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MATERNAL DEPRESSION AFFECTS MATERNAL EATING BEHAVIORS AS SHOWN  
BY LEVELS OF DISINHIBITION, FOOD INSECURITY, AND PERCEIVED BARRIERS TO  
HEALTHY EATING IN A SAMPLE OF WIC MOTHERS

JESSICA ASHLEY GEIDA  
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Reviewed and approved\* by the following:

Leann L. Birch  
Distinguished Professor of Human Development and Family Studies  
Thesis Supervisor

Jennifer Savage Williams  
Associate Director, Center for Childhood Obesity Research  
Thesis Supervisor

Ronald Markle  
Professor of Biology and Director, Premedicine and Science majors  
Honors Adviser

Kate Hynes  
Assistant Professor and Honors Advisor, Human Development & Family Studies  
Honors Adviser

\* Signatures are on file in the Schreyer Honors College.

## ABSTRACT

**Background:** One in 10 mothers is depressed in the United States. Depression impacts a mother's ability to care for herself and others. Additionally, low-income mothers are often food insecure and nutritionally deprived. The purpose of this study is to understand the prevalence of depression among low-income mothers enrolled in WIC of birth to two years, examine the relationship between depression and restraint/disinhibition, and to investigate how depression is associated with perceived levels of food insecurity and barriers to healthy eating.

**Methods:** The study consisted of a cross-section of 60 low-income mothers enrolled in central Pennsylvania's WIC program. Mothers completed the Eating Inventory to assess restraint and disinhibited eating, Food Insecurity Screen and View of Family Meals questionnaire, Barriers to Healthy Eating Survey (BHES), and the Center for Epidemiological Studies Depression Scale (CES-D Scale). Height and weight were self-reported.

**Results:** The majority of mothers were white (75%), unemployed (50%), and had annual incomes below the poverty level (46%); 37% were clinically depressed. Depressed mothers were significantly less likely to engage in disinhibited eating and more likely to report higher levels of dislike for healthy foods and difficulties attaining healthy foods contributing to higher total barriers to healthy eating ( $p < 0.05$ ). Depressed mothers also reported higher levels of food insecurity ( $p < 0.5$ ). There was no significant relationship between depression and restraint or maternal BMI ( $Pr > 0.15$ ).

**Conclusions:** The proportion of mothers who were clinically depressed was 3.6 times higher than the national average and was associated with lower levels of disinhibited eating, higher barriers to healthy eating, and higher reported food insecurity. Depression also has adverse effects on mother's parenting abilities such as reducing responsive parenting and responsive feeding, leading to poor outcomes for the child. In future WIC intervention programs, depression treatment through counseling or support groups and the importance of consuming a healthy diet should be addressed to ensure that depressed mothers engage in healthy eating practices and do not face unnecessary struggles with parenting.

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## Introduction

### *Depression Overview*

According to the World Health Organization (WHO) depression affects about 121 million people worldwide with fewer than 25% of those affected having access to effective treatments (World Health Organization, 2012). Depression is defined as a mental disorder in which the individual expresses “depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disrupted sleep or appetite, low energy, and poor concentration” (World Health Organization, 2012). From this information, we know that depression can lead to disruptions in everyday life; in more extreme cases, to the extent that an individual can no longer take care of him or herself and others. Unfortunately, it is also estimated that 1 in 10 mothers suffer from depression at any given time despite variations in race, ethnicity, socioeconomic status, and other confounding factors (Ertel, Koenen, & Rich-Edwards, 2011). Rates of depression are also significantly higher in low socioeconomic status populations (Adler, Boyce, Chesney, Cohen, Folkman, Kahn, & Syme, 1994). For example, when comparing the rates of depression across high, middle, and low socioeconomic status individuals in a Canadian sample, rates of depression were 6.5 times higher in low socioeconomic status individuals when compared to high socioeconomic status individuals and 2.8 times higher when compared to middle socioeconomic status individuals (Adler et al., 1994). Despite these trends, much of the depression literature is based on studies targeting high socioeconomic status populations, with few studies examining the prevalence or impact of depression among lower socioeconomic status populations. In fact, only 10% of perinatal mental health problems have been studied in low and middle income countries while 90% have been studied in high income countries (Alipour, Lamyian, & Hajizadeh, 2011). Considering that rates of depression are higher for those

individuals from lower socioeconomic statuses, the purpose of the present study is to understand the prevalence of depression in low income populations and to investigate how depression affects maternal health.

Current research shows that maternal depression has negative effects on both the mother and the child. Specifically, mothers suffering from depression generally have an increased amount of perceived stressful life events such as loss of a job, divorce, and inability to care for their children. Additionally, depressed mothers are at an increased risk for developing other psychosocial disorders. Furthermore, it is estimated that only 50% of depressed mothers receive services aimed at treating their depression, with this percentage being lower among certain ethnicities (Ertel et al., 2011). In the same manner, children raised by depressed mothers tend to be more fussy and distressed when compared to those raised by non-depressed mothers (Conger, Ge, Leve, Natsuaki, Neiderhiser, Reid, Reiss, Scaramella, & Shaw, 2010). Additionally, these children tend to display an increased risk of behavioral problems and mental health disorders along with delayed cognitive and language development (Ertel et al., 2011). Overall, children raised by depressed mothers tend to have poorer outcomes in all subsequent stages of life.

While the negative effects of maternal depression have been studied in general and in relation to outcomes of children, little is known about associations of depression with food insecurity, barriers to mothers' healthy eating and eating behaviors including restraint and disinhibition. To more fully understand the public health burden of maternal depression it is necessary to investigate how depression affects maternal well-being, specifically among high-risk populations. Furthermore, another important area of health that is generally more prevalent in low socioeconomic populations is poor-nutrition and subsequent obesity, with approximately 10% of the world's population being obese as of 2008 (World Health Organization, 2011).

Together, the findings above suggest that additional research is needed to examine the impact of depression on eating behaviors and how food insecurity is related to depression. Further, because low-income populations generally have increased risk for chronic disease they are a high risk population. For these reasons, the current study aims to understand how depression is related to maternal eating habits, food insecurity, and barriers to healthy eating among low-income mothers of infants and toddlers.

