate, recommended or excessive weight gain). However, there was a significant (p=0.02) relationship between a woman’s past breastfeeding history and her gestational weight gain classification. Women who had breastfed in the past for six continual months, were more likely to gain recommended gestational weight gain, suggesting a need for WIC dietitians to promote this factor over all others.
ACKNOWLEDGEMENTS

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Lastly, I would like to express appreciation to all pregnant and postpartum women who volunteered their time and agreed to take part in my study. Your input and responses will help produce better health outcomes for Portage County women.
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CHAPTER I
INTRODUCTION

Overview of Literature

Currently, there are over two million women of reproductive age in the state of Ohio, and it is estimated 197,000 of these women will become pregnant annually (Guttmacher Institute, 2011). During pregnancy, health practitioners urge females to gain an appropriate amount of gestational weight gain in order to promote positive birth outcomes. The above message is promoted because research has shown inadequate gestational weight gain is linked to delivery of a small for gestational age infant and an increase in infant mortality (Davis, Hofferth, & Shenassa, 2013) while excessive gestational weight gain also poses its own complications for mother and infant.

Throughout pregnancy, excessive gestational weight gain is linked to abnormal blood glucose levels, shoulder dystocia, and large-for-gestational age in the infant and preeclampsia, gestational diabetes mellitus, and caesarean delivery for mother (Langford, Joshu, Chang, Myles, & Leet, 2011; Morisset et al., 2011; Weisman et al., 2012). While these immediate pregnancy complications have shown to be inconvenient and increase the mother and infants’ hospital length of stays, side effects of excessive gestational weight gain continue in the postpartum period for both mother and infant. Numerous studies have shown excessive gestational weight gain is associated with weight retention and risk of becoming overweight after delivery for the mother and is also associated with higher weight for height in infancy, childhood, and adolescence (Amorim, Rossner,
Carrying excess weight places all individuals at increased risk of costly, chronic disease such as type 2 diabetes mellitus, cardiovascular disease, metabolic syndrome, cancer, and musculoskeletal disease (Coulston & Boushey, 2008; Mahan, Stump, & Raymond, 2012; Shils, Shike, Ross, Cabellero, & Cousins, 2006).

As a result of the above side effects, the Institute of Medicine (IOM) released new gestational weight gain recommendations in 2009. These new recommendations differ from the 1990 recommendations in the fact that women with an obese pre-pregnancy BMI are now instructed to gain 11-20 pounds throughout pregnancy while the 1990 guidelines set a 15 pound minimum (National Institutes of Medicine, 1990; National Institutes of Medicine 2009). In its revision, the IOM cited the scarcity of gestational weight gain data on women from racial and ethnic minority groups and women of food assistance programs (National Institutes of Medicine, 2009).

On average, 50.36% of women in the state of Ohio have excessive weight gain during pregnancy while in Portage County this number is even more alarming at 55.59 percent (Portage County Maternal and Child Health Indicators, 2013). Past research has shown the explanation and rationale behind excessive gestational weight gain is multi-faceted including demographic, socioeconomic, and behavioral factors and differs across geographic locations (Brawarsky et al., 2005; Wells, Schwalberg, Noonan & Gabor, 2006). In Portage County, the per capita average income is significantly less than the
state average, and as a result, 2,585-2,746 women and infants rely on the Supplemental Food Assistance Program for Women, Infants, and Children (WIC) monthly (Ohio Department of Job and Family Services, 2008). Funded by the United States Department of Agriculture (USDA), WIC provides supplemental foods of high nutrient content along with nutrition education, breastfeeding support and referrals to health and social services to low-income pregnancy and postpartum women, and children up to age five. Research has shown WIC women face a multitude of health disparities due to socioeconomic status, so studying their health related behaviors is critical in years to come and will fulfill the National Institute of Medicine’s research need for gestational weight gain data from women enrolled in food assistance programs (United States Department of Agriculture, 2013; Whaley, Koleilat, & Jiang, 2012).

**Statement of the Problem**

Excessive gestational weight gain is a current problem in the state of Ohio (Portage County Maternal and Child Health Indicators, 2013). The problem is even more severe in Portage County related to it being a socioeconomically disadvantaged region (Ohio Department of Jobs and Family Services, 2008). Targeting the environmental, modifiable risk factors that influence a specific behavior in a given location is one way researchers are beginning to attempt to solve the excessive gestational weight gain epidemic today.

By obtaining this environmental, modifiable risk factor data in both pregnant and postpartum women, dietitians can begin to target specific nutrition messages to pregnant
mothers improving their and their child’s health outcomes. Much research has shown both non-modifiable and modifiable risk factors contribute to excessive gestational weight gain, however results have been conflicting across various geographic locations (Brawarsky et al., 2005; Wells, Schwalberg, Noonan & Gabor, 2006). Non-modifiable risk factors include socioeconomic status, education level, ethnicity, and age while modifiable risk factors include exercise status, smoking status, and meal patterning. Furthermore, many studies have shown low socioeconomic status and the use of supplemental food assistance programs place all individuals at risk of becoming overweight or obese (Adler & Rehkkof, 2008; Leung, Willet, & Ding, 2012). Unfortunately, little research combines the above variables and describes weight patterning during pregnancy in high risk, subsidized populations in order to prevent future weight gain outside of Institute of Medicine recommendations.

Portage County’s 2013 Report thoroughly examines most maternal and child health indicators, yet this research again fails to find relations between the variables or examine the specific factors that contribute to excessive gestational weight gain in women (Portage County Maternal and Child Health Indicators, 2013). A more exhaustive list looking at risk factors in combination would be helpful to obtain in order to promote behavior change of Portage County residents. Today, more updated non-modifiable and modifiable risk factor data contributing to excessive gestational weight gain in the geographic specific location of Northeast Ohio is needed and can be obtained from a subsidized, WIC population.
Purpose Statement:

The purpose of this study is to examine if environmental factors are related to gestational weight gain in Portage County, Ohio women enrolled in the Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Hypotheses

$H_1$: There will be environmental factors that are related to gestational weight gain in Portage County, Ohio WIC participants.

$H_0$: Environmental factors will not affect gestational weight gain in Portage County, Ohio WIC participants.

Operational Definitions

- Environmental factors- All physical and societal influences that affect lifestyle behaviors and health (National Library of Medicine, 2014)
- Gestational weight gain- The amount of weight in pounds a pregnant woman gains between the time of conception and the onset of labor (Ramussen & Yaktine, 2009)
- Excessive- A number exceeding the National Institute of Medicine’s range of adequate gestational weight gain in pounds per trimester or week (National Institute of Medicine, 2009)
- Portage County Women, Infants, and Children Program- Portage County is located within the United States, state of Ohio with a population of 161,419 citizens (“Welcome to Portage County,” 2013). The federal WIC program supplies grant money to states for supplemental foods, health care referrals, and nutrition education for low income pregnant, breastfeeding, and non-breast feeding postpartum women, and to infants and children up to age five who are found to be at nutritional risk. The Portage County WIC office served a caseload ranging from 2,585-2,746 individuals per month in the fiscal year of 2013 (Ohio Department of Jobs and Family Services, 2008; United States Department of Agriculture, 2013)
• Pregnancy- The period of conception to birth. A full term pregnancy is defined as 37 weeks gestation (Ramussen & Yaktine, 2009)

• Postpartum- The period beginning immediately after the birth of a child and lasting until the next conception (American College of Obstetrics and Gynecology, 2013)
CHAPTER II

LITERATURE REVIEW

Recommended Gestational Weight Gain

Pre-pregnancy BMI Classifications

A woman's pre-pregnancy weight places her in a body mass index (BMI) category determined by weight in kilograms divided by meters squared (Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity and Obesity, 2011). The pre-pregnancy BMI classes are as follows: underweight defined as a BMI less than 18.5 kg/m², normal defined as a BMI between 18.5 kg/m² and 24.9 kg/m², overweight defined as a BMI between 25 kg/m² and 29.9 kg/m², and obese defined as a BMI of 30 kg/m² or greater (Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity and Obesity, 2011).

Gestational Weight Gain Definition

Gestational weight gain is defined as the amount of weight in pounds a pregnant woman gains between the time of conception and the onset of labor (Ramussen & Yaktine, 2009). Based on the pre-pregnancy BMI classifications, the National Institute of Medicine or IOM (2009) has created gestational weight gain recommendations for women with a singleton intrauterine pregnancy as shown in Table 1.
Table 1: *Gestational Weight Gain Recommendations based on BMI*

<table>
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<tr>
<th>BMI and Class</th>
<th>Recommended Gestational Weight Gain Overall</th>
<th>Recommended Gestational Weight Gain in 2nd and 3rd trimester per week</th>
<th>Excessive Gestational Weight Gain Overall/Per Week</th>
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<td>&lt;18.5, Underweight</td>
<td>28-40 lbs.</td>
<td>1-1.3 lbs</td>
<td>&gt;40 lbs. / &gt;1.3 lbs</td>
</tr>
<tr>
<td>18.5-24.9, Normal</td>
<td>25-35 lbs.</td>
<td>0.8-1.0 lbs</td>
<td>&gt;35 lbs./ &gt;1.0 lbs</td>
</tr>
<tr>
<td>25-29.9, Overweight</td>
<td>15-25 lbs.</td>
<td>0.5-0.7 lbs</td>
<td>&gt;25 lbs./ &gt;0.7 lbs</td>
</tr>
<tr>
<td>≥30</td>
<td>11-20</td>
<td>0.4-0.6 lbs</td>
<td>&gt;20/ &gt;0.6 lbs</td>
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(National Institutes of Medicine, 2009)

Studies conducted before 2009, utilized 1990 IOM guidelines. These 1990 guidelines were the same as above; however, women with a BMI of 30 or greater were instructed to gain a 15 pound minimum with no maximum value established. Also weekly gestational weight gain recommendations did not exist in the 1990 IOM guidelines.

**Epidemiology of Weight Gain in Women**

A recent report by the American Heart Association stated 68% of United States' adults greater than 20 years of age were considered overweight or obese in the year 2009 according to BMI. Of that percentage, 64% of non-pregnant women were considered overweight or obese (Roger et al., 2012, p. 153). Ogden, Carroll, Kit, and Fiegal (2012) further examined the percentage of non-pregnant women considered obese by age. Statistics in the year 2009 were as follows: 31.9% of females 20-39 years of age, 36% of women ages 40-59, and 42.3% of women greater than 60 years of age. The researchers concluded there was no significant difference in obesity prevalence among women and men, and women greater than 60 years of age were more likely to be obese (Ogden, Carroll, Kit, & Fiegal, 2012). Another research study contrasted from Ogden et al. (2012) findings, and stated in 1999-2004, two-thirds of women of childbearing age, defined as 20 to 44 years old, were classified as overweight according to BMI. Nearly 24% of non-
pregnant females 20-34 years of age and 27.1% of non-pregnant females 35-44 years of age were considered overweight (Ramussen & Yaktine, 2009). Research studies have indicated the percentage of non-pregnant females of childbearing age considered overweight or obese has been significant since 1992 and remains a problem today (Ogden et. al, 2012; Ramussen & Yaktine, 2009).

Factors Related to Weight Gain in Women in the United States

Education Level

A female’s weight change over time related to education level was a topic that began to be studied in the 1990’s. In Burke and Bilde’s (1996) study it was found black women between the ages of 18-30 with a high school education or less gained an average of 14.4 pounds over a five year period while college graduate counterparts gained an average of 10 pounds. White women with a high school education or less within Burke and Bilde’s (1996) study gained an average of 10.2 pounds over a five year period while white college graduates gained an average of 5.2 pounds. A more updated study conducted by Truong and Sturm (2005) assessed the national Behavioral Risk Factor Surveillance Data for both women and men from the 1996-2002 period with the average participant age being 45 and found women with no high school diploma were more likely to be greater than the 80th percentile for BMI than those with a college diploma, 30.2% of participants compared to 28.8% of participants, respectively (Troung & Sturm, 2005).

Age

Like Burke and Bilde’s (1996) study that showed women regardless of ethnicity or education level tended to gain weight over time, Guoss, Zeller, Chumlea, and
Siervogel (1999) also showed females increased weight and body fat percentages over time. In the Fels Longitudinal Study, white women with an average age of 44.5 years were followed for an average of 8.95 years. At the follow up visit, women had gained a significant 1.21 pounds, 0.22 kg/m² in BMI, and 0.22% in body fat. Furthermore, postmenopausal women had higher percentages of body fat than pre and peri menopausal women within the study (Gouss, Zeller, Chumlea, & Siervogel, 1999). Interestingly, a study by Williamson (1993) concluded women have substantially greater variation in weight changes over a 10 year period than men. Longitudinal body weight changes showed adults younger than 55 years tended to gain weight over time while those over 55 years, lost weight (Williamson, 1993).

**Ethnicity**

Much research has shown that black women tend to have greater baseline weights in studies than white counterparts (Adler & Rehkof, 2008; Baltrus, Lynch, Rosen, Raghunathan, & Kaplan, 2005). In Baltrus, Lynch, Rosen, Raghunathan, and Kaplan’s (2005) study women in California were studied over a 34 year period as part of the Alameda County study. Black women within this study tended to weigh on average 10.91 pounds more at baseline and gained an additional 0.22 pounds of body weight per year than white counterparts. Another study conducted by Clark, O’Malley, Johnston, Schulenberg, and Lantz (2009) studied weight related health behaviors from the national Monitoring the Future study and concluded black and Hispanic women were likely to gain more weight over a 22 year period than white counterparts. Their explanation behind the phenomenon was the frequency of black and Hispanic females eating breakfast and/or
exercising did not increase like in the white population over a 22 year duration (Clark, O’Malley, Johnston, Schulenberg, & Lantz, 2009).

