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Predictors and outcomes of excess gestational weight gain among low-income pregnant women

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Worldwide, the rate of gestational weight gain within the recommended range, has become a key indicator in monitoring maternal and child health status and effectiveness of health services and programs. The Royal College of Obstetricians and Gynaecologists, the American College of Obstetricians and Gynecologists and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists have identified excess gestational weight gain (GWG) as a major area of concern for public health and encouraging providers to counsel patients on strategies to prevent overweight and obesity during pregnancy (RCOG, 2017; ACOG, 2013; RANZCOG, 2013). Especially, in light of the burgeoning obesity epidemic and a greater percentage of women gaining too much weight during pregnancy, the Institute of Medicine (IOM) set the committee to review the role of GWG in predicting maternal and birth outcomes including obesity risk among children. The committee indicated that excessive weight gain during pregnancy is indeed a major predictor for poor pregnancy and birth outcomes including gestational diabetes, caesarean delivery, giving birth to large for gestational age babies, and low initiation of breastfeeding (Rasmussen & Yaktine, 2009). Based on this evidence, the revised IOM guidelines for the recommended weight gain by pre-pregnancy body mass index (BMI) categories, were released in 2009 (Rasmussen & Yaktine, 2009). The revised guidelines now include a specific and relatively narrow range of recommended weight gain for particularly obese women compared to the original 1990 recommendation of gaining "at least 15 lbs." without a stated upper limit (table 1). In a recent meta-analysis of 23 studies (n = 1,309,136 women) conducted around the world, including in Asia, Europe and America, Goldstein et al concluded that excess GWG is a common problem and about half of the women i.e., 47% are gaining excess weight during pregnancy (Goldsetin et al., 2017).

In the U.S. roughly half of all women and 60% of overweight/obese pregnant women exceed IOM recommendations for GWG (Brawarsky et al., 2005; Catalano, 2007; Chu & D'Angelo, 2009). The health care cost of excess GWG is significant as it can trigger the cycle of obesity among women, by increasing their BMI with each subsequent pregnancy. For instance, researchers have shown that women who gain more than 20kg (44 lbs) during pregnancy, move up one BMI category at 6 months post-partum (Nohr et al., 2008; Viswanathan et al., 2008). Subsequently, an increase in BMI leads to metabolic changes that put women at risk for chronic diseases and health complications including diabetes, hypertension, and dyslipidemia (Gaillard et al., 2013). Excessive GWG is also independently

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and strongly associated with poor birth outcomes, specifically, macrocosmic or large for gestational age infants (Viswanathan et al., 2008), which in turn, is associated with a higher capacity to store body fat. Based on the life course theory, which highlights that individual's health status is based not only on current behaviors, but past experiences and exposures from socio-cultural and familial contexts predict the health trajectory. Using the theory, researchers note that macrosomic infants with excess adiposity, are already at an increased risk for obesity and chronic disease later in life (De Boo & Harding, 2006; Russ, Larson, Tullis, & Halfon, 2014).

Considering the critical importance of GWG, the 2009 IOM committee also called for more research investigating the role of socioeconomic, cultural, and environmental factors in predicting GWG, with specific recommendations to target those women who are at higher risk of exceeding the recommendations for weight gain during pregnancy. Researchers have found that low-income women (those living at ≤ 150 % of the poverty guideline), are more likely to enter pregnancy overweight, gain more than the recommended amount of weight during pregnancy, and experience a higher risk of poor health post-partum (Lederman, Alfasi, & Deckelbaum, 2002; Paul, Graham, & Olson, 2013; Skouteris et al., 2010). In a sample of 47 low-income, African American women, 64% of the total sample (across all BMI categories) gained excessive weight during pregnancy, and specifically all women who were overweight or obese before pregnancy, gained weight above IOM recommendations (Lederman et al., 2002). In focus group discussions with low-income pregnant women participating in the Special Supplemental Nutrition Assistance Program for Women Infants and Children (WIC), women frequently cited- family pressure to "eat for two" and minimal knowledge of appropriate weight gain goals during pregnancy, as two major barriers in meeting GWG recommendations (Herring et al., 2016). In the nutrition symposium of health disparities among minorities in early nutrition at 2011 Experimental Biology meeting, the panelist highlighted that the high birth rates, increased rates of food insecurity and poor dietary habits along with poor access to health care, put racial/ethnic minority women at higher risk for excess GWG than general white women (Perez Escamilla & Bermúdez, 2012).