### ***Maternal Depression Risk Factors***

The chronic stress associated with poverty causes a multitude of health problems in all areas of mental, physical, and emotional well-being (Samuels-Dennis, 2007). For example, people who experience higher levels of stress on a daily basis are at a significantly higher risk for developing chronic illnesses such as cancer, heart disease, and mental health problems (Samuels-Dennis, 2007). Additionally, of all people who develop chronic illnesses, those of low-income status are the least likely to receive treatment. Specifically, in relation to depression, there are many pathways through which the chronic stress associated with poverty increases low-income mother's risk for developing this disease.

One factor that has been shown to influence stress levels, and ultimately development of depression, is the amount of social support that people receive on a day to day basis (Anderson Florence, Wang, & Wu, 2011). The National Cancer Institute defines social support as “a network of family, friends, neighbors, and community members that is available in times of need to give psychological, physical, and financial help” (National Cancer Institute, 2012). Specifically, the more social support that people perceive to have in their lives the less stress they report feeling (National Cancer Institute, 2012). As a whole, social supports acts as a buffer between stress and the negative health outcomes associated with it (Samules-Dennis, 2007).

Research also suggests that perceived social support and perceived stress are better indicators of emotional well-being than actual levels of social support and stress, the difference being how an individual assesses levels of each in his/her life. Typically, low-income populations tend to express lower levels of perceived support and higher levels of perceived stress. Specifically, development of depression is significantly higher in individuals with low levels of perceived social support and consequent high levels of stress (Coiro, 2001). For example, when comparing post-partum depressed and non-depressed mothers, depressed mothers reported significantly lower levels of social support satisfaction along with significantly higher life stress (Boury, Larkin, & Krummel, 2004). As a whole, it is evident that the common high levels of stress and low levels of social support in low-income populations increase a woman's risk for developing depression.

From the definition of social support it is plausible to associate a mother's relationship status with her level of social support and risk of depression. Specifically, a mother's relationship status affects her risk of depression by influencing the amount of stress and social support that mothers receive. As expected, single mothers experience higher amounts of stress and lower amounts of social support when compared to married mothers or those living with a significant other. Onset of depression is higher in single, divorced, and separated mothers than married or partnered ones (Brown & Moran, 1997; Ertel et al., 2011). Additionally, financial hardships are twice as likely for single mothers than mothers in partnered relationships (Brown et al., 1997). Employment status has also been shown to affect rate of depression in that unemployed mothers tend to have higher rates of depression than employed mothers and unemployed single mothers have higher rates of depression than employed single mothers (Samuels-Dennis, 2007). Lastly, level of education, age, and race all affect depression rates such

that depression is higher in lower educated, younger women of minority status (Ertel et al., 2011).

Associations between depression and mother's mental status have also been examined. For example, anxiety during pregnancy is a common predictor of post-partum depression (Palomar-Lever & Victorio-Estrada, 2011). Additionally, negative thinking in "at-risk women" is an important factor that often leads to depressive symptoms (Grant, Hall, Peden, & Rayens, 2007). Low self-esteem is also associated with negative thinking and research has suggested that single, unemployed mothers tend to have the lowest levels of self-esteem. Additionally, poor self-esteem is highly related to development of depression (Brown et al., 1997). Overall, the extra life challenges associated with being a low-income mother, such as financial burdens, lack of social support, and negative mental thoughts contribute to higher stress levels and increased risks for depression.

### ***Eating Behaviors and Depression in Low-Income Mothers***

As a whole, low-income populations are at a higher risk for becoming obese and malnourished. People from low-income populations also tend to consume less healthy food on a daily basis than recommended by the national dietary guidelines for nutrition (Barg, Karasz, Long, Lucan, & Palmer, 2011). Additionally, between the years of 1986 and 2002, "body mass indexes (BMI) were higher every year among adults in the lowest income group than among adults in the highest income group" (Food and Nutrition Service, 2012). Furthermore, "wages were inversely related to BMI and obesity in a nationally representative sample of more than 6,000 adults – meaning, those with low wages had a greater increase in BMI as well as increased chance of being obese" (Food and Nutrition Service, 2012).

This research helps explain the associations between socioeconomic status and poor

nutritional health, such that low-income mothers are at a higher risk for becoming obese and malnourished. In fact, despite knowledge of dietary guidelines, low-income mothers are significantly less likely to follow these guidelines in consumption of grains, vegetables, fruits, and dairy (Freeland-Graves, George, Hanss-Nuss, & Milani, 2005). In addition, low-income mothers tend to consume higher amounts of total calories and calories from fat than high-income mothers, possibly due to the cheaper cost of such energy dense food items and their already higher weight status (Freeland-Graves et al., 2005). There is also evidence of an inverse association between depression and diet quality, with mothers suffering from depression also showing less compliance with dietary guideline recommendations (Freeland-Graves et al., 2005). Furthermore, there is a relationship between depression and BMI, but little is known about the direction of causality. It is also suggested that mothers with higher BMI's post-partum have increased rates of depression (Baker, Brownell, & Carter, 2000).

One aim of the present study is to examine relations between maternal depression and individual differences in eating behavior such as dietary restraint and disinhibition. Based on the Eating Inventory (Three Factor Eating Questionnaire R21; TFEQ), which was developed by Stunkard & Messick (1985), restraint is defined as “the conscious restriction of food intake to prevent weight gain or promote weight loss” and is generally exhibited in response to hunger cues (Hay & Roberts, 2008). Restraint is measured on two sub-scales; rigid restraint, which is “all-or-nothing approach to eating, dieting, and weight” and flexible control, which is “characterized by a more graduated approach to eating, dieting, and weight, in which fattening foods are eaten in limited quantities without feelings of guilt” (Stunkard, Pudel, & Westenhoefer, 1998). In the general non-depressed population, restraint is not associated with BMI or weight change (Hay et al., 2008). However, disinhibition has been related to weight gain and obesity in

the general population (Hay et al., 2008). Disinhibition is defined as “the tendency to overeat in response to different stimuli, which can occur in a variety of circumstances such as when an individual is presented with an array of palatable foods or is under emotional distress” (Hay et al., 2008). Disinhibition is measured by assessing levels of emotional disinhibition, which represents the tendency to overeat in response to emotional states and disinhibited eating, which represents the tendency to overeat in response to daily life circumstances or environmental cues (Hay et al., 2008). Low levels of restraint and high levels of disinhibition have been associated with higher BMI (Stunkard et al., 1998). Additionally, among obese populations, negative mood is associated with uncontrolled eating (Agras and Telch, 1996).