**Socioeconomic Status**

Wang and Chen (2011) examined 4,356 United States adults’ scores on the Healthy Eating Index and Diet and Health Knowledge Quiz from 1994-1996. Socioeconomic status was defined based on education and poverty to income ratios with 0-130% defined as lower class, 131-350% as middle class, and greater than 350% as high class. Regardless of race or gender, individuals of higher socioeconomic status were likely to score higher on both the Healthy Eating Index and Diet and Health Knowledge Quiz than individuals of lower socioeconomic status. As a result, individuals of higher socioeconomic status were found to have lower BMIs than counterparts (Wang & Chen, 2011).

**Demographics**

Often times, location to the nearest supermarket predicts food security or insecurity and researchers have shown living in a rural location places individuals at greater risk of becoming overweight or obese (Adler & Rehkof, 2008). However, Giskes, Lenthe, Pabon, and Brug (2011) concluded minority groups living in community, urban settings were likely to be further from full-service supermarkets than white counterparts. Interestingly, in the Seattle study, it was found only one in seven respondents reported actually shopping at the nearest full-service supermarket to their home. Therefore, distance to the nearest supermarket was not correlated with the risk of becoming obese within a Seattle population, rather the cost of products at these supermarkets. Only nine
percent of shoppers at high price supermarkets were considered obese while 27% of shoppers at lower priced supermarkets were considered obese (Drewnowski, Aggarwal, Hurvits, Monsivais, & Moudon, 2012).

**Lifestyle Patterns**

Guoss, Zeller, Chumlea, and Siervogel (1999) also logically found women with greater amounts of daily physical activity had lower body fat percentages and higher fat free mass than counterparts. Slentz et al. (2004) expanded past research and concluded non-dieting, sedentary individuals gained an average of 2.2 pounds over an eight month period while high amount/vigorous, low amount/vigorous, and low amount/moderate exercisers lost weight, regardless of gender. High amount/vigorous exercisers lost 6.4 pounds, low amount/moderate exercisers 1.98 pounds, and low amount/vigorous exercisers 3.2 pounds over an eight month duration (Slentz et al., 2004).

A study examining diet quality among middle aged women through a 133 item food frequency questionnaire found dietary energy density (ED) was positively correlated with saturated fat ($r=0.16$), trans fat ($r=0.15$), and glycemic index ($r=0.16$) values. Dietary energy density was negatively correlated with vegetable protein ($r=-0.30$), vegetables ($r=-0.27$) and fruit ($r=-0.17$) intake. As a result of the above characteristics, women who increased their dietary ED during the eight year follow-up period gained an average of 14.1 pounds. Women who decreased their daily dietary ED throughout the eight year study, gained an average of 10.0 pounds (Rastrollo et al., 2008).
Implications of Excessive Weight Gain in Women

Chronic Diseases

There are multiple implications of excessive weight gain in women, including type 2 diabetes mellitus (DM), cardiovascular disease (CVD), metabolic syndrome, cancer, and musculoskeletal disease (Mahan, Stump, & Raymond, 2012).

Type 2 Diabetes Mellitus

Mahan, Stump, and Raymond (2012) and Coulston and Boushey (2008) state obesity, particularly intra abdominal obesity, is a risk factor for type 2 DM, and small weight losses are associated with changes in glucose levels toward normal in persons with pre diabetes. Insulin resistance is demonstrated at the adipocyte level, leading to lypolysis and an elevation in circulating free fatty acids. Excess intra abdominal obesity or excess accumulation of visceral fat around and inside abdominal organs, results in an increased flow of free fatty acids, leading to insulin resistance (Coulston & Boushey, 2008, p. 580). Increased fatty acids further decrease insulin sensitivity at the cellular level, impair pancreatic insulin secretion, and exacerbate hepatic glucose production. All of these defects contribute to development and progression of type 2 DM (Mahan et al., 2012, p. 679). Shils, Shike, Ross, Caballero, & Cousins (2006, p. 1059) state 75% of individuals with type 2 DM in the United States were considered obese according to BMI.

Cardiovascular Disease

Many diagnoses can be classified under cardiovascular disease (CVD) including hypertension, coronary artery disease, heart failure, cerebrovascular disease, myocardial
infarction, atherosclerotic heart disease, and hypercholesteremia (Mahan, Stump, & Raymond, 2012, p. 743). Carrying excess adipose tissue affects the heart and Mahan et al. (2012) state obesity places an individual at higher risk of hypertension, prothrombotic state, endothelial dysfunction, dyslipidemia, and increased inflammatory markers of interleukin-6, tumor necrosis factor-alpha, and C-reactive protein. These elevated inflammatory proteins are direct risk factors to CVD (Coulston & Boushey, 2008, p. 515). Small weight losses of 10 to 20 pounds in overweight or obese individuals reduce LDL cholesterol, raise HDL cholesterol, lower triglycerides, reduce high blood pressure, and reduce C-reactive protein levels even if an ideal BMI is not met (Mahan et al., 2012, p. 752). Shils, Shike, Ross, Caballero, & Cousins (2006, p. 1089) state many individuals with elevated LDL levels consume 300 calories more per day than needed to maintain their BMI, resulting in excess lipid stored in the liver predisposing these individuals to atherogenic dyslipidemia.

**Metabolic Syndrome**

Metabolic syndrome is defined as three or more of the following abnormalities: waist circumference greater than 40 inches in males or 35 inches in females, triglyceride levels of 150 mg/dL or greater, high density lipoprotein levels less than 40 mg/dL in males and 50 mg/dL in females, blood pressure 135/85 mmHg or higher, or fasting blood glucose 100 mg/dL or greater (Mahan, Raymond, & Stump, 2012, p. 471). Mahan et al. (2012) state visceral obesity or excessive visceral adipose tissue is a risk factor for metabolic syndrome. Obese persons who lose five to ten percent of initial body weight are likely to improve blood glucose, blood pressure, and cholesterol levels (p. 473). A
recent study by Beltran, Harhay, and McElligott (2013) showed metabolic syndrome has decreased in the United States population from 25.5% in 1999 to 22.5% in 2010 related to the increased use of anti-hypertensive and lipid modifying drugs. However, the abnormalities of hyperglycemia and elevated waist circumference have increased from 12.9 to 19.9% and 45.4% to 56.1%, respectively in the years 1999 to 2010 (Beltran, Harhay, & McElligott, 2013). With over half of the United States population having an elevated waist circumference, this visceral adiposity places individuals at great risk of eventually developing metabolic syndrome despite pharmacological control of triglyceride and blood pressure levels. Metabolic syndrome begins a cascade in to development of other costly, chronic diseases such as cardiovascular disease, type 2 diabetes mellitus, stroke, and kidney disease (Beltran et al., 2013).

Cancer

Typically, a diet high in fat and simple carbohydrates promotes excessive weight gain in individuals. Research has shown high intakes of saturated fat with low intakes of fruits, vegetables, and fiber, or a diet representative of those overweight or obese, increases the risk of breast, colon, and prostate cancer (Mahan, Stump, & Raymond, 2012, p. 286). Shils, Shike, Ross, Cabellero, & Cousins (2006, p. 1628) state high saturated fat and cancer correlations have been found only with animal fat and meat intake rather than vegetable fat consumption, however. Fruits and vegetables rich in vitamin C and vitamin E act as natural antioxidants in the body, protecting DNA from damage; while large intakes of heterocyclic amines found in processed meats, high in saturated fat, exacerbate carcinogen metabolism (Coulston & Boushey, 2008, p. 625).
Furthermore, Mahan et al. (2012) state nutrition and diet contribute 35% to causal factors for cancer while Coulston and Boushey (2008) state nutritional factors can actually contribute to 75% of all malignant tumor incidences. Increases in body fat percentages related to nutrition and dietary intake are also related to increased estrogen levels. Research has shown increased estrogen levels place postmenopausal women at greater risk of developing breast cancer (Morimoto et al., 2002).

Mahan, Stump, and Raymond (2012, p. 836) recommend adults should obtain a BMI between 21-23 to reduce the risk of obesity, hyperglycemia, and metabolic syndrome, all known to play a role in circulating levels of insulin like growth hormone-1 (IGF-1). High secretion of IGF-1 can promote development and progression of prostate, breast, lung, and colon cancer (Mahan, Stump, & Raymond, 2012, p. 836). Furthermore, Mahan et al. (2012) state obese BMI classifications contribute to endometrium, gallbladder, kidney, and esophageal cancers in women.

**Musculoskeletal disease**

Obesity is likely to eventually contribute to physical limitations such as carrying groceries, ability to walk, or run errands, by placing burden on the weight bearing joints. Wolfe and Coditz (1998) state obese women have a two-fold greater risk of becoming physically limited compared to lean women. The Framingham Osteoarthritis Study conducted by Felson (1996) showed 24 percent of Osteoarthritis of the knee was attributed to obesity. The Framingham Osteoarthritis study also showed back pain and mobility disability were associated with obesity (Felson, 1996). More current recommendations align with Felson (1996) findings stating, “The risk for knee OA
increases as BMI increases. Controlling obesity can reduce the burden of OA through both disease prevention and improvement in symptoms” (Mahan, Stump, & Raymond, 2012, p. 908).

**Prevalence of Non-recommended Gestational Weight Gain**

The Centers for Disease Control and Prevention (CDC) uses the pregnancy risk assessment monitoring system to track gestational weight gain of women in the United States (Centers for Disease Control and Prevention, 2013). Ramussen and Yaktine (2009) indicated the percentage of women with less than recommended gestational weight gain, according to IOM standards, has decreased while the percentage of women with greater than recommended gestational weight gain has increased from the years 1993-1994 to 2002-2003 as shown in Table 2.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>35%</td>
<td>30.6%</td>
<td>19.1%</td>
<td>38.4%</td>
</tr>
<tr>
<td>Normal</td>
<td>23.3%</td>
<td>20.5%</td>
<td>35.4%</td>
<td>38.4%</td>
</tr>
<tr>
<td>Overweight</td>
<td>11.7%</td>
<td>10.3%</td>
<td>57.1%</td>
<td>63%</td>
</tr>
<tr>
<td>Obese</td>
<td>25%</td>
<td>23.5%</td>
<td>42.7%</td>
<td>46.3%</td>
</tr>
</tbody>
</table>

(Ramussen & Yaktine, 2009)

Chu, Callaghan, Bish, & D’Angelo (2009) were approved through the CDC’s internal review board to access PRAMS data in 26 of the United States in the years 2004-2005 (Alaska, Arkansas, Colorado, Florida, Georgia, Hawaii, Illinois, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Nebraska, New Jersey, New Mexico, New York [excluding New York City], North Carolina, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Utah, Washington, and West Virginia). For Louisiana,
Mississippi, and Nebraska, data were available only for 2004 and for Ohio, only for 2005) and provide more up to date findings on prevalence of women with excessive gestational weight gain annually in the United States. It was found 40% of women with a normal pre-pregnancy BMI classification and 60% of women with an overweight pre-pregnancy BMI classification gained excessive gestational weight. Furthermore, women with an obese pre-pregnancy BMI classification gained the least amount of weight compared to their counterparts. Chu et al. (2009) also stated gestational weight gain was highest among females 19 years of age or younger. The most recent PRAMS data was collected in the 2007-2008 year with little research existing describing CDC findings (Centers for Disease Control and Prevention, 2013).

Specific Factors Related to Excessive Weight Gain in Pregnancy

Education Level

Chu, Callaghan, Bish, and D’Angelo (2009) demonstrated women with 12 years of education or more tended to gain greater amounts of gestational weight than counterparts. See Table 3.

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>&lt;14 lbs</th>
<th>15-24 lbs</th>
<th>25-34 lbs</th>
<th>35-44 lbs</th>
<th>&gt;45 lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 12 years</td>
<td>19.6%</td>
<td>21.1%</td>
<td>25.7%</td>
<td>18.0%</td>
<td>15.7%</td>
</tr>
<tr>
<td>12 years</td>
<td>17.35%</td>
<td>19.4%</td>
<td>26.0%</td>
<td>19.9%</td>
<td>17.4%</td>
</tr>
<tr>
<td>&gt;12 years</td>
<td>12.7%</td>
<td>17.8%</td>
<td>31.7%</td>
<td>23.5%</td>
<td>14.5%</td>
</tr>
</tbody>
</table>

(Chu, Callaghan, Bish, & D’Angelo, 2009)

The p-values were found to be 0.001 for women with 12 years of education and 0.007 for women with greater than 12 years, both statistically significant within this study. Interestingly, Chu et al. (2009) failed to utilize the 1990 IOM gestational weight gain
range recommendation ranges when reporting results as seen in table six. Research conducted by Heck, Schoendorf, Ventura, and Kiely (1997) as well as Wells, Schwalberg, Noonan, and Gabor (2006) utilized 1990 IOM gestational weight gain recommendations, however, and again reported women with greater educational levels tended to gain greater gestational weight gain than counterparts with less education. Heck et al. (1997) explained this phenomenon by stating participants with greater education levels tended to be older and had children at advanced ages. As a result, these women tended to have excessive gestational weight gain, large for gestational age neonates, and were at greater risk of weight retention; all poor birth outcomes.

**Biological Age**

While Heck, Schoendorf, Ventura, and Kiely (1997) concluded women at an older biological age had higher gestational weight gain, many studies have contrasted with this finding. Chu, Callaghan, Bish, and D’Angelo (2009) in their research examining the multiple variables contributing to gestational weight gain through a regression model, concluded being 30 years of age or older was associated with less gestational weight gain. A more recent study conducted by Koleilat and Whaley (2013) again concluded excessive gestational weight gain decreased by two percent with each one year increase in age among Hispanic WIC participants in Southern California.