In summary, researchers indicate that pregnancy is a critical window of opportunity to prevent two generations of obesity, and identifying those at highest risk, will help with the program design and implementation targets for future interventions that support appropriate weight gain in pregnancy. Therefore, the objectives of this study were to: 1) assess the prevalence and severity of excessive GWG; 2) examine the association between GWG and health status including infants size for gestational age, and; 3) identify predictors of excessive GWG, among low-income pregnant women.

Research Design and Methods

Pregnant women attending a WIC clinic were recruited for this study if they met the following selection criteria: (1) receiving WIC as a maternity client, (2) 18 years of age or older, (3) in the second trimester of pregnancy (defined as 13 to 27 weeks), and (4) ability to speak either English or Spanish. WIC is one of the largest federal food assistance programs in the U.S. It specifically serves pregnant women, breastfeeding mothers and infants and children under the age of five, to promote optimal nutrition key to childhood and family well-being. The basic eligibility requirement is having a family income of 185% or below the poverty level. Currently, the program is serving approximately half of the U.S. born infants.

In the study, participants were involved in 2 data collection activities: 1) a 45–60 minute, in-person interview conducted in the WIC clinic using a closed-ended questionnaire (to collect socio-demographics, food insecurity status, pre-pregnancy body weight and height); and, 2) review of post-natal records after delivery (to extract delivery weights of mothers and their infants, information on diabetes, hypertension during pregnancy, and gestational age). The study protocol was approved by the county WIC department and the Institutional Review Boards' of the University of North Carolina-Greensboro and University of North Carolina-Chapel Hill.

Data Collection Procedures

Recruitment

Recruitment of eligible participants was conducted at the WIC clinic during initial maternity certification appointments. Research staff identified eligible participants at the beginning of the day (by age and estimated due date) and flagged their folder with a study flyer. WIC staff informed the women about the study and introduced interested women to the research staff for recruitment. Study flyers were also posted throughout the WIC clinic, including in waiting rooms, women's restrooms, and other departments in the county health building.

I. In-person interview using a close-ended questionnaire: Upon recruitment and provision of written consent, each participant was interviewed using a closed-ended questionnaire for approximately 45–60 minutes in one of two private spaces at the WIC office during the maternity certification appointment. Initial maternity certification appointment required up to two hours, including long waiting periods. Research staff conducted the interviews during these waiting periods, giving WIC staff priority to interrupt to complete the the next aspect of certification appointments. The study was designed to integrate the research process within the wait times of certification appointments where WIC staff collaborated extensively with research staff to minimize burden on both participants and the clinic. As an incentive, each participant was given a $25 gift-card at the end of the interview. Interviews in English were conducted by trained graduate research assistants and interviews in Spanish were conducted by a trained bilingual community outreach worker fluent in English and Spanish.

Participation rate for the study was 70% i.e., on average 10 WIC maternity certification appointments occurred per week. Of which, roughly 70% met the study criteria and were successfully recruited into the study. Hence, on average, 7 interviews were carried out per week. For most (80%) of the participants, interviews were conducted on the same day of recruitment or during their maternity certification appointments. For others, interviews were scheduled for another day at the clinic. Participants with scheduled interviews were given appointment cards and phone call or text message reminders the day before their interviews with the option to reschedule.

The in-person interview questionnaire contained the following three main sections:

1. Socioeconomic and demographic status: Information on participants' age, household size, income, and ethnicity was collected under this section. This section also included questions to collect information on parity, whether the pregnancy was planned or unplanned, and if the participant was receiving another major form of food assistance i.e., Supplemental Nutrition Assistance Program.