### ***Food Insecurity and Barriers to Healthy Eating***

According to the World Health Organization, food security is a combined measurement of how accessible, usable, and available adequate amounts of food are to a person (World Health Organization, 2012). Specifically, for a household to be considered food secure, the household must be able to easily obtain nutritious food in sufficient quantities and have the knowledge of how to prepare it. By contrast, a household is considered food insecure when it does not have the adequate resources to attain, access, or prepare necessary amounts of nutritious food. In 2010, 14.5% (17.2 million) of U.S. households were food insecure at some time during the year with 5.4% of households considered to be very food insecure (Andrews, Carlson, Coleman-Jensen, & Nord, 2011).

A report of household food security in the United States in 2010 showed that 35.1% of all food insecure households consisted of single mothers with children (Andrew et al., 2011). Additionally, there exists a bidirectional relationship between food insecurity and maternal depression (Charnigo, Huddleston-Casas, & Simmons, 2009). Also, it has been suggested that

food insecurity is more common in women with at least one mental health disorder, such as depression (Dole, Gunderson, Laraia, & Siega-Riz, 2006). Together, these findings suggest that depressed women typically receive fewer nutrients in their diet and are at a higher risk for obesity and/or malnutrition.

Mothers that are food insecure may also experience significant barriers to healthy eating, or circumstances that increase the odds of not practicing healthy eating behaviors. First, obese post-partum mothers general have higher perceptions of barriers to healthy eating than non-overweight post-partum mothers (Clarke, Freeland-Graves, Klohe-Lehman, & Nuss, 2006). Additionally it is possible that low-income mothers experience more barriers to healthy eating when compared to high-income mothers. These barriers may present themselves through less access to transportation to attain healthy food, more stresses related to finances and ability to afford healthy food, and fewer opportunities for childcare, which also makes it harder to find time to attain healthy food. As such, low-income mothers substitute high fat “snacks” for meals, have insufficient food shopping and cooking skills, and express a general lack of nutrient knowledge (Freeland-Graves et al., 2005). Furthermore, low-income mothers typically have a higher preference for foods high in sugar and fat, making it hard for them to consume healthy, low-fat foods even when they are available (Freeland-Graves et al., 2005).

### ***The Women, Infants and Children (WIC) Program***

Women, Infants and Children, also known as WIC, is a prenatal to 5 year old prevention and intervention program that helps serve low income pregnant, post-partum, and breastfeeding women along with their infants and children under 5 years of age who are at a nutritional risk. WIC’s mission is to decrease the risk of poor birth outcomes and to improve the health of the participants during critical stages of growth and development by providing access to healthy

foods and nutrition education (Food and Nutrition Service, 2012). This beneficial program is supported through federal grants from the United States Department of Agriculture (USDA) and in 2010 served a total of 9,175,000 eligible women and children (Food and Nutrition Service, 2012). WIC currently has 90 state agencies which provide service to over 8 million participants a month. Additionally, WIC is available in all 50 states and various other locations such as Indian Tribal Organizations, American Samoa, and Puerto Rico (Food and Nutrition Service, 2012).

In Pennsylvania the WIC program is administered by the Pennsylvania Department of Health and currently ranks 9<sup>th</sup> in total WIC participation (Food and Nutrition Service, 2012). Additionally, there are there are 24 local WIC agencies that provide services to about 265,000 low-income women, infants, and children. To be eligible for such services, mothers must participate in a variety of medical screening tests and must have a medical or nutritional risk that does not allow them to meet the recommended dietary guidelines (Food and Nutrition Service, 2012). Most risks include anemia, maternal underweight or overweight status, and having a household gross income which does not surpass 185% of the U.S. Poverty Income Guidelines (Food and Nutrition Service, 2012). For those who receive services, WIC provides food stamps or grocery vouchers that allow mothers to meet the recommended dietary guidelines for themselves and their children. Additionally, WIC provides breastfeeding support, information on child immunizations and caregiving, health screenings and referrals, and nutrition services and education (Food and Nutrition Service, 2012).

### ***Purpose of Present Study***

Past research has shown a high prevalence of maternal depression in the United States, with an estimated 1 in 10 mothers being depressed at any time (Ertel et al., 2011). Furthermore, significant risk factors for depression, such as chronic life stress, low perceived social support,

and financial hardships are all related to low socioeconomic status (Anderson et al., 2011).

Currently, low income mothers have more perceived barriers to healthy eating and higher rates of food insecurity than middle or high income mothers (Freeland-Graves et al., 2005).

Additionally, it is suggested that low income mothers, particularly depressed mothers, are at increased risk for becoming obese or malnourished. While much is known about eating behaviors in depressed women and low-income women separately, little has been studied regarding the exact effects of depression on maternal eating behavior in low income populations.

The purpose of the current study is to examine the prevalence of depression in low income mothers in WIC in central Pennsylvania, examine how depression is associated with weight status and with individual differences in dietary restraint and disinhibition, and examine how depression is associated with perceptions of food insecurity and barriers to healthy eating.

## **Aims and Hypotheses**

**Aim 1:** To examine the prevalence of depression among low income mothers of birth to 2 years in WIC in central PA.

**Hypothesis:** Based on previous evidence that currently 1 in 10 mothers are depressed (Ertel et al., 2011) and that depression rates are higher in low income populations, we predict that depression rates will be greater than 10% for WIC mothers in central PA.

**Aim 2:** To examine how depression is associated with eating practices in low income mothers, specifically in relation to restraint and disinhibition.

**Hypothesis 2:** Previous research has shown that depression is related to less compliance with dietary guidelines and higher BMI's in mothers (Freeland-Graves et al., 2005). Thus, we predict that depressed mothers will exhibit lower levels of restraint and higher levels of disinhibition in relation to eating practices. This is predicted to be more significant among overweight or obese populations (Stunkard et al., 1998).