**Ethnicity**

Much research has shown the general black female population is likely to gain more weight over time than white counterparts (Adler & Rehkof, 2008; Baltrus, Lynch, Rosen, Raghunathan, & Kaplan, 2005). In Chu, Callaghan, Bish, and D’Angelo’s (2009)
20

study, however, white women participants gained the greatest amount of gestational weight gain on average compared to black, Hispanic, or women of other ethnicities. Furthermore, Caulfield, Witter, and Stoltzfus (1996) also concluded black women were 0.89 times less likely to over-gain than white women delivering at John Hopkin’s Hospital in Maryland. These findings were a stark contrast to research conducted by Wells, Schwalberg, Noonan, and Gabor (2006) who found 45.8% of black female participants compared to 42.6% of non-Hispanic whites experienced excessive gestational weight gain. Schieve, Cogswell, and Scanlon (1998) further attempted to identify health disparities at WIC clinics in Indiana, Kansas, Massachusetts, Minnesota, and Nebraska. It was found excessive gestational weight gain was most common in Native American and Asian populations in both 1990 and 1996.

**Socioeconomic Status**

Socioeconomic status is difficult to define in research and many studies label participants of low socioeconomic status when government subsidies are utilized such as WIC, The Supplemental Nutrition Assistance Program (SNAP), or Medicaid benefits. Interestingly, few research articles have been published examining gestational weight patterning among WIC participants, or mothers with a yearly household income between 100-180% of the federal poverty guidelines, despite counties publishing their specific information in yearly health department reports. In the little research that does exist, it was found 43.7% of mothers of various ages and ethnicities had excessive gestational weight gain in 1996 at Indiana, Kansas, Massachusetts, Minnesota, and Nebraska WIC clinics, indicating excessive gestational weight gain was a clear problem among the
economically disadvantaged (Schieve, Cogswell, & Scanlon, 1998). A more recent study by Wells, Schwalberg, Noonan, and Gabor (2006) contrasted from past studies and concluded government subsidies reduced the percentage of Colorado women with excessive gestational weight gain. See Table 4.

Table 4: Percent of Colorado Participants with Inadequate, Adequate, and Excessive Gestational Weight Gain based on Socioeconomic Status

<table>
<thead>
<tr>
<th></th>
<th>Inadequate</th>
<th>Adequate</th>
<th>Excessive</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIC enrolled</td>
<td>33.1%</td>
<td>28.1%</td>
<td>38.8%</td>
</tr>
<tr>
<td>Non WIC enrolled</td>
<td>36.1%</td>
<td>21.9%</td>
<td>42.0%</td>
</tr>
<tr>
<td>Medicaid</td>
<td>30.9%</td>
<td>29.3%</td>
<td>39.9%</td>
</tr>
<tr>
<td>Non Medicaid</td>
<td>36.9%</td>
<td>21.7%</td>
<td>41.5%</td>
</tr>
</tbody>
</table>

(Wells, Schwalberg, Noonan, & Gabor, 2006)

Tovar, Guthrie, Platek, Stuebe, Herring, and Oken (2011) did examine specific household income levels in their research, however a major limitation existed. Percentages were only given for number of participants that did not have a gestational weight gain goal concordant with IOM gestational weight gain recommendations. Individuals were not studied longitudinally for final gestational weight gains and placed within an inadequate, adequate, or excessive category. However, it was found 22.7% of Massachusetts women with a household yearly income less than $70,000 per year, 20.8% with an income of $70,000-100,000 and 56.4% of women with an income of greater than $100,000 possessed gestational weight gain goals outside of IOM recommendations (Tovar et al., 2011).

Demographics

Wells, Schwalberg, Noonan, and Gabor (2006) also showed when a regression model was run; living in Denver or another metropolitan area was a stronger predictor of excessive gestational weight gain than living in a rural area with odds ratio values of 1.08
and 0.91 respectively. Callagher, Liu, Probst, Martin, and Hall (2012) findings concurred with Schwalberg et al. (2006) and concluded living in a rural South Carolina area decreased the risk of normal, overweight, and obese women experiencing excessive gestational weight gain. Interestingly, it was found; however, women residing in these rural South Carolina areas were likely to enter a pregnancy with a BMI classification of overweight or obese.

**Parity**

Much research has also shown parity, defined as the number of times a female has delivered a live infant, influences gestational weight gain. Tovar et al. (2011) concluded women who have had two or more children were more likely to report a gestational weight gain goal concordant with IOM recommendations related to past experience and knowledge. Logically, Wells, Schwalberg, Noonan, and Gabor (2006) showed in their research excessive gestational weight gain reduced from 44.5% of nulliparous participants to 38.0% when participants were multiparous. Findings were even more dramatic in WIC populations and concluded 51.4% of nulliparous participants experienced excessive gestational weight gain compared to 37.6% of counterparts delivering two or more live births in the past (Schieve, Cogswell, & Scanlon, 1998).

**Lifestyle Patterns**

While the above factors contributing to abnormal gestational weight gain tend to be non-modifiable; modifiable, environmental risk factors also exist. In Wells, Schwalberg, Noonan, and Gabor’s (2006) study, stress factors, smoking status, and alcohol consumption were examined in relation to gestational weight gain. Females who
smoked cigarettes or drank alcohol during pregnancy had a marginally greater chance of inadequate weight gain, with smoking being a significant risk factor with a confidence interval of 1.81. However, Brawarsky et al. (2005) concluded females within this California study were actually more likely to gain excessive gestational weight gain when smoking during pregnancy than non-smokers, contrasting with Wells et al. (2006) findings. Furthermore, women who smoked one or more packs of cigarettes daily during pregnancy were at greatest risk of excessive gestational weight gain than those only smoking 0.5 packs of cigarettes or less (Brawarsky et al., 2005).

Women were asked about maternal stress through the PRAMS questionnaire including a list of 13 stressful life events they had experienced in the past 12 months. Findings concluded women were approximately two percent more likely to experience excessive gestational weight gain when zero life stressors were present compared to those with three or greater (Wells, Schwalberg, Noonan, & Gabor. 2006). Brawarsky et al. (2005) findings agreed with Wells, Schwalberg, Noonan, and Gabor (2006) and concluded women were at risk of inadequate weight gain with frequent stress.

Many studies with pregnant women have utilized the Prime Screen Nutrition Questionnaire to describe diet quality of participants (Brawarsky et al., 2005; Herring et al., 2012). The Prime Screen is a shortened food frequency questionnaire that allows participants to describe their food patterns over the past month. Herring et al. (2012) found greater than or equal to 2-4 times per week intakes of sugar sweetened beverages, potato chips, dairy products, and fruit/vegetable intakes were correlated with a greater risk of excessive gestational weight gain. Women were 9.06 times more likely to
experience excessive gestational weight gain with fried or fast food intake greater than once per week and 8.34 times more likely to experience excessive gestational weight gain with sugar sweetened beverage intakes greater than or equal to 2-4 times per week than counterparts with daily intakes lower than established values (Herring et al., 2012). In Brawarsky et al. (2005) responses to the Prime Screen Questionnaire were summarized in to weekly servings of fruits and vegetables, dairy, grains, and protein and compared against the median. Those participants with consumption above the median for all food groups were classified as having high food consumption. Fifty seven percent of females with high food consumption had excessive gestational weight gain while 53.1% of females without high food consumption experienced excessive gestational weight gain (Brawarsky et al., 2005).

Brawarsky et al. (2005) categorized participants in to exercisers and non-exercisers and interestingly found 54.7% of exercising participants gained excessive gestational weight gain while only 50.7% on non-exercisers experienced the same side effect. However, the Brawarsky et al. (2005) study had a limitation in that duration and intensity of the physical activity was not defined. Herring et al. (2012) expanded past research and defined “active” participants as those participating in light to moderate physical activity for 30 minutes or greater, five times a week or more. Findings from Herring et al. (2012) concluded 23% of active participants gained excessive weight while 77% with limited or no activity gained excessive gestational weight gain. Furthermore, longer durations of sedentary activity, or two or more hours of television time daily, caused women to be 1.04 times more likely to gain excessive gestational weight (Herring
et al., 2012). In the Herring et al. (2012) study, time spent being sedentary during sleep was also examined. Women with less than seven hours of sleep daily were 2.87 times more likely to experience excessive gestational weight gain than women with seven hours of sleep or greater daily.

**Specific Implications of Maternal Gestational Weight Gain**

**Need for Maternal Pre-pregnancy BMI Control**

There are three periods in a woman’s life where weight gain is possible: pre-pregnancy, gestational, and the postpartum period. Ferraro et al. (2012) suggested the need for pre-pregnancy BMI control as this has been shown to greatly influence a woman’s gestational and postpartum weight gains, as well. In the Ferraro et al. (2012) study, women with an overweight pre-pregnancy BMI gained the greatest amount of gestational weight among all study participants. As a result, these women birthed heavier neonates and predisposed the infants to the risk of becoming overweight and obese between the ages of two and twenty. Zilko, Rehkopf, and Abrams (2010) confirmed children born to a mother with an obese pre-pregnancy BMI were 24.4% more likely to be considered overweight than counterparts born to a mother with a normal pre-pregnancy BMI. Despite predisposing the child to weight retention, research has also shown a mother with a high pre-pregnancy BMI and excessive gestational weight gain is likely to retain weight and continue to increase weight over a 15 year period (Amorim, Rossner, Neovius, Lourenco, & Cinne, 2007). The negative cycle of continual maternal and child weight gain throughout life is discussed in the following sections.
Pattern of Women’s Short-term Postpartum Weights and BMIs

Many studies have examined a woman’s short-term weight retention in the six to twelve month postpartum period. Mannan, Doi, and Mamum’s (2013) review article gave insight in to the severity of short-term postpartum weight retention among women with excessive gestational weight gain. Mannan et al. (2013) examined twelve overall studies and found women with excessive gestational weight gain were likely to retain 6.5 additional pounds than counterparts with adequate gestational weight gain. Furthermore, Rooney and Schauberger (2002) findings concurred with Mannan et al. (2013) and showed women with excessive gestational weight gain retained 9.24 pounds while those with adequate gestational weight gain retained 3.96 pounds on average in a six month postpartum period. Table 5 demonstrates the significant difference between weight categories at both six month (short-term) and five year (long-term) follow ups.

Table 5: Mean Weight Retention at 6 Month and 5 Year Follow up Visit among Participants based on Gestational Weight Gain

<table>
<thead>
<tr>
<th>Gestational Weight Gain</th>
<th>6 months postpartum (p=0.01)</th>
<th>5 year follow up visit (p=0.01)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate</td>
<td>1.34 lbs</td>
<td>9.02 lbs</td>
</tr>
<tr>
<td>Adequate</td>
<td>3.96 lbs</td>
<td>14.3 lbs</td>
</tr>
<tr>
<td>Excessive</td>
<td>9.24 lbs</td>
<td>18.48 lbs</td>
</tr>
</tbody>
</table>

(Rooney & Schauberger, 2002)

Pattern of Women’s Long-term Postpartum Weights and BMIs

Fewer studies have examined more significant, long-term weight retention over a five to 15 year period. However, Rooney & Schauberger (2002) also expanded their research and showed change from pre-pregnancy weight continued to be the highest among those with excessive gestational weight gain at a five year postpartum follow up.
visit (See Table 5). The significant differences in participants’ mean BMIs based on weight category can be seen in Table 6.

Table 6: Mean BMI of Participants at 6 Months Postpartum and a Decade Later

<table>
<thead>
<tr>
<th>Gestational Weight Gain</th>
<th>6 months postpartum (p ≤ 0.01)</th>
<th>10 year follow up visit (p ≤ 0.01)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate</td>
<td>23.9</td>
<td>25.6</td>
</tr>
<tr>
<td>Adequate</td>
<td>26.2</td>
<td>28.6</td>
</tr>
<tr>
<td>Excessive</td>
<td>26.0</td>
<td>27.7</td>
</tr>
</tbody>
</table>

(Rooney & Schauberger, 2002)

The above findings in Table 6 concluded all women were likely to progressively increase BMI over time regardless of the amount of gestational weight gain obtained throughout pregnancy. Interestingly, however, women in this study who gained recommended gestational weight actually had a higher mean BMI of 28.6 at a 10 year follow up than those who gained more than the recommended amount with a mean BMI of 27.7. Another updated study conducted by Amorim, Rossner, Neovius, Lourenco, and Cinne (2007) however, contrasted from Rooney and Schauberger (2002) findings, and demonstrated women who gained excessive gestational weight during pregnancy actually had an average increase in 2.4 m/kg² in long-term BMI at a 15 year follow up than women who gained an adequate amount of gestational weight.

Therefore when all research is summarized, it can be concluded all women tend to increase their pre-pregnancy weight and BMI as the aging process occurs. However, weight increases in the six month to 15 year postpartum period from pre-pregnancy levels, tend to be largest among those who experienced excessive gestational weight gain. Informing mothers to be of the future postpartum consequences of excessive gestational weight gain is crucial to health outcomes.
Weight Patterning in Children of Mothers with Non-recommended Gestational Weight Gain

In 2010, one in three children was considered overweight or obese indicating a clear need for an explanation to this phenomenon (Roger et al., 2013). Researchers have for multiple years cited excessive maternal gestational weight gain as a contributor, and a vast number of studies exist describing an infant’s weight and body composition immediately after delivery to a mother with excessive gestational weight gain. Excessive gestational weight gain has been associated with decreased risk of small for gestational age, defined as less than the 10th percentile, and increased risk of large for gestational age, defined as greater than the 90th percentile (Ferraro et al., 2012; Zilko, Rehkopf, & Abrams, 2010). Ferraro et al. (2012) concluded an infant was 2.86 times more likely to be large for gestational age when born to a mother with excessive gestational weight gain. Davenport, Ruchat, Giroux, Sopper, and Mottolz (2013) expanded past research and examined the effects of gestational weight gain timing on a neonate’s body weight and body fat percentage. Neonates born to mothers with excessive gestational weight gain in the first half of pregnancy exhibited greater birth weight and excessive body fat, defined as greater than 14%, compared to counterparts born to mothers with recommended or late, defined as the last half of pregnancy, excessive gestational weight gain (Davenport, Ruchat, Sopper, & Mottolz, 2013).