2. Household food security status: This section measured food security using the United States Department of Agriculture's (USDA) validated U.S. Food Security Survey Scale. For multiparous women, 18-item version of the scale was used, while for nulliparous women or households without children, a 10-item Scale (without the last 8 statements pertaining to food situations for children) was used. A score of 1 was given for each affirmative response. Consequently, for households with children, the total score ranged from 0 to 18. For households without children, the score ranged from 0 to 10. Using the standard scoring categories for households with or without children, study participants were divided into the following four categories: 1) High food security (0 score); 2) Marginal food security (1–2 score); 3) Low food security (3–7 score with children/3–5 score without children); 4) Very low food security (8–18 score with children/6 – 10 score without children). For Spanish interviews, a validated Spanish version of the 10 or 18 item U.S. Food Security Survey was used.

For the Spanish questionnaire, the remaining questions on socio-demographics were first translated using a basic online translation program (Google Translate). This translated version was reviewed and back translated by our first generation Latina community interviewer to assess content and concept accuracy against the English version. The community interviewer also assessed all translated text for cultural appropriateness.

3. Pre-pregnancy BMI: At the end of the interview, participants were asked to self-report height and pre-pregnancy weight. Self-reported pre-pregnancy weight has been shown to correlate well with measured weights (Lin, DeRoo, Jacobs, & Sandler, 2012). Height and pregnancy body weight were collected in participants' preferred metrics i.e., kilograms or pounds for weight and inches/feet or meters for height. Using this information, participants' BMI was calculated using the following standard formula: [weight (in kilograms) divided by height (in meters) squared] (National Institutes Of Health, 1998). Prior to BMI calculation, all weight values were converted from pounds to kilograms while height values were converted from inches to meters. The BMI values were then grouped into the following four standard categories: 1) < 18.5 kg/m2 = underweight; 2) 18.5–24.9 kg/m2 = normal; 3) 25–29.9 kg/m2 = overweight; 4) ≥ 30.0 kg/m2 = obese.

II. Review of post-natal records after delivery: Participants' post-natal medical records were retrieved to collect information on the following variables: 1) participants' body weight at the end of pregnancy or just prior to delivery, 2) occurrence of gestational dia betes; 3) occurrence of hypertension during pregnancy; 4) gestational age, and; 5) birth weight of the newborn. Participants signed a HIPAA release form at the beginning of the initial in-person interview to allow for the collection of data from the pregnancy related medical records at the county health department. Using participant WIC id#, date of birth and name, health records were retrieved and matched with interview data.

For the analyses, participants' body weight at the end of pregnancy was subtracted from the self-reported body weight recorded during the interview. The difference was used to estimate net weight gained or lost in lbs. This information was then compared with the IOM recommended range of weight gain by participant's pre-pregnancy BMI category (table 1). Subsequently, this comparison was used to group women into the following three categories of GWG: 1) below; 2) within; 3) above, IOM recommended range. For those who gained above the recommended range, the difference in pounds between the total weight gained during pregnancy and the upper limit of the IOM-recommended range of weight gain for a given pre pregnancy BMI, was calculated. Information on gestational diabetes and hypertension during pregnancy, noted with a yes or no option, was retrieved from the post-natal records. Information on infant birth weight and gestational age from post-natal records was retrieved to calculate size for gestational age for infants. Size for gestational age of full term (≥ 37 weeks) infants was estimated using the World Health Organization growth charts for infants and children by gender (CDC, 2016). For pre-term (< 37 weeks) infants, size for gestational age was determined using the Fenton growth charts for preterm boys and girls (Fenton & Kim, 2013). Small for Gestational Age (SGA) infants were classified as those who weighed in the 10^{th} percentile or less for their gestational age. Large for Gestational Age (LGA) infants were those who weighed in the 90^{th} percentile for their gestational age. For the purposes of analyses, all SGA or LGA infants were re-categorized as non-normal size for gestational age and all other Appropriate for Gestational Age (AGA) infants were categorized as normal size for gestational age.