**Aim 3:** To examine associations of depression with perceptions of food insecurity and barriers to healthy eating in low income WIC mothers.

**Hypothesis 3:** Based on previous research, food insecurity and barriers to healthy eating have been shown to reduce the quality and types of food that women and their children consume. We hypothesize that women who are more depressed are likely to report greater food insecurity and barriers to healthy eating.

## **Methods**

### ***Participants***

Participants were part of a larger study designed to 1) identify views regarding sources of information and support for feeding infants and toddlers and 2) obtain information on the determinants of infant feeding practices among ethnically diverse low-income, formula feeding mothers who are enrolled in Pennsylvania WIC, and to 3) use this information to redesign existing materials that can be used to develop infant feeding nutrition education materials. Participants were recruited in person by the Center for Childhood Obesity Research staff on-site from PA WIC clinics located in Blair, Lancaster, and Dauphin counties. Mothers were also recruited using flyers posted at WIC clinics and distributed by WIC staff during scheduled clinic appointments. To be eligible for participation, mothers had to be at least 18 years old, have a child less than 2 years of age, have introduced formula by 1 month of age, and be fluent in English; 140 women consented to participate in this study. Among these women, 70 women attended the focus group (50% attendance). The Pennsylvania State University Institutional Review Board approved all study procedures.

### ***Survey Measures***

*Background characteristics.* At the beginning of each group session mothers were asked to fill out a background demographics questionnaire. This questionnaire was developed at the Center for Childhood Obesity Research. This questionnaire includes information about family background and healthy history. Questions addressed items such as marital status, household composition, family income and employment, family history of chronic or serious illness, parents' weight history, infant's health, pregnancy information, and past experience with health care professionals.

*Depression status questionnaire.* The Center for Epidemiological Studies depression Scale (CES-D Scale), a 20 item depression scale was used to measure the prevalence of depression in mothers within the sample (Radloff 1977). These 20 items measured subscales for depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance. Each item was based on a 5 point Likert scale, which ranged from “rarely/not at all” to “most days;” there was also a “does not apply to me” option. After completion, item total scores were compiled ranging from 0-60 with a score greater than 16 indicating depressed status and a score less than 16 indicating non-depressed status. This cut off number has been used to determine depression status in past studies as well. The internal consistency of the total depression subscale in this study was excellent ( $\alpha = 0.94$ ).

*Restraint and disinhibition questionnaire.* The Eating Inventory (Three Factor Eating Questionnaire R21; TFEQ) was used to measure mothers’ levels of restraint and disinhibition. This questionnaire assesses 1) dietary restraint, or cognitive control of eating behavior, 2) dietary disinhibition, or disinhibition of cognitive control of eating, and 3) susceptibility to hunger. The TFEQ used in the current study uses a 20 item subscale based on the original 51-item Eating Inventory by Stunkard and Messick (1985). Mean scores were calculated for each subscale ranging from 1 to 4. The internal consistency of the cognitive restraint, uncontrolled eating, and emotional eating subscale were good or excellent,  $\alpha = 0.80$ ,  $\alpha = 0.62$ , and  $\alpha = 0.91$ , respectively.

#### *Food Insecurity*

*Food insecurity screen (FI Screen).* The FI Screen questionnaire was developed and validated by Hager et al. The FI Screen was developed from a shortened version of the US Household Food Security Scale (HFSS), which is often used by the US Census Bureau to

determine the prevalence of food insecurity in the United States. The two items used from the HFSS were “within the past 12 months we worried whether our food would run out before we got money to buy more” and “within the past 12 months the food we bought just didn’t last and we didn’t have money to get more”. Women participating in this study were able to choose a response between often true, sometimes true, never true, or don’t know/refused. Responses of “often true” and “sometimes true” were combined and representative of participant food insecurity while responses of “never true” were representative of food security. The reliability of this scale was acceptable as indicated by a correlation between the two items of 0.66 ( $p < 0.001$ ).

*Views of family meals questionnaire.* The view of family meals questionnaire was based on a subset of items from a larger 221-item survey used during Project EAT (Eating Among Teens) and from “Dinner environment from TEENS project”. The current questionnaire contains 19 items that measure mother’s views on eating together as a family. Items 2 and 3, which assessed availability of food and hunger respectively, were averaged to form a view of family meals food insecurity subscale (VFMinsecurity) with scores ranging from 1 to 4. Higher scores on the VFMinsecurity subscale indicate food security while lower scores indicate food insecurity.

*Barriers to healthy eating survey.* Barriers to healthy eating were measured using the Barriers to Healthy Eating Scale (BHES) developed by Fowles and Feucht (2004). The current 16 item scale was based on an earlier 18 item scale. Mothers participating in this survey were able to choose from a 5 point Likert scale, ranging from “strongly agree” to “strongly disagree” for each of the 16 items. The total possible range of scores was from 18-90 with lower scores indicating fewer barriers. The internal consistency of the total barriers to healthy eating subscale in this study was great ( $\alpha = 0.84$ ).

*Body mass index and weight status.* Maternal weight and height were self-reported.

Mothers reported their pre-pregnancy and current weight. For women, recommendations made by the Centers for Disease Control and Prevention (2010) were used to classify participants as overweight (BMI = 25-29.9) and obese (BMI  $\geq$  30).

### *Statistical Analyses*

The author of this thesis was primarily responsible for entering survey data and generating the aims and hypotheses for this research with the assistance of Dr. Savage Williams and Dr. Leann Birch. Dr. Savage Williams and Michele Marini assisted with analyzing these data using the SAS software (SAS Version 9.2: Statistical Analysis Software, 2001). Descriptive information was generated for all variables of interest and all variables were assessed for normality. Descriptive statistics (means, proportions, and standard errors) were calculated using SAS. Frequencies were calculated to examine the prevalence of depression among low income mothers participating in WIC in central PA. To test the second aim, associations between depression status and eating practices, chi-square and correlations were used. Lastly, to test the third aim of this study, analysis of variance and correlations were used to examine associations between depression and perceptions of food insecurity and barriers to healthy eating, respectively.