Fewer cross sectional studies and no longitudinal studies have been done examining weight patterning in children greater than two years old born to a mother with excessive gestational weight gain. Oken, Taveras, Kleinman, Edward, and Gillman
(2003) however, found a strong correlation between excessive maternal gestational weight gain and child adiposity at age three. It was found 54% of children were considered overweight, defined as the 85th-94th BMI percentile, and 61% of participants obese, defined as ≥95th BMI percentile, when born to a mother with excessive gestational weight gain compared to 35% and 32% respectively in children born to mothers with recommended gestational weight gain (Oken, Taveras, Kleinman, Edward, & Gillman, 2003). Wrothiak, Shults, Buss, and Stettler (2008) examined weight patterning in older children and found similar results to Oken et al. (2003). The risk of seven year old offspring being overweight, defined as ≥ 95th BMI for age and sex, increased by three percent for each kilogram of maternal gestational weight gain. Furthermore, children were 48% more likely to be classified as overweight if born to a mother with excessive gestational weight gain (Wrothiak, Shults, Buss & Stettler, 2008).

**Birth complications**

**Risk for mother.** A study conducted by Langford, Joshu, Chang, Myles, and Leet (2011) discussed the impact of excessive gestational weight gain above IOM recommendations in overweight women. It was found the risk of being diagnosed with preeclampsia, defined as blood pressure ≥140/90 mmHg, increased from six percent for women gaining within IOM recommendations to nine percent in women gaining greater than IOM gestational weight gain recommendations. Again, researchers also examined the timing of gestational weight gain in relation to the risk of disease. Morisset et al. (2011) found women who gained excessive gestational weight gain in the first trimester of pregnancy were more likely to develop gestational diabetes mellitus, defined as blood
glucose $\geq 10.3$ mmol/L one hour after administration of a 75 g oral glucose tolerance test, than those gaining excessive weight in the second or third trimesters of pregnancy.

Women with gestational diabetes mellitus (GDM) gained an average of 7.48 pounds while the control group without GDM gained an average of 4.1 pounds within the first trimester of pregnancy. Furthermore, women with an overweight or obese pre-pregnancy BMI were found to be 1.1 times more likely to develop gestational diabetes mellitus than counterparts with a normal pre-pregnancy BMI (Morisset, et al., 2011). Mahan, Stump, and Raymond (2012) state a mother’s development of gestational diabetes mellitus predicts neonatal hyperinsulinemia.

**Risk for infant.** As mentioned above, excessive gestational weight gain has been linked to large for gestational age pregnancies and high birth weights of the neonate (Davenport, Ruchat, Giroux, Sopper, & Mottolz, 2013; Ferraro et al., 2012; Zilko, Rehkopf, & Abrams, 2010). Weisman et al. (2012) found large for gestational age pregnancies were 1.81 times more likely to result in maternal postpartum hemorrhages from cesarean section deliveries, 2.61 times more likely to result in neonatal shoulder dystocia, and 2.53 times more likely to result in neonatal hypoglycemia compared to adequate for gestational age pregnancies. All of the above complications increased mother and infant’s hospital length of stay (Weisman et al., 2012).

**Linkage to Weight Related Chronic Disease**

Consequences of excessive gestational weight gain extend into the postpartum period and create a greater lifelong risk of chronic disease for both mother and the infant related to weight retention. Carrying excess weight places all individuals at risk of type 2
diabetes mellitus, cardiovascular disease, metabolic syndrome, cancer, and musculoskeletal disease (Coulston & Boushey, 2008; Mahan, Stump, & Raymond, Shils, Shike, Ross, Cabellero, & Cousins, 2006). Furthermore, much research has shown a female infant born to a mother with excessive gestational weight gain, is likely to eventually enter her own pregnancy with an overweight or obese BMI classification, creating a viscous intergenerational cycle of obesity and chronic disease (Oken, Taveras, Kleinman, Edward, & Gillman, 2003; Wrothiak, Shults, Buss, & Stettler, 2008).

**Supplemental Food Assistance Programs Used by Pregnant Women**

Pregnant women of low socioeconomic status have two main government subsidized options to aid in food security; The Supplemental Nutrition Assistance Program (SNAP) and the Women, Infants, and Children Program (WIC). SNAP and WIC have different policies and regulations on who can participate.

**SNAP Overview**

The Supplemental Nutrition Assistance Program (SNAP), run by the U.S. Department of Agriculture (USDA), provides money on electronic benefit transfer cards to households based on size, income level, and expenses. Currently one in seven Americans report using the SNAP program (What is the SNAP Food Stamps Program? 2013). Participants utilizing SNAP benefits may purchase any food item at grocery stores, supermarkets, and registered farmer’s markets. Excluded items include alcohol, tobacco products, vitamins/medicines, and hot prepared foods. The new SNAP tagline is “Putting healthy foods within reach” showing the program cares about good nutrition and healthy eating. Furthermore, a nutritional education component has recently been added.
entitled SNAP-Ed with a goal of providing nutrition education to improve the likelihood individuals eligible for SNAP will make healthy food choices within a limited budget and choose physically active lifestyles consistent with the *Dietary Guidelines for Americans* and MyPlate (United States Department of Agriculture, 2013).

**WIC Overview**

The Women, Infants, and Children program (WIC) is another U.S. Department of Agriculture subsidized food assistance program that works to safeguard the health of low income women, infants, and children up to age five found to be at nutritional risk. Federal grant money is supplied to states for supplemental foods, health care referrals, and nutrition education. WIC participants are given a list of acceptable fruit, vegetable, dairy, and whole grain products available through purchase at registered grocery stores, supermarkets, and farmer’s markets (United States Department of Agriculture, 2013).

**Effect of SNAP and WIC on Pregnancy Outcomes**

Current research describing the effects of the SNAP program on pregnancy outcomes is limited potentially due to this program’s use in multiple populations rather than a pregnant population alone. A study completed by Almond, Haynes, and Schanzenbach (2011) confirmed the initiation of food stamps, previous name for the USDA supplemental food assistance program, three months prior to birth yielded deliveries with increased birth weights across multiple United States’ counties. Data in this study is outdated however because change in birth weights were examined from a 1968-1977 time period. Almond et al. (2011) also concluded neonatal mortality decreased with initiation of food stamps and positive birth outcomes were 50-150% more
likely in a black than white population. A more recent study conducted in Illinois from 1990-1996 found infants whose mothers utilized WIC or food stamp services, jointly or alone, were less likely to have incidences of abuse or neglect, failure to thrive, and iron deficiency anemia (Lee & Bilaver, 2007). See Table 7:

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>WIC and FSP</th>
<th>WIC only</th>
<th>FSP only</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abuse or neglect</td>
<td>0.035*</td>
<td>0.001*</td>
<td>0.039</td>
<td>0.100</td>
</tr>
<tr>
<td>Anemia</td>
<td>0.103*</td>
<td>0.058*</td>
<td>0.060*</td>
<td>0.195</td>
</tr>
<tr>
<td>Failure to thrive</td>
<td>0.033*</td>
<td>0.018*</td>
<td>0.021*</td>
<td>0.128</td>
</tr>
</tbody>
</table>

*Indicates a significant difference between each program group participants and non-participants at $p < .05$ (Lee & Bilaver, 2007)

More research exists on the WIC program in order to track outcomes in a specific maternal and child health population. Bitler and Currie (2004) provided specifics in their book and stated every dollar the government spent on WIC saved each mother $1.77-$3.13 dollars in health care costs related to pregnancy complications. Bitler and Currie’s (2004) study examined births of mothers all enrolled in the federally funded Medicaid program. A woman utilizing WIC services was 1.4-1.5 times more likely to initiate prenatal care in the first trimester of pregnancy, promoting gestational weight gain within recommendations. Final birth outcomes indicated women enrolled with WIC were 0.7 times less likely to deliver a low birth weight infant than Medicaid alone counterparts. In terms of benefits to the infant, infants born to a mother enrolled in WIC tended to spend one less night in the hospital on average and were 0.9 times less likely to be admitted to the ICU than infants born to mothers who were not enrolled in WIC. All of the above health outcomes were most significant in a WIC population 18 years of age or younger (Bitler & Currie, 2004).
Health Implications Related to the Use of Supplemental Foods in a Non-pregnant Population

While both SNAP and WIC can aid in food security for families, research has shown SNAP places a non-pregnant population at greater risk of adverse health outcomes. Leung, Willet, and Ding (2012) showed SNAP recipients were at greater risk of obesity, higher triglyceride levels, lower HDL levels, and higher waist circumferences than counterparts not receiving SNAP benefits. Women enrolled in the SNAP program were 1.51 times as likely to have a waist circumference greater than 35 inches placing them at increased risk of metabolic syndrome (Leung, Willet, & Ding, 2012). The rationale behind the increased risk of obesity and chronic disease from SNAP participation can be explained through the Wilde, McNamara, and Ranney (2000) study that concluded individuals with SNAP benefits were more likely to consume more meat, added sugars, and total fats than if not enrolled in the program. Since WIC funds and mandates postpartum women and children select healthful, nutrient-dense options, Wilde et al. (2000) concluded WIC participants were less likely to consume added sugars than in the absence of the program in contrast.
CHAPTER III

METHODS

Study Design

This study was a quantitative, non-experimental, post-test only design approved by both Kent State University’s and The Ohio Department of Health’s Internal Review Boards. The purpose of this study was to examine if environmental factors were related to gestational weight gain in Portage County, Ohio women enrolled in the Supplemental Nutrition Program for Women, Infants, and Children (WIC). The study also examined how environmental factors interact both individually and in combination in their contribution to gestational weight gain in Portage County, Ohio women.

Sample

A convenience sample of women enrolled in Portage County WIC were utilized. Participants served as their own control since women with inadequate, adequate, and excessive gestational weight gain were all included. Any adult woman, ≥ 18 years of age, in the ≥second trimester of pregnancy or within a six month postpartum period with a singleton, intrauterine pregnancy was included. A pregnant or postpartum mother with either a diagnosis of type 1 or type 2 diabetes prior to pregnancy was excluded. Past research studies have excluded individuals with type 1 or type 2 diabetes related to insulin’s ability to impact gestational weight gain patterning (Brawarsky et al., 2005; Wells, Schwalberg, Noonan, & Gabor, 2006). Women under the age of 18 were excluded related to the need for parental consent to participate and protection of minors. If a
woman had previously carried or was carrying multiple fetuses with her most recent pregnancy, she was also excluded from this study since the National Institutes of Medicine (IOM) has issued separate gestational weight gain recommendations for this population (National Institutes of Medicine, 2009). Furthermore, if a postpartum woman did not carry to term, (<37 weeks gestation), she was excluded related to either a miscarriage or pre-term labor impacting the total amount of gestational weight gained.

**Questionnaire Development**

Two, separate, paper based questionnaires, consisting of six parts each, (Part I: Exclusion Criteria; Part II: Demographics; Part III: Pregnancy History and Intention; Part IV: Lifestyle Patterns; Part V: Anthropometrics; and Part VI: Socioeconomic Status) were developed for the two participant groups: pregnant women and postpartum women (Appendix A and B). The questionnaire for pregnant women included 49 questions and was written at a 4.1 grade reading level while the questionnaire for postpartum women included 48 questions and was written at a 4.7 grade reading level according to the SMOG formula (Text Statistics, 2013). All written material provided to participants was written at a reading level below sixth grade; a standard used at the Portage County WIC clinic. Pregnant women answered environmental questions based on current behaviors while postpartum women answered the questionnaire based on retrospective behaviors during their pregnancy.

**Pilot Testing**

Four women, who were experiencing or had experienced pregnancy within a two year period, were asked to complete this study questionnaire. These women were
friends or family members of the co-investigator and were not affiliated with the WIC program. Participants who were experiencing pregnancy were given Appendix A for the pregnant woman while participants who had experienced pregnancy were given Appendix B for the postpartum woman. From pilot testing, it was determined the questionnaire took approximately 10-15 minutes to complete. Misleading and confusing questions were either deleted or reworded based on pilot testing participants’ feedback.

**Procedure**

Women were given one individualized questionnaire, either a questionnaire for pregnant or for postpartum women based on their current status. The questionnaire took approximately 10-15 minutes to complete.

**Part I: Exclusion Criteria**

The questionnaire for pregnant women included two closed-ended, yes/no questions while the questionnaire for postpartum women included three questions. If a “yes” was circled regarding any of the exclusion criteria: having a diagnosis of type 1 or type 2 diabetes before pregnancy, carrying multiple fetuses with most recent pregnancy, and/or not carrying to term, the participant stopped the survey and returned to a designated box in the WIC office.