In total, 198 pregnant women were recruited and interviewed from January -July 2014. In retrieval of post-natal information, 29 cases did not have complete information on GWG, birth weight of newborn and related pregnancy outcomes. Additionally, in the analyses of pre-pregnancy BMI and GWG, it was noted that a very small group of women were categorized as having an underweight pre-pregnancy BMI and/or those who lost weight during pregnancy (n = 9). Hence, to avoid empty cells or less than five cases per cell during the analyses, this group of women were excluded from the analyses.

Hence, the sample size for socio-demographic analyses was 198, while for the GWG and related analyses, the sample size was 160.

Data Analytic Procedures

All data for this study was entered and coded using the SPSS version 17.0 (Chicago, IL). For all the analyses, the level of significance was set at an α level of $\leqq$ 0.05. Descriptive statistics and frequencies were computed to estimate socio-demographic characteristics, food insecurity rate and pre-pregnancy BMI distribution among participants. The analyses were also carried out to estimate the percentage of women exceeding the IOM recommendations for GWG and the range of excessive weight gain.

One-way ANOVA was used to examine significant differences in mean excess weight gain by socio-demographic variables: income per month, employment status, education, marital status, ethnicity/race, receiving SNAP, parity, food security status and planned vs. unplanned pregnancy. The extent of excess weight gain during pregnancy was also compared by two indicators of gestational health outcomes, diabetes and hypertension. Finally, the difference in excess weight gain during pregnancy was compared by birth outcome or the infants' size for gestational age (normal (AGA) vs. non-normal (LGA and SGA)).

Multivariate analysis using backward stepwise logistic regression was carried out to estimate the predictors for not meeting the IOM recommendations for GWG. The dependent variable was meeting (0) vs. exceeding or not meeting the IOM recommendation for GWG (1), in the model. Socio-demographic characteristics that were associated with excess weight gain at the α level of 0.05 to 0.10 in the bivariate analyses of ANOVA (table 2), were included in the backward stepwise regression model. Odds ratios and the corresponding 95% confidence interval were reported for logistic regression analyses. The goodness-of-fit test of Hosmer-Lemeshow test was used.

Results

Among the total sample of 198 WIC women, descriptive analyses indicated that the average monthly household income of participants was $1,126, with 13% reporting no household income. The average age of participants was 26 years and 38% were pregnant for the first time. Approximately half of the participants (54%) were receiving Supplemental Nutrition Assistance Program benefits. About half of the participants identified as being of African American race and the remaining were Non-Hispanic whites, Hispanics, including refugees and immigrants from different countries such as Myanmar (formerly Burma), Vietnam and Bhutan. Overall, 51% of the participants reported having high school education or less, and 59% of women reported being single, widowed, divorced, or separated. When examining food security status, 57% of the participants reported being food secure. Among the remaining 43% of study participants, 24% reported experiencing low food security, while 19% of them reported very low food security indicating hunger in the household.

Descriptive results on pre-pregnancy BMI categories indicated that 32% and 34% of participants started pregnancy in overweight and obese categories, respectively. Among 160 participants of normal, overweight or obese BMI, 64% gained GWG above IOM recommendations. Based on the calculations for net weight gain during pregnancy, it was found that, women in the study gained weight on average 10 lbs (4.5 kgs) in excess or above the maximum IOM cutoff range in reference to their pre-pregnancy BMI category. Post-natal records indicated that the rate of gestational diabetes was 5%, and the rate of hypertension was 7%. Using gestational age and infant birth weight from post-natal records, growth chart plots indicated that 71% of infants were AGA, 10% were LGA, and 6% were SGA.