## Results

Sample characteristics shown in **Table 1** reveal that approximately 30% of mothers were married, about 63% had only completed a high school education or less, about 50% were unemployed (45% were employed or on maternity leave), 24% of mothers reported an annual income at or below \$5,000 and 46% report an income of more than \$5,000 but less than \$15,000. Given that the poverty level for a family of 2 in the state of Pennsylvania in 2011 was \$14,710 a large proportion of this sample is considered below the poverty level. Seven percent of mothers were Hispanic. While ethnic diversity existed in this sample, a large majority of mothers (75%) reported being Caucasian; 19% were African American.

As shown in **Table 2**, based on self-reported height and weight, 60% of mothers who participated in this study were overweight or obese. The mean post-pregnancy BMI of mothers was 30.3, which falls into the obese classification. There was no significant difference between depressed mothers mean BMI ( $M=30.82$ ,  $SD\pm 7.1$ ) and non-depressed mothers mean BMI ( $M=30.05$ ,  $SD\pm 6.2$ ) ( $Pr>0.15$ ). Additionally, clinical depression was not associated with maternal pre-pregnancy weight. Furthermore, as shown in **Table 3**, BMI is not significantly associated with any of the other measures investigated in this study.

### *Depression Prevalence*

As reported in **Table 4**, 36.7% of mothers (22) reported being clinically depressed at the time of the study as reported using the depression status questionnaire. As shown in **Table 5**, depression is more prevalent in non-married, single, or divorced mothers (73%) than in married or co-habiting mothers (28%) ( $p<0.5$ ).

### *Eating Behaviors by Depression Status*

*Restraint.* As shown in **Table 6**, there was no significant difference between levels of

cognitive restraint in depressed and non-depressed mothers. This was shown by comparing the mean values of level of restraint for depressed mothers ( $M=3.05$ ,  $SD\pm 0.85$ ) and non-depressed mothers ( $M=2.84$ ,  $SD\pm 0.92$ ) ( $Pr>0.15$ ).

*Disinhibition.* As shown in **Table 6**, there was a significant relationship between depression and disinhibited uncontrolled eating and depression and disinhibited emotional eating. Specifically, depressed mothers ( $M=2.74$ ,  $SD=\pm 0.42$ ) have significantly lower levels of uncontrolled eating than non-depressed mothers ( $M=3.07$ ,  $SD=\pm 0.42$ ) ( $Pr=0.0071$ ). Additionally, depressed mothers ( $M=2.95$ ,  $SD=\pm 0.65$ ) have significantly lower levels of emotional eating than non-depressed mothers ( $M=3.39$ ,  $SD=\pm 0.76$ ) ( $Pr=0.0314$ ). As a whole, depressed mothers exhibit significantly lower levels of disinhibition when compared to non-depressed mothers.

As shown in **Table 7** maternal BMI and disinhibited uncontrolled eating have a positive relationship ( $p<0.05$ ). Specifically, disinhibited uncontrolled eating is greater ( $M=3.76$ ) in overweight mothers than in normal or obese mothers ( $M=3.09$ ,  $M=3.20$ ).

### ***Food Insecurity and Barriers to Healthy Eating by Depression Status***

*Food insecurity.* As shown in **Table 8**, the view of family meals food insecurity subscale was associated with the FI Screen, indicating that both measures are accurate in measuring food insecurity. As shown in **Table 9**, there was a trend in the association between depression status and food insecurity such that the majority of depressed mothers reported being food insecure. As shown in **Table 10**, there was a negative significant relationship between depression and food insecurity when food insecurity was assessed using the view of family meals food insecurity subscale. Specifically, depressed mothers reported being significantly less food secure than non-depressed mothers ( $p<0.05$ ).

As shown in **Table 11**, there was a negative association between reports of food insecurity and disinhibited emotional and disinhibited uncontrolled eating. Specifically, mothers who reported being food insecure were significantly more likely to engage in disinhibited uncontrolled eating than mothers who reported being food secure ( $p < 0.05$ ). Additionally, results revealed a trend between food insecurity and disinhibited emotional eating, suggesting that mothers who reported being food insecure may also be more likely to engage in disinhibited emotional eating than food secure mothers ( $p = 0.19$ ). In addition, when examining associations between the view of family meals food insecurity subscale and maternal eating behaviors results revealed a significant relationship between restraint and food insecurity. Specifically, mothers who reported being food secure also reported higher levels of restraint than food insecure mothers ( $r = 0.27$ ,  $p = 0.3$ ). However, there was no significant relationship between restraint and food insecurity when assessed using the FI Screen.

*Barriers to healthy eating.* As shown in **Table 12** there was a significant positive relationship between total barriers to healthy eating and depression such that depressed mothers ( $M = 30.14$ ,  $SD = \pm 7.55$ ) exhibited significantly higher scores on total barriers to healthy eating than non-depressed mothers ( $M = 25.62$ ,  $SD = \pm 6.85$ ) ( $Pr = 0.0236$ ).

Five subscales were used to measure the combined barriers to healthy eating that mother's face. Of the five subscales used, there was a positive relationship between depression and inconvenience and depression and preference only. Specifically, depressed mothers ( $M = 4.27$ ,  $SD = \pm 1.69$ ) reported significantly higher levels of inconvenience in attaining healthy foods than non-depressed mothers ( $M = 3.54$ ,  $SD = \pm 1.07$ ) ( $Pr = 0.0463$ ). Additionally, depressed mothers reported significantly higher scores on the preference subscale of not liking healthy foods ( $M = 9.59$ ,  $SD = \pm 3.73$ ) than non-depressed mothers ( $M = 7.14$ ,  $SD = \pm 2.37$ ) ( $Pr = 0.0031$ ). In other

words, clinically depressed mothers have a harder time attaining healthy foods and a higher dislike of healthy foods, contributing to their overall higher total barriers to healthy eating scores. Finally, there was no significant relationship between depression and unavailability, expense, or difficulty in attaining healthy foods, which indicates that these factors do not influence the total barriers to healthy eating score.