**Part II: Demographics**

This part of the survey on both the pregnant and postpartum questionnaire was composed of three questions. Part II addressed standard demographics during the participant’s pregnancy and identified the education level, ethnicity/race, and age of the participant. The above demographic factors provided the researcher with descriptive
data. All participants were given multiple choice responses to choose from for defining their education level and race during pregnancy while age was asked in an open-ended format. Education level and ethnicity/race categories were adapted from the Wells, Schwalberg, Noonan, and Gabor (2006) study examining factors contributing to gestational weight gain in Colorado residents

**Part III: Pregnancy History and Intention**

Three questions within Part III were included on both the pregnant and postpartum questionnaires and addressed participant parity, pregnancy intention, and past breastfeeding history to provide the researcher with descriptive data. To address pregnancy intention, a question adapted from the Centers for Disease Control and Prevention’s PRAMS survey and used in Wells et al. study (2006) was utilized. Parity and number of children breastfed in the past for six continual months, asked in an open-ended format, provided continual data while pregnancy intention was a categorical intended vs. unintended. Answering the question with “I wanted to be pregnant sooner or I wanted to be pregnant then/now” categorized the participant as having an intended pregnancy while “I wanted to be pregnant in the future or I wanted to never be pregnant” categorized the participant as having an unintended pregnancy. Questions regarding parity and number of children breastfed in the past have been utilized in other research studies and therefore were utilized in this current study to create an exhaustive list of variables contributing to gestational weight gain (Brawarsky et al., 2005; Herring et al., 2012).
Part IV: Lifestyle Patterns

The modifiable, lifestyle patterns that were addressed in this survey included smoking status, sleep patterning, physical activity, and diet quality and were inquired about in thirty questions both on the pregnant and postpartum questionnaires. The above variables were the main analytical variables of the study that allowed the researcher to provide Portage County WIC dietitians with useful data in order to alter health-related behaviors of Portage County WIC mothers. Participants selected one multiple choice answer that best described their behavior during pregnancy. Smoking status categories were adapted from the Brawarsky et al. (2005) study. Sleep patterning categories were adapted from the Herring et al. (2012) study. The level of physical activity of participants was assessed using The Rapid Assessment of Physical Activity (RAPA) 1, validated, questionnaire (Centers for Disease Control and Prevention, Health Promotion Research Center, 2013). After completion, participants were categorized as sedentary, under-active, under-active regular-light activities, under-active-regular, or active based on responses. RAPA 1 was scored by choosing the question with the highest affirmative response. Diet Quality was assessed utilizing the Prime Screen Nutrition Questionnaire. The Prime Screen Nutrition Questionnaire has been validated as a quick way to assess quality of diet among adults and has adequate reproducibility, in that results compare well with a longer food frequency questionnaire (Rifas, Willett, Lobb, Kotch, Dart, & Gillman, 2001). Its use in a pregnant population has been tested by Herring et al. (2012). The maximum score for diet quality within this study was a 44 with a score of 35-44.
indicating an excellent diet, a score of 16-34 a good diet, a score of 1-15 a fair diet, and a score of zero or less a poor diet.

**Part V: Anthropometrics**

All anthropometrics were self-reported from study participants and asked in an open-ended format. The questionnaire for pregnant women included five questions within Part V while the questionnaire for postpartum women included three. Pregnant participants were asked in an open-ended format for their pre-pregnancy weight, current weight, and current height without shoes. The current date and due date of the pregnant participant was also asked in order to calculate if the female was in her second trimester of pregnancy or later for inclusion criteria and appropriate gestational weight gain recommendations. The postpartum participant was asked in an open-ended format for her retrospective pre-pregnancy weight with her most recent child, highest pregnancy weight, and current height without shoes. From self-reported pre-pregnancy weights and current heights, the participant’s pre-pregnancy BMI was calculated and classified as underweight, normal, overweight, or obese according to Centers for Disease Control standards. Furthermore, it was then determined if the woman gained an inadequate, recommended, or excessive amount of gestational weight gain based on total or weekly recommendations from the National Institutes of Medicine (Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity, and Obesity, 2011; National Institutes of Medicine, 2009) (Table 1). This gestational weight gain classification served as the dependent variable within the study.
Part VI: Socioeconomic Status

Six questions were placed within Part VI on the pregnant and postpartum questionnaires. Pregnant and postpartum participants were asked to list the number of adults and children residing in their home and total yearly household income currently or retrospectively during pregnancy in an open-ended format. From these responses, participants were categorized in to the United States Department of Health and Human Services (2014) federal poverty line percentages for data analysis. If families of the participants did not fall in to a perfect poverty line percentage, income levels were rounded down for classification purposes. Current or retrospective food insecurity was also measured with questions adapted from Blumberg, Bialostosky, Hamilton, and Briefel’s (1999) short form of the household food security scale. If participants respond with an affirmative to either question, they were categorized as food insecure while those answering no were categorized as food secure. The use of an additional food assistance program, the Supplemental Nutrition Assistance Program or SNAP, currently or retrospectively during pregnancy was also assessed among both groups of participants in a closed-ended yes/no format.

Statistical Analysis

All variables were placed in to a backward regression utilizing SPSS 19 (IBM, New York) with a p-value selected a priori 0.05 for significance. Descriptive statistics were utilized to describe frequencies, standard deviations, and means of participants’ responses. The variables that were placed in to the backward regression model are listed below with the type of data they provided: continual, discrete, or categorical.
Independent Variables:

- Education Level-Categorical-4 Levels, Part II
- Ethnicity- Categorical-6 Levels, Part II
- Age-Continual, Part II
- Parity- Discrete, Part III
- Past breastfeeding history- Discrete, Part III
- Pregnancy Intention- Categorical- 2 Levels, Part III
- Smoking Status- Categorical-5 Levels, Part IV
- Sleep Patterning- Categorical- 2 Levels, Part IV
- Physical Activity- Categorical- 5 Levels. Part IV
- Diet Quality- Continual, Part IV
- Pre-Pregnancy BMI- Continual, Part V
- Pre-Pregnancy BMI Class-Categorical-4 Levels, Part V
- Percent Federal Poverty Line- Continual, Part VI
- Food Security- Categorical- 2 Levels, Part VI
- SNAP Recipient- Categorical- 2 Levels, Part VI
- Pregnant or Postpartum Classification- Categorical- 2 Levels

Since the data was not normally distributed, non-parametric statistics were used. A Kruskal-Wallis Test was run to assess the analysis of variance between the dependent variable, gestational weight gain and each independent variable. The dependent gestational weight gain variable provided categorical data with three levels (inadequate,
recommended, or excessive weight gain) and was calculated in Part V of the questionnaire.
CHAPTER IV

JOURNAL ARTICLE

Introduction

Women enrolled in food assistance programs are at greater risk of health disparities when entering pregnancy as compared to counterparts related to food insecurity, access to prenatal care, etc. To combat one disparity, pregnant women have two main federal, subsidized programs to aid in food security; The Supplemental Nutrition Assistance Program (SNAP) or the Supplemental Food Assistance Program for Women, Infants, and Children (WIC). WIC strives to safeguard the health of low income women, infants and children up to age five found to be at nutritional risk by providing health care referrals, nutrition education, and food coupons to purchase fruits, vegetables, dairy products, and whole grains at registered grocery stores (United States Department of Agriculture, 2013). Many WIC recipients are concurrently enrolled in SNAP, posing health complications, such as greater rates of obesity, high triglycerides, and higher waist circumferences related to a greater consumption of meats, added sugars and total fats among participants (Leung, Willet, &Ding, 2012; Wilde, McNamara, &Ranney, 2000).

The National Institute of Medicine has issued gestational weight gain recommendations for women; however, there is a scarcity of data for women enrolled in these above mentioned food assistance programs (National Institutes of Medicine, 2009).

Health practitioners urge females in the second trimester of pregnancy or greater to gain an appropriate amount of gestational weight gain (National Institutes of Medicine,
Inadequate gestational weight gain is linked to delivery of a small for gestational age infant and an increase in infant mortality (Davis, Hofferth, & Shenassa, 2013). However, excessive gestational weight gain poses its own adverse complications for mother and the infant by increasing a mother’s risk of developing gestational diabetes mellitus, preeclampsia, having a caesarian delivery and weight retention postpartum.

Complications from excessive weight gain for the infant include abnormal blood glucose levels, shoulder dystocia, and large for gestational age with weight retention and gain throughout childhood and adolescence (Amorim, Rossner, Neovius, Lourenco, & Cinne, 2007; Langford, Joshu, Chang, Myles, & Leet, 2011; Morisset et al., 2011; Weisman et al., 2012). This weight retention and gain predisposes this pediatric population to chronic obesity and related chronic diseases (Coulston & Boushey, 2008; Mahan, Stump, & Raymond, 2012).

The amount of gestational weight gained throughout pregnancy is influenced by a myriad of environmental factors including age, race, parity, diet, exercise status, smoking status, etc. (Brawarsky et al., 2005; Wells, Schwalberg, Noonan, & Gabor, 2006). However, these past studies fail to analyze the interaction between both non-modifiable and modifiable environmental factors that contribute to the excessive gestational weight gain epidemic. The purpose of this study was to examine if environmental factors were related to gestational weight gain in Portage County, Ohio women enrolled in the Supplemental Nutrition Program for Women, Infants, and Children (WIC). The research hypotheses was there will be environmental factors that are related to gestational weight gain in Portage County, Ohio WIC participants while the null hypothesis was
environmental factors will not affect gestational weight gain in Portage County, Ohio WIC participants.

**Methods**

**Study Design**

This study was a quantitative, non-experimental, post-test only design approved by both Kent State University’s and The Ohio Department of Health’s Internal Review Boards. The purpose of this study was to examine if environmental factors were related to gestational weight gain in Portage County, Ohio women enrolled in the Supplemental Nutrition Program for Women, Infants, and Children (WIC). The study also examined how environmental factors interact both individually and in combination in their contribution to the gestational weight gain among Portage County, Ohio women.

**Sample**

A convenience sample of women enrolled in Portage County WIC were utilized. Any adult woman, ≥ 18 years of age, in the ≥second trimester of pregnancy or within a six month postpartum period with a singleton, intrauterine pregnancy was included.

A pregnant or postpartum mother with either a diagnosis of type 1 or type 2 diabetes prior to pregnancy was excluded. Past research studies have excluded individuals with type 1 or type 2 diabetes related to insulin’s ability to impact gestational weight gain patterning (Brawarsky et al., 2005; Wells, Schwalberg, Noonan, & Gabor, 2006). Women under the age of 18 were excluded related to the need for parental consent to participate and protection of minors. If a woman had previously carried or was carrying multiple fetuses with her most recent pregnancy, she was also excluded from
this study since the National Institutes of Medicine (IOM) has issued separate gestational weight gain recommendations for this population (National Institutes of Medicine, 2009). Furthermore, if a postpartum woman did not carry to term, (<37 weeks gestation), she was excluded related to either a miscarriage or pre-term labor impacting the total amount of gestational weight gained.

**Questionnaire Development**

Two separate, paper based questionnaires, consisting of six parts each (Part I: Exclusion Criteria; Part II: Demographics, Part III: Pregnancy History and Intention, Part IV: Lifestyle Patterns, Part V: Anthropometrics, and Part VI: Socioeconomic Status), were developed for the two participant groups, pregnant women and postpartum women. The questionnaire for pregnant women included 49 questions and was written at a 4.1 grade reading level while the questionnaire for postpartum women included 48 questions and was written at a 4.7 grade reading level according to the SMOG formula (Text Statistics, 2013). All written material provided to participants was written at a reading level below sixth grade; a standard used at the Portage County WIC clinic. Pregnant women answered environmental questions based on current behaviors while postpartum women answered the questionnaire based on retrospective behaviors during their pregnancy.

**Pilot Testing**

Four women, who were experiencing or had experienced pregnancy within a two year period, were asked to complete this study questionnaire. These women were friends or family members of the co-investigator and were not affiliated with the WIC program.
From pilot testing, it was determined the questionnaire took approximately 10-15 minutes to complete. Misleading and confusing questions were either deleted or reworded based on pilot testing participants’ feedback.

**Procedure**

Women were given one individualized questionnaire, either a questionnaire for pregnant or for postpartum women based on their current status. Both questionnaires took approximately 10-15 minutes to complete.

**Part I: Exclusion Criteria**

The questionnaire for pregnant women included two closed-ended, yes/no questions while the questionnaire for postpartum women included three questions. If a “yes” was circled regarding any of the exclusion criteria: having a diagnosis of type 1 or type 2 diabetes before pregnancy, carrying multiple fetuses with most recent pregnancy, and/or not carrying to term, the participant stopped the survey and returned to a designated box in the WIC office.

**Part II: Demographics**

This part of the survey on both the pregnant and postpartum questionnaire was composed of three questions. Part II addressed standard demographics during the participant’s pregnancy and identified the education level, ethnicity/race, and age of the participant. The above demographic factors provided the researcher with descriptive data. All participants were given multiple choice responses to choose from for defining their education level and race during pregnancy while age was asked in an open-ended format. Education level and ethnicity/race categories were adapted from the Wells,
Schwalberg, Noonan, and Gabor (2006) study examining factors contributing to gestational weight gain in Colorado residents

**Part III: Pregnancy History and Intention**

Three questions were included within Part III on both the pregnant and postpartum questionnaires and addressed participant parity, pregnancy intention, and past breastfeeding history to provide the researcher with descriptive data. To address pregnancy intention, a question adapted from the Centers for Disease Control and Prevention’s PRAMS survey and used in Wells et al. study (2006) was utilized. Parity and number of children breastfed in the past for six continual months, asked in an open-ended format, provided continual data while pregnancy intention was a categorical intended vs. unintended. Answering the question with “I wanted to be pregnant sooner or I wanted to be pregnant then/now” categorized the participant as having an intended pregnancy while “I wanted to be pregnant in the future or I wanted to never be pregnant” categorized the participant as having an unintended pregnancy. Questions regarding parity and number of children breastfed in the past have been utilized in other research studies and therefore were utilized in this current study to create an exhaustive list of variables contributing to gestational weight gain (Brawarsky et al., 2005; Herring et al., 2012).