Results of One-way ANOVA analyses indicated that excessive GWG among study participants was significantly associated with marital status, parity, and pre-pregnancy BMI (see Table 2). Specifically, primiparous women and those who were single, divorced or separated were gaining higher amounts of excess weight. Women who started pregnancy at obese BMI were also at risk of excess GWG. Additionally, participants who reported this pregnancy as an unplanned pregnancy gained significantly higher amounts of excess weight compared to women with planned pregnancies. As indicated in table 2, education level and ethnicity were marginally associated with excess GWG with those having more than high school education and those of African American identity gained higher amount of weight. Food security status was not significantly associated with excess GWG in our sample.

In examination of pregnancy and birth outcomes, excess weight gain during pregnancy was significantly associated with non-normal size for gestational age infants (nearly all LGA) and these women gained nearly double the amount of excess weight compared to those women giving birth to normal size for gestational age or AGA infants (figure 1). No significant difference in excess GWG was seen for gestational diabetes and hypertension (See Figure 1).

Multivariate logistic regression results showed that African American identity, unplanned pregnancy, and obese pre-pregnancy BMI increased the risk of exceeding the IOM recommendation for GWG. In the final model, the odds of the participant gaining above the IOM recommendation for GWG were 2.2 times higher among those who were African American (Table 3). Women with an unplanned pregnancy were twice as likely to exceed the IOM guidelines versus those with planned pregnancies. Finally, the odds of excess GWG were 2.89 times higher for women with an obese pre-pregnancy BMI compared to those who started pregnancy at a normal BMI. Although overweight pre-pregnancy BMI was not significant in the multivariate logistic regression analyses, overall, pre-pregnancy BMI remained in the final model as a contributing covariate.

Variables that were significant in the bivariate analyses but that did not remain in the multivariate model were: parity; marital status; employment status and education. Each step of the backward elimination logistic regression procedure was analyzed closely to ensure the robustness of the analytical process. There were 5 elimination steps. In the first step, educational status ($P = 0.675$) was eliminated. In the second step, employment status was eliminated ($P = 0.674$). In the third step, parity was eliminated ($P = 0.233$) and lastly marital status ($P = .174$) was discarded. In all instances, the variables eliminated had, by far, the highest P value and eliminating them did not affect the overall fit of the model at each step. Thus, the backward elimination process was found to be very robust.

Discussion

The purpose of the research team was to analyze and describe potential socio-demographic characteristics that put low income women at risk of excessive GWG in pregnancy. In our study, more than half of the women had overweight/obese pre-pregnancy BMI and they gained significant amounts of excess weight than the participants who were normal weight in the beginning of pregnancy. This finding is not surprising and aligns with conclusions made by researchers from their studies conducted in the U.S. and in other countries (Chu, Callaghan, Bish, & D'Angelo, 2009; Enomoto et al., 2016; Fuemmeler et al., 2016; Goldstein et al., 2017, Lederman et al., 2002). In a sample of 97,157 Japanese women, Enomoto et al (2016) found that pre-pregnancy BMI category predicted weight gain during pregnancy and birth outcomes. The authors also concluded that IOM guidelines for GWG were applicable for even Japanese women.

Based on the study results, we found that nulliparous women were gaining higher amount of excess weight. This is critical, because researchers have shown that excess GWG is significantly predictive of postpartum weight retention and this association has been higher in nulliparous women (Endres et al., 2015; Haugen et al., 2014; Kirkegaard et al., 2014; Krukowski, Bursac, McGehee, & West, 2013). In an epidemiological study with 56,101 Norwegian women, Haugen et al found that 74% of nulliparous women in their study sample gained above IOM recommendations and experienced significant postpartum weight retention compared to their multiparous counterparts (Haugen et al., 2014). Based on the results of our study, we also highlight a critical need for programs aimed at helping nulliparous women gain weight within the recommendation during pregnancy and prevent them from entering the obesity cycle.

Women in this study who reported that this was an unplanned pregnancy also experienced a significant amount of excess weight gain. This is concerning, since, approximately 50% of pregnancies in the U.S. are unplanned (Finer & Zolna, 2011). In alignment with our study, Endres et al. found that women with unplanned pregnancies were at significant risk of retaining more than 20 lbs post-partum (Endres et al., 2015). Unplanned pregnancies are more common among low income, single, ethnic /racial minority women. Additionally, researchers have found that unplanned pregnancy is associated with delayed prenatal care and poor maternal and infant outcomes including premature birth and poor nutritional status (Mayer, 1997; Mosher, Jones, & Abma, 2012; Orr, Miller, James, & Babones, 2000).