## Discussion

The purpose of the current study was to examine the prevalence of depression in low income mothers enrolled in the Pennsylvania WIC program, examine how depression is associated with weight status and eating practices such as levels of restraint and disinhibition, and examine how depression affects perceptions of food insecurity and barriers to healthy eating. The proportion of women exceeding the cutoff for clinical depression among this sample of WIC mothers was significantly higher than the national proportion of 10% (Ertel et al., 2011). Additionally, we found that depression is negatively associated with disinhibition, that depression is positively associated with food insecurity, and that depression is positively associated with total perceived barriers to healthy eating. We also found that no significant relationships exist between depression and maternal BMI and depression and levels of restraint. Finally, we found that no association exists between maternal BMI and restraint, disinhibition, food insecurity, or total barriers to healthy eating. When combined with past research, which suggests that depressed individuals are less able to care for themselves or others and that only 50% of depressed mothers receive treatment, our findings suggest that treating maternal depression among WIC mothers could reduce their risk of partaking in unhealthy eating practices (Adler et al., 1994; Ertel et al., 2011).

In agreement with our first hypothesis, the current study found that 36.7% of mothers were clinically depressed according to the depression status questionnaire. Compared to national data, which indicate that 10% of all mothers are currently depressed in the United States at any given time, this sample of WIC mothers has a much greater prevalence of reported depression (Ertel et al., 2011). In fact, the prevalence of depression was 3.6 times higher than the national average. Results also found that majority of WIC mothers were White (75%), unemployed

(50%), had a reported annual income less than the national poverty level of \$15,000 for a family of two (70%), had only completed a high school education or less (63%), and were divorced or single (48%) (implying low levels of social support) at the time of the study. Previous research has found that financial hardships, lack of social support, and being single are risk factors for depression in low income populations (Brown et al., 1997; Coiro, 2001; Ertel et al., 2011). Results supported the link between relationship status and depression risk, specifically demonstrated by 73% of our depressed population not being married. These findings may help explain the higher than national average percentage of mothers being depressed.

Contrary to our second hypothesis, depressed mothers reported lower levels of disinhibited eating than non-depressed mothers. Specifically, we found that there is a significant negative relationship between depression and disinhibited uncontrolled eating and depression and disinhibited emotional eating. Depressed mothers experience less disinhibited uncontrolled ( $M=2.74$ ) and disinhibited emotional eating ( $M=2.95$ ) than their non-depressed counterparts ( $M=3.07$ ;  $M=3.39$ ) suggesting that depressed mothers have fewer bouts of eating palatable food and feeling that their eating is “out of control”. In partial support of our second hypothesis, we found that maternal BMI is positively related to disinhibited uncontrolled eating and that this relationship is most prominent among overweight mothers. This suggests that overweight mothers are more likely to engage in disinhibited uncontrolled eating than normal or obese mothers.

Also, contrary to our hypothesis, there was no significant relationship between depression and reported maternal pre and post-partum BMI. The negative relationship between levels of disinhibition and depression could help explain why despite 60% of mothers being overweight or obese there was no relationship between depression and BMI. However, further analysis

relating BMI, disinhibition, and depression are needed to confirm this relationship. Also contrary to our hypothesis, there was no significant relationship between restraint and depression status.

Regarding our third hypothesis, results revealed that total barriers to healthy eating ( $M=30.14$ ) are higher in depressed mothers, specifically on the subscales of inconvenience ( $M=4.27$ ) and preference ( $M=9.59$ ). As a whole, depressed mothers report higher barriers to healthy eating due to their dislike for healthy foods and hardships in attaining them. These results are similar to previous studies relating depression and compliance with dietary guidelines (Barg et al., 2011). The negative relationship between depression and preference for healthy food could help explain why despite acknowledging proper dietary guidelines, low-income mothers are significantly less likely to follow these guidelines in consumption of grains, vegetables, fruits, and dairy (Freeland-Graves et al., 2005). Additionally, the finding that 48% of mothers were unmarried or single, and most likely have little social support or child care opportunities, could help to explain why depressed mothers report higher levels of inconvenience in attaining healthy foods (Freeland-Graves et al., 2005).

In agreement with our third hypothesis, we found a significant negative relationship between food insecurity (as measured by the view of family meals subscale) and depression. Specifically, depressed mothers are significantly more food insecure than their non-depressed counterparts. Additionally, we found a trend between food insecurity (as measured by the FI Screen) and depression such that the majority of food insecure mothers were also depressed. A possible explanation for the discrepancy between depression and food insecurity when assessed by the two different scales could be the small sample size of WIC mothers. We believe that with a larger sample size both food insecurity scales will reveal significant results in relation to

maternal depression, however further analyses should be completed to determine this relationship. Our finding that depressed mothers are more likely to report being food insecure is consistent with past research, which states that food insecurity is more common in women with at least one mental health disorder, such as depression (Dole et al., 2006).

Additionally, we found that food insecurity and disinhibition are significantly related. Specifically, mothers who reported being food insecure also reported significantly higher levels of disinhibited uncontrolled eating. Food insecure mothers also reported significantly lower levels of restraint than food secure mothers. These findings suggest that food insecure mothers are more likely to engage in uncontrolled disinhibited eating and less likely to restrict their eating.

There are several limitations to this study, one being that our small sample size and lack of ethnic diversity does not allow us to generalize findings to larger sample sizes or other races and ethnicities. Additionally, only 36.7% of mothers were clinically depressed at the time of the study, adding to the limited applicability of our findings in larger studies. Also, the majority (60%) of mothers were overweight or obese, which could limit our findings relating maternal BMI to other variables. Additionally, all mothers were enrolled in WIC and provided with adequate food resources, which could have influenced scores on the depression and food insecurity scales. Finally, the use of self-report for data collection rather than objective measures allows measurement bias to be an additional study limitation.