**Part IV: Lifestyle Patterns**

The modifiable, lifestyle patterns that were addressed in this survey included smoking status, sleep patterning, physical activity, and diet quality and were inquired about in thirty questions both on the pregnant and postpartum questionnaires. The above
variables were the main analytical variables of the study that allowed the researcher to provide Portage County WIC dietitians with useful data in order to alter health-related behaviors of Portage County WIC mothers. Participants selected one multiple choice answer that best described their behavior during pregnancy. Smoking status categories were adapted from the Brawarsky et al. (2005) study. Sleep patterning categories were adapted from the Herring et al. (2012) study. The level of physical activity of participants was assessed using The Rapid Assessment of Physical Activity (RAPA) 1, validated, questionnaire (Centers for Disease Control and Prevention, Health Promotion Research Center, 2013). After completion, participants were categorized as sedentary, under-active, under-active regular-light activities, under-active-regular, or active based on responses. RAPA 1 was scored by choosing the question with the highest affirmative response. Diet Quality was assessed utilizing the Prime Screen Nutrition Questionnaire. The Prime Screen Nutrition Questionnaire has been validated as a quick way to assess quality of diet among adults and has adequate reproducibility, in that results compare well with a longer food frequency questionnaire (Rifas, Willett, Lobb, Kotch, Dart, & Gillman, 2001). Its use in a pregnant population has been tested by Herring et al. (2012). The maximum score for diet quality within this study was a 44 with a score of 35-44 indicating an excellent diet, a score of 16-34 a good diet, a score of 1-15 a fair diet, and a score of zero or less a poor diet.

**Part V: Anthropometrics**

All anthropometrics were self-reported from study participants and asked in an open-ended format. The questionnaire for pregnant women included five questions within
Part V while the questionnaire for postpartum women included three. Pregnant participants were asked in an open-ended format for their pre-pregnancy weight, current weight, and current height without shoes. The current date and due date of the pregnant participant was also asked in order to calculate if the female was in her second trimester of pregnancy or later for inclusion criteria and appropriate gestational weight gain recommendations. The postpartum participant was asked in an open-ended format for her retrospective pre-pregnancy weight with her most recent child, highest pregnancy weight, and current height without shoes. From self-reported pre-pregnancy weights and current heights, the participant’s pre-pregnancy BMI was calculated and also classified as underweight, normal, overweight, or obese according to Centers for Disease Control standards. Furthermore, it was then determined if the woman gained an adequate, recommended, or excessive amount of gestational weight gain based on total or weekly recommendations from the National Institutes of Medicine (Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity, and Obesity, 2011; National Institutes of Medicine, 2009). This gestational weight gain classification served as the dependent variable within the study.

**Part VI: Socioeconomic Status**

Six questions were placed within Part VI on the pregnant and postpartum questionnaires. Pregnant and postpartum participants were asked to list the number of adults and children residing in their home and total yearly household income currently or retrospectively during pregnancy in an open-ended format. From these responses, participants were categorized in to the United States Department of Health and Human
Services (2014) federal poverty line percentages for data analysis. If families of the participants did not fall in to a perfect poverty line percentage, income levels were rounded down for classification purposes. Current or retrospective food insecurity was also measured with questions adapted from Blumberg, Bialostosky, Hamilton, and Briefel’s (1999) short form of the household food security scale. If participants respond with an affirmative to either question, they were categorized as food insecure while those answering no were categorized as food secure. The use of an additional food assistance program, the Supplemental Nutrition Assistance Program or SNAP, currently or retrospectively during pregnancy was also assessed among both groups of participants in a closed-ended yes/no format.

**Statistical Analysis**

All variables were placed in to a backward regression utilizing SPSS 19 (IBM, New York) with a p-value selected a priori 0.05 for significance. Descriptive statistics were utilized to describe frequencies, standard deviations, and means of participants’ responses. The independent variables that were placed in to the backward regression model were education level, ethnicity, age, parity, past breastfeeding history, pregnancy intention, smoking status, sleep patterning, physical activity, diet quality, pre-pregnancy BMI, pre-pregnancy BMI class, percent federal poverty line, food security classification, SNAP recipient classification, and pregnant or postpartum classification. All independent variables either provided continual, discrete, or categorical data. The dependent variable within the study was gestational weight gain and it provided three levels of categorical data (inadequate, recommended, or excessive weight gain). Since the data was not
normally distributed, non-parametric statistics were used. A Kruskal-Wallis Test was run to assess the analysis of variance between the dependent variable, gestational weight gain and each independent variable.

**Results**

A convenience sample of 100 total participants completed the questionnaire (65.3% postpartum participants, 34.7% pregnant participants). Of these 100 returned questionnaires, 95 participants were included for data analysis after accounting for incomplete data, missing responses, or the exclusion criteria found in Part I of the questionnaire. Women were excluded from the study if they had a diagnosis of type 1 or type 2 diabetes prior to pregnancy, carried multiple fetuses with their most recent pregnancy, or did not carry to term defined as 37 weeks of gestation.

**Overall Subject Characteristics**

Table 8 depicts the descriptive statistics of the 95 participants. A majority of the study responses were from white (88.4%), postpartum (65.3%) women who were new mothers with no previous live births (39.8%). In terms of the analytical data of the study, a majority of participants were smokers at some point in their lives (54.8%), slept seven hours or greater nightly (57.9%), were underactive (73.7%), and consumed poor diets ($\bar{x} =0.5\pm7.54$).
Table 8: Descriptive Statistics of Respondents Completing the Pregnant or Postpartum Questionnaire

(\(n=95\))

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Category</th>
<th>%</th>
<th>Std. Deviation</th>
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<td>25.3</td>
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<td>Pre-pregnancy BMI (kg/m(^2))</td>
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<td>Gestational Weight Gain Classification( ^h )</td>
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<td>Federal Poverty Line (%)</td>
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<td>Food Security( ^i )</td>
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<td>62.1</td>
<td>0.48</td>
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<td></td>
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<td>35.8</td>
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<td>SNAP Recipient( ^j )</td>
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<td>60.2</td>
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<td>Pregnant or</td>
<td>95</td>
<td>1.7</td>
<td>1</td>
<td>34.7</td>
<td>0.48</td>
</tr>
</tbody>
</table>

\(^a\) The range for education is 1 (less than 9th grade) to 6 (graduate degree).
\(^b\) The range for race is 1 (non-Hispanic White) to 6 (Hispanic).
\(^c\) The range for pregnancy intention is 1 (no intention) to 2 (unplanned).
\(^d\) The range for smoking status is 1 (never smoker) to 5 (daily smoker).
\(^e\) The range for sleep patterning is 1 (short sleep) to 5 (long sleep).
\(^f\) The range for physical activity is 1 (very active) to 5 (very inactive).
\(^g\) The range for BMI classification is 1 (underweight) to 4 (obese).
\(^h\) The range for gestational weight gain classification is 1 (underweight) to 3 (normal weight gain).
\(^i\) The range for food security is 1 (food insecure) to 1 (food secure).
\(^j\) The range for SNAP recipient is 1 (yes) to 2 (no).
Postpartum Grouping

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gestational Weight Gain Class</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education categories:</td>
<td>1-less than high school, 2-high school graduate or GED, 3-greater than high school, 4-college graduate or higher</td>
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<tr>
<td>Race categories:</td>
<td>1-white, 2-Hispanic or Latino, 3-African American or black, 4-Native American or American Indian, 5-Asian, 6-other</td>
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<td></td>
</tr>
<tr>
<td>Pregnancy intention categories:</td>
<td>1-planned pregnancy, 2-unplanned pregnancy</td>
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<tr>
<td>Smoking status categories:</td>
<td>1-never a smoker, 2-smoker prior to pregnancy, 3-smoked &lt;0.5 packs of cigarettes, 4-smoked 0.5-1 pack of cigarettes, 5-smoked 1+packs of cigarettes</td>
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<tr>
<td>Sleep patterning categories:</td>
<td>1-&lt;7 hours nightly, 2≥7 hours nightly</td>
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</tr>
<tr>
<td>Physical activity categories:</td>
<td>1-sedentary, 2-under-active, 3-under-active regular-light, 4-under-active regular, 5-active</td>
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<tr>
<td>Pre-pregnancy BMI classifications:</td>
<td>1-underweight, 2-normal, 3-overweight, 4-obese</td>
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<td>Gestational weight gain classification:</td>
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<tr>
<td>Food security classification:</td>
<td>1-food insecure, 2-food secure</td>
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<td>SNAP recipient classification:</td>
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<td>Pregnant or postpartum grouping:</td>
<td>1-pregnant participant, 2-postpartum participant</td>
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</table>

Subject Characteristics based on Gestational Weight Gain Classification

Of the 95 respondents, 21 had inadequate gestational weight gain (22.1%), 21 had recommended gestational weight gain (22.1%), and 53 had excessive gestational weight gain (54.7%) throughout pregnancy. Table 9 depicts the univariate analysis of variance when the independent variables of age, parity, breastfeeding history, diet, pre-pregnancy BMI, smoking status, sleep patterning, physical activity, federal poverty line percentage, food security classification, and SNAP recipient classification were compared against gestational weight gain classifications (inadequate, recommended, and excessive).

Women with excessive gestational weight gain entered pregnancy with a greater mean BMI ($\bar{x} = 27.0 \text{ kg/m}^2 \pm 5.31$) than women with inadequate gestational weight gain ($\bar{x} = 26.3 \text{ kg/m}^2 \pm 8.49$) and women with recommended gestational weight gain ($\bar{x} = 25.4 \text{ kg/m}^2 \pm 6.29$), respectively. All gestational weight gain classes, however, had a mean pre-pregnancy BMI that placed these individuals within the overweight category.

Table 9: Descriptive Statistics based on Participants’ Gestational Weight Gain Classification
<table>
<thead>
<tr>
<th></th>
<th>Inadequate</th>
<th>Recommended</th>
<th>Excessive</th>
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</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
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<tr>
<td>Inadequate</td>
<td>21</td>
<td>24.9</td>
<td>3.78</td>
</tr>
<tr>
<td>Recommended</td>
<td>21</td>
<td>25.9</td>
<td>6.01</td>
</tr>
<tr>
<td>Excessive</td>
<td>52</td>
<td>26.0</td>
<td>5.53</td>
</tr>
<tr>
<td><strong>Parity (# of children)</strong></td>
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<tr>
<td>Inadequate</td>
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<td>1.1</td>
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<td>0.00</td>
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<td><strong>Pre-Pregnancy BMI (kg/m²)</strong></td>
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<td>26.3</td>
<td>8.49</td>
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<td><strong>Physical Activity</strong></td>
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<td><strong>Federal Poverty Line (%)</strong></td>
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<td>0.51</td>
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<td>Excessive</td>
<td>52</td>
<td>1.4</td>
<td>0.50</td>
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</table>
a. Smoking status categories: 1- never a smoker, 2-smoker prior to pregnancy, 3-smoked <0.5 packs of cigarettes, 4-smoked 0.5-1 pack of cigarettes, 5-smoked 1+packs of cigarettes
b. Sleep patterning categories: 1-<7 hours nightly, 2-≥ 7 hours nightly
c. Physical activity categories: 1-sedentary, 2-under-active, 3-under-active regular-light, 4-under-active regular, 5-active
d. Food security classification: 1-food insecure, 2-food secure
e. SNAP recipient classification: 1-SNAP recipient, 2-not a SNAP recipient

**The Independent Variables’ Effects on Gestational Weight Gain**

There was a significant difference in a woman’s past breastfeeding history (p=0.02) and her gestational weight gain classification as compared to the other variables when a Kruskal-Wallis Test was run. Women who gained recommended gestational weight gain were more likely to have breastfed an infant for six continual months prior to their most recent pregnancy with a mean rank of 54.69 as compared to women with inadequate gestational weight gain with a mean rank of 41.50 and women with excessive gestational weight gain with a mean rank of 46.01, respectively. No other variables were found to have a significant effect on gestational weight gain (education, p=0.58; race, p=0.48; age, p=0.10; parity, p=0.53; pregnancy intention, p=0.99, smoking, p=0.71, sleep, p=0.85; physical activity, p=0.22, diet, p=0.81; pre-pregnancy BMI classification, p=0.21; federal poverty line percentage, p=0.59; food security classification, p=0.55, and SNAP recipient classification, p=0.78), respectively.

**Relationship between Independent Variables and Gestational Weight Gain**

A backward regression demonstrated no significant differences (p<0.05) in all the variables (education, race, age, parity, pregnancy intention, breastfeeding history, smoking status, sleep patterning, physical activity, diet, pre-pregnancy BMI, pre-pregnancy BMI classification, federal poverty line percentage, food security
classification, and SNAP recipient classification) that contributed to gestational weight gain in combination.

**Discussion**

The purpose of this study was to examine if environmental factors were related to gestational weight gain in Portage County, Ohio women enrolled in the Supplemental Nutrition Program for Women, Infants, and Children (WIC). The study results indicated: 1.) Breastfeeding was the only variable that individually significantly contributed to excessive gestational weight gain; 2.) No variables significantly contributed to gestational weight gain, in combination. Therefore, the research hypothesis stating there will be environmental factors that are related to gestational weight gain in Portage County, Ohio WIC participants was rejected while the null hypothesis stating environmental factors will not affect gestational weight gain was accepted.

**Descriptive Data Findings**

Overall, the descriptive data showed most of the participants were Caucasian, nulliparous with no past breastfeeding history, smokers at some point in their lives, under-active, food insecure, and were consuming poor diets. The study was originally intended to examine the relationship between the variables and their effect on gestational weight gain patterning, however, the study provided these unintentional descriptive data findings indicating Portage County women enrolled in WIC are practicing unhealthy behaviors.