Women in our study who reported as single, divorced or separated also experienced significant excessive weight gain. Like our study, Olson and Strawderman (2003) found that 42% of women who reported as separated or divorced and 48 % of women who reported as single gained above IOM recommendations compared to only 38% of married women. These findings may suggest that a lack of social support could be a factor. Maternal and child health researchers suggest broadening the examination of health disparities among low income women by seeking to understand how the contextualization of their lives puts them at risk (Lu & Halfon, 2003; Ramey et al., 2015; Shonkoff et al., 2011). Many researchers have cited the preconception stress resiliency model which hypothesizes the importance of mother-father relationships and social support as important factors in biosocial development during pregnancy. It is important to note that the absence of a spouse or partner does not necessarily indicate that these mothers are not getting social support from other friends or family. The role of social networks among low-income pregnant women should be further investigated as potential factors and/or modifiers of excessive weight gain in pregnancy. Based on the qualitative study results, Anderson et al (2015) indicated that women view mothers, friends and family members as facilitators to a healthy pregnancy by providing support and health information during pregnancy. Laraia et al. found that the presence of a grandmother in the household was associated with food security, which in turn was associated with normal GWG and low rate of gestational diabetes. The authors suggested that family support might offer not only financial assistance, but also emotional support in the form of guidance on healthy eating, and support for prenatal care (Laraia, Borja, & Bentley, 2009).

Based on the results, we conclude that African American women, are more likely to exceed IOM recommendations for weight gain during pregnancy. Traditionally, African American women were more at risk of insufficient GWG (Herring et al., 2016; Krukowski et al., 2013). However, based on the recent studies, researchers indicate that the trend has changed and now African American women are at a higher risk for gaining excess weight during pregnancy. Herring et al. suggest that perception and knowledge of appropriate weight gain may be contributing factors to excess GWG for African American women. For instance, participants in their study believed that consuming more calories and gaining extra weight during pregnancy was protective for their babies (Herring, Henry, Klotz, Foster, & Whitaker, 2012). In a qualitative study examining knowledge and beliefs related to eating and health behaviors among pregnant African American women, researchers found that gaining more weight was considered protective and women felt that physical activity might harm the fetus (Goodrich, Cregger, Wilcox, & Liu, 2013). Participants in their study also cited cravings and the availability of unhealthy foods as barriers to healthy eating.

We found a positive association between excess GWG and infant of non-normal size for gestational age (the majority of which were LGA). Similar results were also found in a study conducted by Li et al among 48,867 women in China. The likelihood of delivery of an LGA infant doubled among women with excess GWG compare to women with normal weight gain (Li, Liu, Zhang., 2015). Additionally, Li et al found that excess GWG increased the likelihood of gestational hypertension (adjusted OR 2.55; 95% CI = 1.92–2.80) and cesarean section (adjusted OR 1.31; 95% CI = 1.18–1.36) among Chinese women.

Interestingly and contrary to many previous findings, socio-economic status, including income, education, and food security status were not significantly associated with excess GWG in our sample. One plausible explanation for this could be due to sampling an all low-income women where they met the criteria for participation in the food assistance program of having an income at or below 185% of the poverty guideline. Additionally, in this study, a current food insecurity status i.e., food insecurity during first and second trimester, was not a significant predictor of GWG. To further examine the role of food insecurity, a retrospective study designed to examine food insecurity before pregnancy, in addition to during pregnancy, is warranted, since it is unclear whether access to nutritious food worsens or improves during pregnancy, and how that affects pregnancy outcomes.