In summary, low socioeconomic mothers, especially those enrolled in state funded WIC programs are at a higher risk for depression due to a variety of social factors such as level of income, amount of social support received, and relationship status (Brown et al., 1997; Coiro, 2001; Ertel et al., 2011). Specifically, not married or divorced mothers had significantly higher

rates of depression than mothers in relationships. Although the majority of mothers in our sample were not depressed at the time of the study, those who were (36.7%) reported significantly more challenges in relation to their healthy eating habits. Specifically, depressed mothers experience a higher level of inconvenience in attaining healthy foods and a higher dislike of healthy foods, contributing to higher total barriers to healthy eating. These findings can help explain why depressed mothers are less likely to comply with dietary guidelines and why depressed mothers are at a higher risk for becoming obese or malnourished (Freeland-Graves et al., 2005). Additionally, depressed mothers are more likely to report being food insecure. As a whole, these findings exhibit the difficulties that depressed mothers face on a daily basis and highlight the importance for depression treatment and education programs especially among low income, single, and unemployed mothers, such as those enrolled in the PA WIC program. Specifically, programs should be aimed at increasing depressed mothers social support and emphasizing the importance of a balanced, healthy diet for her and her family.

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**Tables**

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**Table 1**

Maternal Demographics (N=60)

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	Percent
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<b>Marital Status</b>	
Not Married	43.3%
Married	28.3%
Not Married, Living w/ Partner	18.3%
Divorced	5.0%
Common Law	3.3%
Other	1.7%
<hr/>	
<b>Mom Education</b>	
8 <sup>th</sup> Grade or Less	1.8%
Some High School	19.3%
High School Graduate	42.1%
Some College/Tech School	24.6%
Completed College	8.7%
Post Graduate Training/Degree	3.5%
<hr/>	
<b>Mom Race</b>	
Asian	3.5%
African American	19.3%
White	75.4%
Mixed	1.8%

	Percent
<b>Income</b>	
≤ \$5,000	24.1%
\$5,000- \$9,999	11.1%
\$10,000-\$14,999	11.1%
\$15,000- \$24,999	16.7%
\$25,000- \$34,999	22.2%
\$35,000- \$49,000	11.1%
\$50,000- \$74,999	3.7%
<b>Mom Current Employment Status</b>	
On maternity leave: no benefits	3.5%
Working full-time	15.5%
Working part-time	25.9%
Unemployed	50.0%
Other	5.2%
<b>Mom Ethnicity</b>	
Hispanic or Latina	7.4%
Not Hispanic or Latina	92.6%
<b>Smoking During Pregnancy</b>	
No	60.3%
Yes	39.7%

**Table 2**

Maternal Background Characteristics (N=58)

	%	Mean	SD	Range	(Pr)
<b>Maternal Characteristics</b>					
Mom Current BMI		30.3	6.5	18.3 - 45.2	
Mom Pre-Pregnancy BMI		29.2	7.8	18.9 – 39.3	
Non-Depressed Mom BMI		30.1	6.2	23.9-36.3 *	
Depressed Mom BMI		30.8	7.1	23.7-37.9 *	
<b>Weight Status</b>					
Normal	40%				
Overweight	19%				
Obese	41%				
<i>Note*</i> Probability>0.15					
*Weight Status Normal=18.0-24.9, Overweight=25.0-29.9, and Obese=30.0 and Above					

**Table 3** Correlations between depression, eating behavior, food insecurity and barriers to healthy eating with current and pre-pregnancy BMI in the total sample (N=54)

	Mom Current BMI	Mom Pre-Pregnancy BMI
	Mean	Mean
	( <i>P</i> =)	( <i>P</i> =)
Depression subscale	0.087 (0.67)	-0.03 (0.81)
Total Depression score	0.065 (0.67)	-0.047 (0.76)
Restraint	-0.16 (0.23)	-0.04 (0.74)
Disinhibited Emotional	-0.16 (0.38)	-0.00 (0.99)
Disinhibited Uncontrolled	0.05 (0.69)	0.09 (0.48)
Food Insecurity Screen	0.00 (0.99)	0.05 (0.69)
Views of Family Meals Insecurity	-0.034 (0.79)	-0.02 (0.87)
Total Barriers to Healthy Eating	-0.02 (0.87)	0.08 (0.51)

**Table 4**

Percent of Clinically Depressed\* Mothers of birth to 2 years old (N=60)

Depressed Status*	Percent (N)
Depressed	36.7% (n =22)
Not Depressed	63.6% (n=38)

*Note.*\*Depression Status was represented with a score of above 16 on the Center for Epidemiological Studies Depression Scale (CES-D Scale)

**Table 5**

Association between Maternal Depression Status and Relationship Status\* (N=60)

	Not Married	Married	<i>P</i> <
Non-depressed	26.67%	36.67%	
	42.11%	57.89%	
	50.00%	78.57%	
Depressed	26.67%	10.00%	
	72.73%	27.27%	
	50.00%	21.43%	
			0.05

*Note* \* Married includes women reporting that they were married or living with a partner;

Depression Status was represented with a score of above 16 on the Center for Epidemiological Studies Depression Scale (CES-D Sclae).

Chi Square test revealed dependence such that single mothers were significantly more likely to be depressed than married mothers ( $p=0.02$ )

**Table 6**

Eating Behaviors and Maternal Depression by Depressed Status\* (N=56)

	Non-depressed	Depressed	Probability
	<i>M</i> ( $\pm$ SD) (N=36)	<i>M</i> ( $\pm$ SD) (N=20)	
Restraint	2.84 ( $\pm$ 0.92) (1.92-3.76)	3.05 ( $\pm$ 0.85) (2.20-3.90)	NS*
Uncontrolled Eating	3.07 ( $\pm$ 0.42) (2.65-3.49)	2.74 ( $\pm$ 0.42) (2.32-3.16)	0.0071
Emotional Eating	3.39 ( $\pm$ 0.76) (2.63-4.15)	2.95 ( $\pm$ 0.65) (2.30-3.60)	0.0314

*Note:* \*Depression Status was represented with a score of above 16 on the Center for

Epidemiological Studies Depression Scale (CES-D Sclae).

\*Probability >0.15

**Table 7**

## Eating Behaviors by Maternal BMI Status\*

	Normal Weight	Overweight	Obese Weight	<i>P</i> <
Restraint	2.81	3.24	2.94	NS
Disinhibited	2.86	3.09	3.02	NS
Uncontrolled				
Disinhibited	3.09 <sup>a</sup>	3.76 <sup>b</sup>	3.20 <sup>a</sup>	0.05
Emotional				

*Note:* Different letters indicate significant differences between groups.