Comparing the present study with past reviewed literature, there were less variations in race among participants. Past studies have included large sample sizes of...
African American or Hispanic women while this present study had 88.4% of respondents being of Caucasian race. Adler & Rehkof (2008) found African Americans were more likely to gain excessive gestational weight than Caucasian counterparts while Chu, Callaghan, Bish, & D’Angelo (2009) found the opposite to hold true. The large percentage of Caucasian women within the present study indicates race is not the only factor contributing to gestational weight gain, and it is important for other counties and states with more diverse populations to not generalize the findings found within the present study.

Parity has long been studied as a factor that contributes to excessive gestational weight gain. Past research has shown multiparous women who have delivered two or more children were more likely to have a gestational weight gain goal concordant with IOM recommendations (Tovar et al., 2011). Logically, research has also shown multiparous women were less likely to have excessive gestational weight gain than nulliparous women regardless if enrolled in a food assistance program (Schieve, Cogswell, & Scanlon; 1998; Wells, Schwalberg, Noonan, & Gabor, 2006). A majority of women within the present study were nulliparous (39.8%) thus logically contributing to the large percentage of women reporting no past breastfeeding history (87.4%). These present findings indicate Portage County women enrolled in WIC are entering pregnancies inexperienced, suggesting a need for pre-pregnancy education on the importance of gaining recommended gestational weight and breastfeeding in the postpartum period.
Lifestyle patterns tend to be modifiable and have served as analytical variables in past studies. Wells, Schwalberg, Noonan, & Gabor (2006) concluded females who smoked throughout pregnancy were more likely to experience inadequate gestational weight gain. The present study contrasts with this finding with a majority of women, (54.8%), reporting smoking prior to pregnancy, yet experiencing excessive gestational weight gain. Due to nicotine’s addictive nature, it is unlikely Portage County women entirely stopped smoking throughout pregnancy, and may have contributed to the 54.7% of women with excessive gestational weight gain seen. Furthermore, the 54.8% of women who reported smoking before or during pregnancy in the present study is not surprising considering research has long shown smoking prevalence among disadvantaged groups is higher with uptake also higher among individuals of lower socioeconomic status and quit attempts less likely (Hiscock, Bauld, Amos, Fidler, & Munafo, 2011). Despite weight patterning, this smoking status raises concern for future immune function, asthma development, and decreased lung function for both mother and the infant (Hollams, Klerk, Holt, & Sly, 2013).

Under-active women have long been descriptive of pregnant populations and past research has shown leading a sedentary lifestyle places all individuals at risk of carrying excess weight (Rastrollo et al., 2008). Herring et al. (2012) found 77% of women gained excessive gestational weight with limited or no activity while only 23% of active women experienced excessive gestational weight gain. The present study concurs with the past research showing sedentary behavior among Portage County women (77.3%) that may
eventually lead to development of weight related chronic disease such as type 2 diabetes mellitus, cancer, cardiovascular disease, etc. if not addressed.

Logically, diet serves as another factor that influences gestational weight gain and Brawarsky et al (2005) found women with higher mean intakes of fruit and vegetables, dairy products, grains, and protein were 4.9% more likely to gain excessive gestational weight. The present study improves past research and actually quantifies an individual’s diet quality with a maximum score of 44 points utilizing the Prime Screen Nutrition Questionnaire. Alarmingly, the average diet quality score among participants was 0.48, indicating very poor diet quality, potentially explained by low socioeconomic demographics.

All women within the present study can be classified as being of lower socioeconomic status related to their ability to qualify for WIC and fall at 180% of the federal poverty line or below. To date, the present study has the highest percentage of women with excessive gestational weight gain (54.7%) enrolled in a food assistance program with past research percentages ranging from 38.8-43.7 (Schieve, Cogswell, &Scanlon; 1998, Wells, Schwalberg, Noonan, &Gabor, 2006). Furthermore, the present study demonstrated 31.9% of respondents reported their yearly household income to be at 25% of the federal poverty line or below suggesting past research has overlooked the poverty severity among these food assistance recipients. Lastly, 62.1% of respondents in the present study were classified as food insecure with an analysis of variance between gestational weight gain groupings showing a p value of 0.019 for significance, despite the fact 58.9% were also concurrently enrolled in SNAP. Food insecurity places all
individuals at greater risk of obesity, high triglycerides, and higher waist circumferences related to a diet higher in added sugars and fat (Leung, Willet, & Ding, 2012; Wilde, McNamara, & Ramney, 2000).

All of the above descriptive statistics, unfortunately, show pregnant and postpartum WIC participants within the present study are unhealthy with poor health history. The alarming rates of sedentary behavior, poor diet quality, and food insecurity reported among participants helps to explain why all women regardless of gestational weight gain classification (inadequate, recommended, or excessive), entered pregnancy with a mean overweight BMI. While this overweight BMI does increase the risk of maternal excessive gestational weight gain, grave consequences extend in to the postpartum period with weight retention and gain for mother and the infant likely (Ferraro et al., 2013). Carrying excess weight places all individuals at increased risk of chronic diseases such as type 2 diabetes mellitus, cancer, cardiovascular disease, metabolic syndrome, etc (Coulston & Boushey, 2008; Mahan, Stump, & Raymond, 2012; Shils, Shike, Ross, Caballero, & Cousins, 2006). So while excessive gestational weight gain in Portage County, Ohio residents is becoming a growing concern (Portage County Maternal and Child Health Indicators, 2013), looking at the gestational weight gain epidemic multi-factorially within the present study, indicates an even larger concern and public health need. Other community agencies need to step up and provide low income women with health related messages in the pre-pregnancy period so these women obtain a healthy weight before even contemplating conception.

Relationship between Factors and Gestational Weight Gain
Breastfeeding was the only factor found to have a significant effect on a woman’s gestational weight gain classification with women who gained recommended gestational weight, more likely to have breast fed in the past for six continual months. These findings suggest women who opt to breastfeed are truly thinking of the health and well-being of both themselves and their infants, placing them a step ahead of counterparts. Unfortunately, past research has shown there is a significant disparity in breastfeeding rates. Women with higher yearly incomes are more likely to breastfeed with research also showing a negative association between WIC participation and both initiation and duration of breastfeeding (Jensen, 2011; McDowell, Wang, & Stephenson, 2008). Jensen (2011) explained this phenomenon by stating women enrolled in WIC strive for net benefit maximization where perceived benefits outweigh the perceived or real cost. Since WIC offers free formula, women feel the formula package offers monetary, societal, and convenience benefits that outweigh the health consequences of not breastfeeding. To combat this belief, WIC modified its food packages in 2009 to provide a greater variety of food options to the exclusively breastfeeding mother and less formula for the partially breastfeeding mother. Rates of exclusively breastfeeding mothers at three and six months nearly doubled in a Los Angeles County, California population, however, in service motivational interviewing training sessions were conducted with WIC staff concurrently to promote breastfeeding among participants (Langellier, Chapparo, Wang, Koleilat, & Whaley, 2014). The present study aligns with past McDowell, Wang, and Stevenson (2008) research, with 84.7% of participants reporting no prior breastfeeding history suggesting a research need to obtain Portage County women’s own perceptions and
barriers to breastfeeding. In service motivational interviewing training among Portage County WIC staff might also help improve initiation and duration of breastfeeding by increasing participants own self efficacy.

The other factors (education level, ethnicity, age, parity, pregnancy intention, smoking status, sleep patterning, physical activity, diet quality, pre-pregnancy BMI, pre-pregnancy BMI class, percent federal poverty line, food security classification, and SNAP recipient classification) were found to be insignificant related to small sample sizes. Only 95 total women were included for data analysis and descriptive statistics showed similar characteristics among these pregnant and postpartum women. Variances between subjects were low causing the backwards regression and Kruskal-Wallis Test to show no significance.

**Limitations**

Although this study offers the most exhaustive list of environmental factors that individually and in combination contribute to gestational weight gain, limitations exist. The Portage County WIC clinic represents only one county’s experiences with gestational weight gain, so results may not be applicable to other counties in Ohio or other states. In order to improve this current study, increasing the sample size of both pregnant and postpartum participants to 90 plus in each grouping would allow for a better backward regression to be run that may provide more significant findings. Additionally, all data was self-reported from pregnant and postpartum women so the validity of responses; particularly the lifestyle, anthropometric, and socioeconomic variables, can be
questioned. Problems with self-reported yearly income levels were noted during data analysis with some women reporting yearly household income levels that were at the federal poverty line of 200%, making them ineligible for WIC services.

**Applications**

Excessive gestational weight gain has become an increasing concern in Portage County, Ohio related to its ability to create adverse maternal and infant health outcomes (Portage County Maternal and Child Health Indicators, 2013). However, much research has indicated weight gain actually begins to occur before the period of pregnancy with poor dietary quality and sedentary behavior (Rastrollo et al., 2008; Sletnz et al., 2004). The above is evidenced in the present study by all gestational weight gain classifications entering pregnancy with a mean overweight BMI. Descriptive statistics within the present study also show Portage County WIC participants practice unhealthy behaviors. Most had no prior breastfeeding history, had poor diet quality, were sedentary, and were smokers at some point in their lives, all raising concerns for health outcomes in general. Women are not changing their pre-pregnancy habitual and established behaviors simply due to conception, so another community agency needs to step up and provide health related messages to low income women in the pre-pregnancy period. When pregnant women arrive at WIC for nutrition counseling, habitual unhealthy behaviors have already been established and WIC sadly serves solely as a safety net in improving food security. Such past pre-pregnancy health initiatives such as increasing folic acid consumption among women of child bearing age in order to prevent neural tube defects, have proven to be tremendously successful (Blencowe, Cousens, Modell, & Lawn, 2010). Community
agencies promoting health related messages in the pre-pregnancy period must realize, however, their clients have their own culture of poverty and place relationships at the center of their cognitive frame over achievements like the middle class or connections like the wealthy class (Devol, 2004). Building on this theory, a relationship of trust and empathy must be built where educators asks clients what they feel they need to practice this above mentioned healthy lifestyle and obtain a healthy weight.

In applying the present findings to WIC, breastfeeding efforts both nationwide and in Portage County, Ohio are falling short of Healthy People 2020 guidelines of 60 percent of the population breastfeeding an infant until at least six months of age. WIC’s mission is to promote breastfeeding among participants by offering classes, breastfeeding peer counselor support, and breast pumps. A recent study indicated 34.1% of females nationwide were breastfeeding an infant to four months of age while only 21.1% of WIC participants who received WIC services in the first trimester of pregnancy on were breastfeeding an infant at four months of age (Ziol & Hernandez, 2010). Numbers within Portage County, Ohio WIC participants are even poorer, with only 12.4% of mothers reporting breastfeeding an infant at six months of age (Portage County Maternal and Child Health Indicators, 2013).

Women of childbearing age have several health related factors to consider before and during pregnancy such as ensuring proper macro and micronutrient intake, smoking cessation, leading an active lifestyle, obtaining a healthy weight, and making infant feeding decisions. If WIC staff can begin to promote breastfeeding over all other factors,
the present study shows women will begin to take better care of themselves in general, gaining recommended gestational weight.

**Conclusion**

This study demonstrated demographic, pregnancy history and intention, lifestyle patterns, anthropometrics, and socioeconomic status variables had little effect on a woman’s gestational weight gain classification. More concerning, however, was descriptive data demonstrating women were practicing poor health related behaviors such as unplanned conception, poor diet, smoking prior to pregnancy, and leading a sedentary lifestyle. Instead of continually reminding women of National Institute of Medicine (2009) gestational weight gain recommendations, WIC dietitians should begin to target messages to both pregnant and postpartum mothers on how to obtain a recommended weight regardless of pregnancy status.
APPENDICES
APPENDIX A

QUESTIONNAIRE FOR THE PREGNANT WOMAN
Appendix A

Questionnaire for the Pregnant Woman

Directions: Do NOT place your name on this survey. Please start with Part I. If you answer yes to any of these questions, stop and return the survey to the marked box. If you are not sure where to place the survey, ask WIC staff. If no is answered to all of the Part I questions, either fill in the blank or circle one response. It is ok to place “I do not know” in a blank or skip a question. At the end of the survey, return to the marked box.

I. Exclusion Criteria
1. Did you have type 1 or type 2 diabetes prior to your most recent pregnancy?
   a. Yes
   b. No

2. Are you carrying more than one child?
   a. Yes, I am carrying twins, triplets, or multiples
   b. No or I do not know

   • If you answered yes to questions 1-2, please stop and return survey to marked box.