Conclusions

The 2009 IOM guidelines on recommended weight gain during pregnancy by pre-pregnancy BMI, are applicable and used worldwide to monitor and assess maternal health. Based on the findings of our study, we also conclude that excess GWG is common and is associated with negative pregnancy and birth outcomes. Considering an increased trend of gaining excess weight during pregnancy, the maternal and child health organizations, such as the Royal College of Obstetricians and Gynaecologists, calls for interventions that specifically target pre- and peri-natal counseling and education programs on maintaining a healthy weight and appropriate weight gain in pregnancy (ACOG, 2013, RCOG, 2017, RANZCOG, 2013). Results of this study is generalizable to low-income women, who are likely to have a limited food budget and rely on cheap, calorie-dense foods to prevent hunger and maintain sufficient food supply for their families. The results of our study are applicable even for low and middle income countries, where nowadays both maternal obesity and micronutrient deficiencies are seen in the same household due to increased worldwide expansion and high commercialization of processed and fast food industry. Perhaps more support is needed for community and food assistance programs, who directly serve low-income women, to provide GWG educational support and help women achieve optimal health for themselves and their children.

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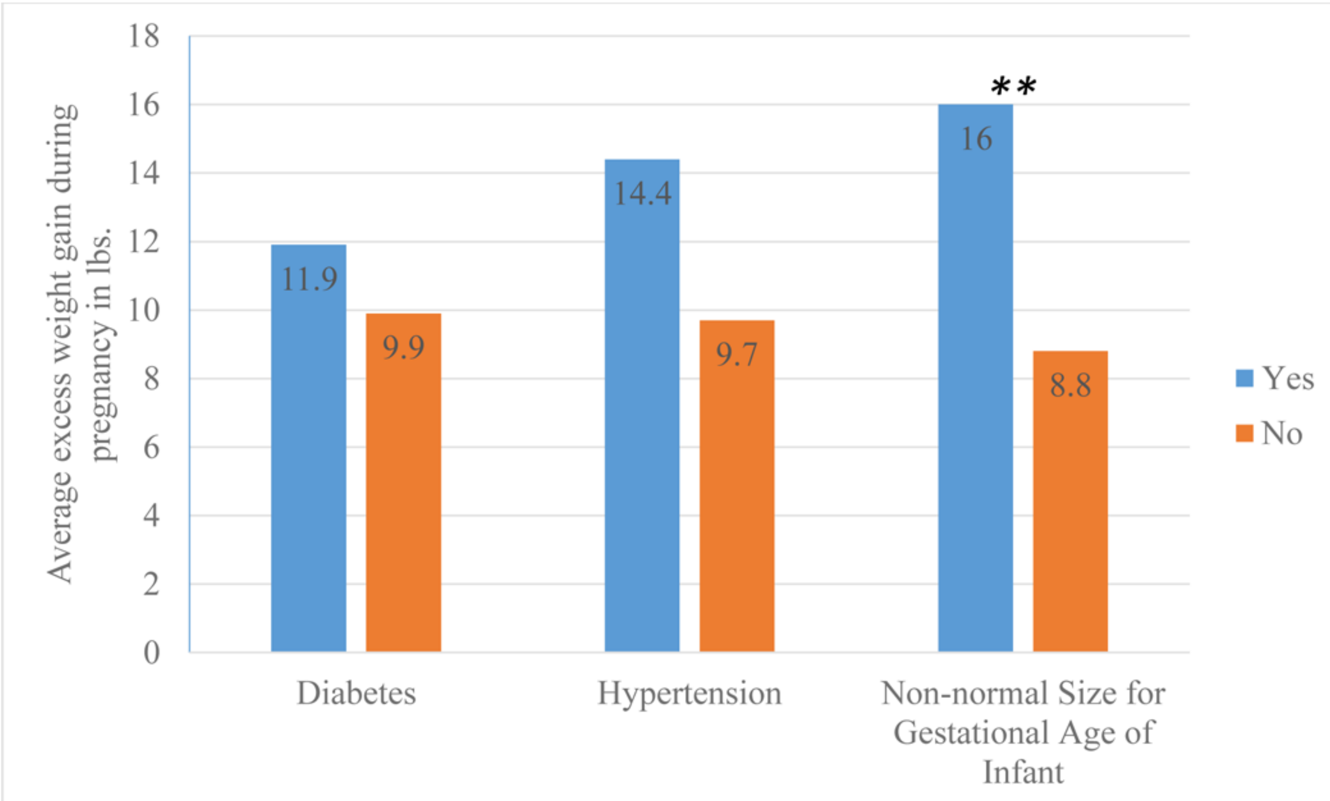