\*Weight Status Normal=18.0-24.9, Overweight=25.0-29.9, and Obese=30.0 and Above

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**Table 8**

Views of Family Meals Food Insecurity (VFMinsecurity) by FI Screen Groups

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	Secure	Insecure
VFMinsecurity Subscale	3.8	3.1

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*Note:* Higher scores indicate food security on the VFMinsecurity subscale

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**Table 9** Number and Percent of Mothers reporting feelings of Food Insecurity as related to Depression Status\* (N=55)

	Non-Depressed	Depressed	Total	Chi Square
Food Secure	19	16	35	
	33.3%	28.1%	61.4%	
	54.3%	45.7%		
	70.4%	53.3%		
Food Insecure	8	14	22	
	14.0%	24.6%	38.6%	
	36.4%	63.6%		
	29.6%	46.7%		
Total	27	30		0.187*
	47.4%	52.6%		

*Note:* \*Depression Status was represented with a score of above 16 on the Center for Epidemiological Studies Depression Scale (CES-D Scale); \*Trend in the association between depression status and food insecurity

**Table 10** Association between Depression Status\* and Food Insecurity as measured with the Views of Family Meals Food Insecurity Subscale (VFMinsecurity)

	Non-Depressed ( <i>P</i> =)	Depressed ( <i>P</i> =)
VFMinsecurity Subscale	-0.25 (0.08)	-0.28 (0.03)

*Note:* \*Depression Status was represented with a score of above 16 on the Center for Epidemiological Studies Depression Scale (CES-D Scale)

**Table 11** Maternal Eating Behaviors and Food Insecurity as determined by the FI Screen

	Food Secure	Food Insecure	P
Restraint	2.93	2.98	NS*
Disinhibited Emotional Eating	3.43	3.18	0.19
Disinhibited Uncontrolled Eating	3.11	2.84	0.01

*Note: \*Probability>0.15*

**Table 12** Barriers to Healthy Eating (BHE) and Maternal Depression by

Depression Status\* (N=59)

	Non-depressed	Depressed	Probability
Total Barriers	25.62 ( $\pm 6.85$ ) (18.77-32.47)	30.14 ( $\pm 7.55$ ) (22.59-37.69)	0.0236
<i>Total Barrier Subscales</i>	Non-depressed	Depressed	Probability
Unavailability	5.24 ( $\pm 2.91$ ) (3.05-7.33)	5.81 ( $\pm 2.65$ ) (3.16-8.46)	NS
Expense	4.46 ( $\pm 1.88$ ) (2.58-6.34)	5.00 ( $\pm 1.92$ ) (3.08-6.92)	NS
Difficulty	5.24 ( $\pm 2.74$ ) (2.50-7.98)	5.59 ( $\pm 2.97$ ) (2.62-8.56)	NS
Inconvenience	3.54 ( $\pm 1.07$ ) (2.47-4.61)	4.27 ( $\pm 1.69$ ) (2.58-5.96)	0.07
Preference	7.14 ( $\pm 2.37$ ) (4.77-9.51)	9.59 ( $\pm 3.73$ ) (5.86-13.32)	0.0094

*Note:* \*Depression Status was represented with a score of above 16 on the Center for Epidemiological Studies Depression Scale (CES-D Scale); NS =Probability >0.15

## ACADEMIC VITA

<b>EDUCATION</b>	<p><b>The Pennsylvania State University</b>, University Park, PA          Schreyer Honors College          B.S. in Science, Life Science option, Minor: Psychology          Honors Thesis with The Center for Childhood Obesity and Research          Dean's List Achievement</p>	Class of 2012
<b>WORK EXPERIENCE</b>	<p><b>Mount Nittany Medical Center</b>, State College, PA  <i>Electronic Medical Records Technician</i>          Facilitated the transition to paperless medical records by assisting physicians in discharges and software use</p> <p><b>Lion Line</b>, State College, PA  <i>Call Representative</i>          Persuade alumni to donate to Penn State by communicating how their involvement will support PSU</p> <p><b>Lion Tutors, LLC</b>, State College, PA  <i>Administrative and Marketing Assistant</i></p> <p><b>St. Albans Swim and Tennis Club</b>, Marple Newtown, PA  <i>CPR Certified Life Guard and Swim Instructor</i></p>	<p>Summer 2010</p> <p>June 2010 – Present</p> <p>January 2009- January 2012</p> <p>Summer 2009 and 2010</p>
<b>LEADERSHIP</b>	<p><b>Alpha Delta Pi Sorority, Delta Kappa Chapter (ADPi)</b>  <i>Director of Standards and Ethics</i>          Actively served on the executive board and headed the standards council by conducting meetings regarding bylaw revisions, standards code breaches, and member's personal issues  <i>Scholarship Chair</i>          Made sure that all members had a 2.80 GPA and worked with those below it to improve their academics</p> <p><b>Penn State University Dance Marathon</b>  <i>Supply Logistics Captain – Paint, Hardware, and Lumber Donor Contact</i>          Secure all in-kind paint donations for THON weekend and the many events leading up to it          Attend weekly meetings, reach out to new donors, and help plan THON evns  <i>Hospitality Committee Member</i>  <i>Rules and Regulations Committee – Spirit Chair</i></p> <p><b>Penn State Lion Scouts</b>  <i>Tour Guide</i>          Volunteering time to show potential students and families around Penn State's campus          Answering questions and concerns through online chat rooms and telephone calls</p> <p><b>Health-Works, University Health Services</b>  <i>Peer Educator</i>          Promote mental, physical, and emotional health in a variety of manners          Selected as 1 of 30 summer hires out of more than 100 applicants</p> <p><b>PNC Leadership Assessment Center</b>          Participated in a one day performance analysis of my strengths and weakness in the work field</p>	<p>Fall 2009- Present          2010 School Year</p> <p>Fall 2009-Present</p> <p>Fall 2010 - Present</p> <p>Fall 2010 - Present</p>
<b>HONORS</b>	<p><b>Induction into Alpha Epsilon Delta (AED) Honors Pre-Medical Society</b></p>	