II. Demographics
3. Select your current education level
   a. Less than high school
   b. High School Graduate or G.E.D.
   c. Greater than high school
   d. College Graduate or Higher

4. Select your ethnicity/race
   a. White
   b. Hispanic or Latino
   c. African American or Black
   d. Native American or American Indian
   e. Asian
   f. Other____________________________

5. What year were you born?______________

III. Pregnancy History and Intention
6. How many past live births have you delivered?______________________

7. Select the response below that best describes how you felt about this pregnancy?
a. I wanted to be pregnant sooner  
b. I wanted to be pregnant now  
c. I wanted to be pregnant in the future  
d. I wanted to never be pregnant

8. How many children have you breastfed in the past until at least 6 months of age? 

IV. Lifestyle Patterns
9. Select your smoking status per day with your current pregnancy.  
a. I was never a smoker  
b. I was a smoker prior to pregnancy  
c. I currently smoke less than 0.5 packs of cigarettes  
d. I currently smoke 0.5-1 pack of cigarettes  
e. I currently smoke 1+ packs of cigarettes

10. How many hours of sleep do you get nightly?  
a. < 7 hours  
b. ≥ 7 hours

11. At the present time, I rarely or never do any physical activities. Does this accurately describe you?  
a. Yes  
b. No

13. At the present time, I do some light (my heart beats slightly faster than normal and I can talk and sing) physical activity every week. Does this accurately describe you?  
a. Yes  
b. No

14. At the present time, I do moderate (my heart beats faster than normal and I can talk but not sing) physical activities every week, but less than 30 minutes a day or 3 days a week. Does this accurately describe you?  
a. Yes  
b. No
15. At the present time, I do vigorous (my heart rate increases a lot and I can’t talk) physical activities every week, but less than 20 minutes a day or 3 days a week. Does this accurately describe you?
   a. Yes
   b. No

16. At the present time, I do 30 minutes or more a day of moderate (my heart beats faster than normal and I can talk but not sing) physical activities, 5 or more days a week. Does this accurately describe you?
   a. Yes
   b. No

17. At the present time, I do 20 minutes or more of vigorous (my heart rate increases a lot and I can’t talk) physical activities, 3 or more days a week. Does this accurately describe you?
   a. Yes
   b. No

18. Currently, how often do you eat dark, leafy green vegetables? (spinach, romaine lettuce, mesclun mix, kale, turnip greens, bok choy, swiss chard
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

19. Currently, how often do you eat broccoli, broccoli rabe, cauliflower, cabbage, or brussel sprouts?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

20. Currently, how often do you eat carrots?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day
21. Currently, how often do you eat other vegetables (eg: peas, corn, green beans, tomatoes, squash)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

22. Currently, how often do you eat beans, split peas or lentils? Not green beans.
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

23. Currently, how often do you eat citrus fruits (eg: oranges, grapefruits)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

24. Currently, how often do you eat other fruits (eg: apples or pears, bananas, berries, grapes, or melons)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

25. Currently, how often do you eat whole milk dairy foods (eg: whole milk, hard cheese, butter, ice cream)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day
26. Currently, how often do you eat low-fat milk products (eg: low-fat/skim milk, yogurt, cottage cheese)?
   a.  Less than once per week
   b.  Once per week
   c.  2-4 times per week
   d.  Nearly daily or daily
   e.  Twice or more per day

27. Currently, how often do you eat whole eggs?
   a.  Less than once per week
   b.  Once per week
   c.  2-4 times per week
   d.  Nearly daily or daily
   e.  Twice or more per day

28. Currently, how often do you eat beef, pork, or lamb?
   a.  Less than once per week
   b.  Once per week
   c.  2-4 times per week
   d.  Nearly daily or daily
   e.  Twice or more per day

29. Currently, how often do you eat processed meats (eg: sausages, salami, bologna, hot dogs, bacon)?
   a.  Less than once per week
   b.  Once per week
   c.  2-4 times per week
   d.  Nearly daily or daily
   e.  Twice or more per day

30. Currently, how often do you eat turkey or chicken?
   a.  Less than once per week
   b.  Once per week
   c.  2-4 times per week
   d.  Nearly daily or daily
   e.  Twice or more per day
31. Currently, how often do you eat fish/seafood (not fried but broiled, baked, poached, or canned)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

32. Currently, how often do you eat margarine?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

33. Currently, how often do you eat Refined grains (eg: white bread, white rice, white pasta)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

34. Currently, how often do you eat Whole grain breads and cereals (whole wheat bread, oatmeal, brown rice, barley)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

35. Currently, how often do you eat baked, sweet products (muffins, doughnuts, cookies, cakes, pastries)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day
36. Currently, how often do you drink calorie-containing beverages (regular soda, sweetened tea, Gatorade)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

37. Currently, how often do you eat deep fried foods (eg: french fries, fried chicken)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

38. Currently, how often do you add salt to food at the table?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

V. **Anthropometrics**
39. What was your pre-pregnancy weight? ________________

40. How much do you currently weigh? ________________

41. What is the date today? ________________

42. When are you due? ________________

43. How tall are you without shoes? ________________

VI. **Socioeconomic Status**
44. How many children (<18 years of age) are living in your household currently? ________________

45. How many adults (≥18 years of age), including yourself, are living in your household currently? ________________

46. What is your yearly household income? ________________
47. Currently, “I/we worry whether my/our food will run out before I/we get money to buy more.” Is this…
   a. Often true
   b. Sometimes true
   c. Never true

48. Currently, “The food I/we buy just doesn’t last and I/we don’t have money to buy more.”
   Is this…
   a. Often true
   b. Sometimes true
   c. Never true

49. Do you receive food stamps from the Supplemental Nutrition Assistance Program?
   (SNAP)
   a. Yes
   b. No
APPENDIX B

QUESTIONNAIRE FOR THE POSTPARTUM WOMAN
Appendix B

Questionnaire for the Postpartum Woman

Directions: Do NOT place your name on this survey. Please start with Part I. If you answer yes to any of these questions, stop and return the survey to the marked box. If you are not sure where to place the survey, ask WIC staff. If no is answered to all of the Part I questions, either fill in the blank or circle one response. It is ok to place “I do not know” in a blank or skip a question. At the end, return survey to the marked box.

I. Exclusion Criteria
1. Did you have type 1 or type 2 diabetes prior to your most recent pregnancy?
   a. Yes
   b. No

2. With your most recent pregnancy did you carry more than one child?
   a. Yes, I carried twins, triplets, or multiples
   b. No

3. Did your most recent pregnancy NOT go full term, <37 weeks?
   a. Yes
   b. No
   • If you answered yes to any of questions 1-3, please return survey to marked box.

II. Demographics
4. Select your education level when you were pregnant with your most recent child:
   a. Less than high school
   b. High School Graduate or G.E.D.
   c. Greater than high school
   d. College Graduate or Higher

5. Select your ethnicity/race:
   a. White
   b. Hispanic or Latino
   c. African American or Black
   d. Native American or American Indian
   e. Asian
   f. Other __________________________

6. How old were you when you delivered your most recent child?______________
III. Pregnancy History and Intention
7. Before your most recent pregnancy, how many past live births had you delivered?__________________________

8. Select the response below that best describes how you felt about your most recent pregnancy?
   a. I wanted to be pregnant sooner
   b. I wanted to be pregnant then
   c. I wanted to be pregnant in the future
   d. I wanted to never be pregnant

9. How many children had you breastfed until at least 6 months of age before your most recent pregnancy? ___________

IV. Lifestyle Patterns
10. Select your smoking status per day during your most recent pregnancy.
    a. I was never a smoker
    b. I was a smoker prior to pregnancy
    c. I smoked less than 0.5 packs of cigarettes
    d. I smoked 0.5-1 pack of cigarettes
    e. I smoked 1+ packs of cigarettes

11. How many hours of sleep did you get nightly during your most recent pregnancy?
    a. < 7 hours
    b. ≥ 7 hours

12. During my most recent pregnancy, I rarely or never did any physical activities. Does this accurately describe you?
    a. Yes
    b. No

13. During my most recent pregnancy, I did some light (my heart beat slightly faster than normal but I could talk and sing) or moderate (my heart beat faster than normal and I could talk but not sing) physical activities, but not every week. Does this accurately describe you?
    a. Yes
    b. No

14. During my most recent pregnancy, I did some light (my heart beat slightly faster than normal and I can talk and sing) physical activity every week. Does this accurately describe you?
    a. Yes
    b. No
15. During my most recent pregnancy, I did moderate (my heart beat faster than normal and I could talk but not sing) physical activities every week, but less than 30 minutes a day or 3 days a week. Does this accurately describe you?
   a. Yes
   b. No

16. During my most recent pregnancy, I did vigorous (my heart rate increased a lot and I couldn’t talk) physical activities every week, but less than 20 minutes a day or 3 days a week. Does this accurately describe you?
   a. Yes
   b. No

17. During my most recent pregnancy, I did 30 minutes or more a day of moderate (my heart beat faster than normal and I could talk but not sing) physical activities, 5 or more days a week. Does this accurately describe you?
   a. Yes
   b. No

18. During your most recent pregnancy, how often did you eat dark, leafy green vegetables? (spinach, romaine lettuce, mesclun mix, kale, turnip greens, bok choy, swiss chard)
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

19. During your most recent pregnancy, how often did you eat broccoli, broccoli rabe, cauliflower, cabbage, or brussel sprouts?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day
21. During your most recent pregnancy, how often did you eat carrots?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

22. During your most recent pregnancy, how often did you eat other vegetables (eg: peas, corn, green beans, tomatoes, squash)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

23. During your most recent pregnancy, how often did you eat beans, split peas or lentils? Not green beans.
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

24. During your most recent pregnancy, how often did you eat citrus fruits (eg: oranges, grapefruits)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

25. During your most recent pregnancy, how often did you eat other fruits (eg: apples or pears, bananas, berries, grapes, or melons)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day
26. During your most recent pregnancy, how often did you eat whole milk dairy foods (eg: whole milk, hard cheese, butter, ice cream)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

27. During your most recent pregnancy, how often did you eat low-fat milk products (eg: low-fat/skim milk, yogurt, cottage cheese)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

28. During your most recent pregnancy, how often did you eat whole eggs?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

29. During your most recent pregnancy, how often did you eat beef, pork, or lamb?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

30. During your most recent pregnancy, how often did you eat processed meats (eg: sausages, salami, bologna, hot dogs, bacon)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day
31. During your most recent pregnancy, how often did you eat turkey or chicken?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

32. During your most recent pregnancy, how often did you eat fish/seafood (not fried but broiled, baked, poached, or canned)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

33. During your most recent pregnancy, how often did you eat margarine?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

34. During your most recent pregnancy, how often did you eat Refined grains (eg: white bread, white rice, white pasta)?
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day

35. During your most recent pregnancy, how often did you eat Whole grain breads and cereals (whole wheat bread, oatmeal, brown rice, barley)
   a. Less than once per week
   b. Once per week
   c. 2-4 times per week
   d. Nearly daily or daily
   e. Twice or more per day
36. During your most recent pregnancy, how often did you eat baked, sweet products (muffins, doughnuts, cookies, cakes, pastries)?
   a. Less than once per week  
   b. Once per week  
   c. 2-4 times per week  
   d. Nearly daily or daily  
   e. Twice or more per day

37. During your most recent pregnancy, how often did you drink calorie-containing beverages (regular soda, sweetened tea, Gatorade)?
   a. Less than once per week  
   b. Once per week  
   c. 2-4 times per week  
   d. Nearly daily or daily  
   e. Twice or more per day

38. During your most recent pregnancy, how often did you eat deep fried foods (eg: french fries, fried chicken)?
   a. Less than once per week  
   b. Once per week  
   c. 2-4 times per week  
   d. Nearly daily or daily  
   e. Twice or more per day

39. During your most recent pregnancy, how often did you add salt to food at the table?
   a. Less than once per week  
   b. Once per week  
   c. 2-4 times per week  
   d. Nearly daily or daily  
   e. Twice or more per day

VII. Anthropometrics
40. What was your pre-pregnancy weight?_________________

41. What was your heaviest pregnancy weight? ________________

42. How tall are you without shoes? ________________________

VIII. Socioeconomic Status
43. How many children (<18 years of age) lived in your household during your most recent pregnancy? _______________

44. How many adults (≥18 years of age) lived in your household, including yourself, during your most recent pregnancy? _______________
45. What was your yearly household income during your most recent pregnancy?

46. During your most recent pregnancy…, “I/we worried whether my/our food would run out before I/we got money to buy more.” Was this…
   a. Often true
   b. Sometimes true
   c. Never true

47. During your most recent pregnancy, “The food I/we bought just didn’t last and I/we didn’t have money to buy more.” Was this….
   a. Often true
   b. Sometimes true
   c. Never true

48. Did you receive food stamps from the Supplemental Nutrition Assistance Program (SNAP) during your most recent pregnancy?
   a. Yes
   b. No
APPENDIX C

CONSENT FORM
Appendix C

Consent Form

Title: Environmental Factors Contributing to Gestational Weight Gain in Portage County, Ohio Women

Principal Investigator: Natalie Caine-Bish
Co-Investigator: Erin Kintner

You are being asked to be part of a study. This form will tell you what you will need to do, and the risks and gains. You have the choice to be or not be in the study. Please read with care. You should ask questions in order to make the best choice. You will get a copy of this form to take with you.

Purpose:
The reason for this study is to see if things like age, race, diet, exercise, etc. cause a high weight gain during pregnancy in Portage County women using WIC.

Methods:
You will be asked to read and then circle or fill in answers to questions. These should take 15 minutes and will ask about your education, race, pregnancy history, diet, exercise, weight, height, and income.

Benefits:
There are no direct benefits to you. By being in this study, you help us realize things that cause high weight gain during pregnancy. If you become pregnant later, this study may help you gain a healthy weight and help you have a healthy baby.

Risks:
There are no risks beyond what you face each day in life. If you wish not to answer a question, you may skip it or place, “I do not know” in an answer space.

Privacy:
None of your answers will be tied to you. You will keep this form and the questionnaire in their own boxes.
Voluntary Participation:
Taking part in this study is up to you. You may choose not to be a part or you may stop without loss of WIC services.

Contact Information
If you have any questions or concerns about this study, you may call Natalie Caine-Bish at 330-672-2148 or Erin Kintner at 740-503-9884. This project has gone through the Kent State University Institutional Review Board. If you have any questions about your rights, you may call the IRB at 330-672-2704.

Consent Statement
I have read this form and have asked needed questions. All of my questions have been answered. I agree to be in this study. I know I can look at this form later for help.

_________________________________________________________  _______________________
Signature                                                Date
REFERENCES