†Oneway ANOVA; **significant difference, *P <0.05*

Figure 1:

Differences in mean excess weight gain above the IOM recommendations by prevalence of gestational diabetes, hypertension and non-normal size for gestational age for infants among low-income pregnant women (n = 160)† †Oneway ANOVA; **significant difference, *P <0.05*

Table 1.

Institute of Medicine (IOM) Recommendations for Weight Gain During Pregnancy, by Prepregnancy BMI[a]

Pre-Pregnancy BMI	Total Weight Gain Range (lbs.)
Underweight (< 18.5)	28–40
Normal weight (18.5–24.9)	25–35
Overweight (25.0–29.9)	15–25
Obese (≥30.0)	11–20

BMI= Body Mass Index

[a]Guidelines are for singleton pregnancies.

Table 2.

Comparison of mean excess weight gain above IOM recommendations in relation to participants' socio-demographic characteristics and food security status (n = 160).

Participants characteristics	n	Mean ± SD[Ø]	P[*]
Income Per Month[a]			0.18
0 - $ 500	37	13.23 ± 12.83	
$ 501 - $ 1000	44	10.11 ± 13.28	
1000 or more	78	8.62 ± 11.42	
Employment Status			0.14
Working	70	11.66 ± 14.06	
Not working	90	8.78 ± 10.71	
Education			0.07
High school or less	79	8.22 ±11.15	
More than high school	81	11.81±13.22	
Marital Status			**0.00**
Single/divorced/separated	92	12.41 ±13.72	
Married/living together	68	6.82 ± 9.33	
Ethnicity/Race			0.07
Not African American	75	8.16 ±12.07	
African American	85	11.69 ±12.40	
Receives SNAP [c]			0.27
Yes	49	9.08 ±12.40	
No	111	11.27 ±12.22	
Parity			**0.01**
Primiparous	58	13.31 ±14.72	
Multiparous	102	8.18 ±10.37	
Food Security Status[c]			0.57
Food Secure	86	10.53 ±13.05	
Food Insecure	66	9.40 ±11.40	
Planned Pregnancy			**0.02**
Yes	54	6.67 ±8.60	
No	106	11.52 ±13.43	
Pre-pregnancy BMI			**0.03**
Normal	55	7.35 ±10.20	
Overweight	49	9.33 ±11.94	
Obese	56	13.55 ±13.95	

[*]Oneway ANOVA; SD: Standard Deviation;

[Ø]excess weight gain in lbs.

[a]n = 159;

[b]receives Supplemental Nutrition Assistance Program (formerly known as Food Stamps);

[c] n = 152

Table 3.

Predictors of gaining excess gestational weight gain among low-income pregnant women (n = 160)*

Characteristics	Odds Ratio	95% Confidence Interval	*P*
Pregnancy Planning			0.053
Planned	1.00		
Unplanned	2.05	0.99 – 4.62	
Ethnicity/Race			0.025
Not African American	1.00		
African American	2.20	1.10 – 4.37	
Pre-Pregnancy BMI			0.050
Normal	1.00		
Overweight	1.55	0.68 – 3.49	
Obese	2.89	1.23 – 6.75	

*Backward stepwise logistic regression. Variables eliminated from the model were Parity; Marital status; Employment status and Education. Hosmer-Lemeshow fitness *P*-value=0.651 (chi-square=5.96, df=8). Dependent variable is meeting IOM recommendations for weight gain by pre-pregnancy BMI status: 0 = meeting and 1 = not meeting IOM recommendation (gaining excess).