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Gestational Weight Gain of Pregnant African American Adolescents Affects Body Mass Index 18 Years Later

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Abstract

Objective—To determine if gestational weight gain (GWG) in adolescents is associated with long-term weight increases 12 years and 18 years after delivery of a first child and the differential effects of weight gain during pregnancy that is inadequate, the appropriate amount, and excessive based on the 2009 Institute of Medicine (IOM) recommendations.

Design—Secondary data analysis of data from a randomized controlled trial.

Setting—Memphis, Tennessee.

Participants—Two hundred ninety eight (298) primiparous low-income Black women who were adolescents at the time of their first pregnancies.

Methods—Linear regression was used to examine the relationship between body mass index (BMI) at 12and 18 years postdelivery and GWG, parity, prepregnancy BMI, and smoking.

Results—The total sample experienced a significant BMI increase from prepregnancy to 12 years and 18 years postdelivery. More than 50% of the women had a BMI increase greater than 10 kg/m^2. By 18 years postdelivery, 85% were overweight or obese. Prepregnancy BMI and GWG had a positive significant effect on BMI 12 and 18 years later, whereas smoking had a negative effect. Those who gained excessive weight based on the IOM recommendations had a significantly higher BMI compared with those who gained appropriately.

Conclusion—Gestational weight gain had long-term effects on BMI in a minority adolescent population. Excessive pregnancy weight gain is likely to contribute to long-term weight retention, especially if adolescents are overweight or obese when they become pregnant with their first children. Intervention during pregnancy to limit GWG has the potential of limiting long-term negative health consequences that result from overweight and obesity in minority women.

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The authors report no conflict of interest or relevant financial relationships.

Keywords

gestational weight gain; obesity; weight retention; adolescent pregnancy; minority women; body mass index; IOM recommendations

Pregnancy is a critical life-stage characterized by physiological, psychological, and social change (Halfon & Hochstein, 2002). Excessive gestational weight gain (GWG) in relation to the recommendations of the Institute of Medicine (IOM) and prepregnancy body mass index (BMI) are known contributors to postpartum weight retention (Rasmussen & Yaktine, 2009). Nearly 50% of pregnant women gain more than the IOM recommendations (Simas et al., 2011) and, therefore, are at risk for long-term obesity, which is associated with various negative health consequences, such as hypertension, cardiovascular disease (CVD), diabetes mellitus, and osteoarthritis (Centers for Disease Control and Prevention, 2011).

Researchers in a limited number of studies have addressed the long-term effect (3 years or more) of GWG on weight retention (Fraser et al., 2011). Nehring, Schmoll, Beyerlein, Hauner, and von Kries (2011) conducted a meta-analysis to compare short-term and long-term effects of GWG on postpartum weight retention and concluded that there is increased postpartum weight retention in women who gain excessive weight compared with women who gain within the IOM recommendations. However, the IOM recommendations were revised in 2009. The revision included the addition of an upper limit to the amount of weight obese women should gain *during pregnancy*, use of the World Health Organization (WHO) criteria for adult BMI categories, and incorporation of maternal and infant outcomes (Fernandez, Hoffmire, & Olson, 2011). The 1990 recommendations specified that adolescents, as well as Black women, should gain weight according to the upper end of the recommendations (IOM, 1990). The revised recommendations indicate that there is inadequate evidence to support continuation of those specific recommendations (Rasmussen & Yaktine, 2009).

Since the inception of the revised recommendations, Fernandez et al. (2011) demonstrated that the use of adult BMI categories was appropriate for differing ages and racial groups in adolescents. Additionally, the results from a recent study of adolescents in which researchers used the revised IOM guidelines indicated that prepregnancy BMI and GWG were significant predictors of weight retention at 1-year postpartum (Joseph et al., 2008). However, long-term associations of BMI and maternal GWG with respect to the 2009 IOM recommendations have not been reported in Black women who were adolescents during their first pregnancies.

In our previous study we examined adolescent GWG and its effect on long-term BMI change at 6 years and 9 years postdelivery of a first child (Groth, 2008). The specific aims for this secondary data analysis were to examine the effects of GWG on BMI 12 years and 18 years after delivery of a first child using the 2009 IOM recommendations and the differential effects of weight gain during pregnancy that is inadequate, appropriate, or excessive based on the 2009 IOM recommendations.

Method

Design

This study was a secondary analysis of a subgroup of women from the New Mother's Study (NMS) conducted in Memphis, Tennessee. The NMS is a large, ongoing randomized controlled trial (RCT) that tests the effectiveness of nurse home visitation in improving the health and well-being of women and their children (Kitzman et al., 1997; Kitzman et al.,

2000). The home visits occurred for primiparous, socially disadvantaged women during pregnancy and the first two years of their first children's lives. The NMS, which began in 1990 and for which measures at 18 years were recently obtained postdelivery, was approved by the university Institutional Review Board (IRB). In this analysis we retrospectively examined Black women from the NMS who gave birth during their adolescent years (19 years of age or less) to full-term infants. We examined the GWG and maternal BMI 12 years and 18 years after childbirth. Our prior publication indicates the results for adolescents from the NMS at 6 years and 9 years postdelivery of the first child (Groth, 2008).

Sample

This cohort of 298 low-income, Black women was enrolled in the NMS as adolescents who were pregnant for the first time. At enrollment they had no previous live births, no known chronic illnesses that could affect pregnancy, and at least two of three sociodemographic risk factors: unmarried, less than 12 years of education, or unemployed. The participants ranged in age from 12–19 years, with a mean age of 16.3 years at conception. All participants were followed longitudinally from enrollment until the index child was 18 years old. Before combining treatment and control groups from the NMS for this analysis, it was determined that there were no significant group differences in prepregnancy BMI, current BMI, and GWG. Women who reported a current pregnancy or a pregnancy within the six months before weight measurement at 12 years or 18 years postdelivery were excluded from this analysis.

Measures

Predictor variables for this study included GWG, prepregnancy BMI, and age at the time of conception. Parity and smoking were included as covariates. Outcome variables included BMI at 12 years and 18 years postdelivery of the index child.

Maternal gestational weight gain was defined as the difference between maternal weight measured at the time of delivery and self-reported prepregnancy weight. Inadequate weight gain and excessive weight gain were dummy-coded with appropriate weight gain as the comparison. This variable was used in place of continuous GWG to determine the effects of gaining less than or more than the appropriate amount based on the IOM recommendations for pregnancy weight gain, which vary depending on prepregnancy BMI (Rasmussen & Yaktine, 2009). The IOM GWG recommendations indicate gestational weight gain ranges are 28–40 pounds for underweight women, 25–35 pounds for normal weight women, 15–25 pounds for overweight women; and 11–20 pounds for obese women. These recommendations have been demonstrated to be used appropriately in adolescent girls (Fernandez et al., 2011).

Pre-pregnant BMI for the index pregnancy was calculated from self-reported prepregnancy weight and measured height, which were obtained from the medical record. Prepregnancy BMI category was determined using the standard groupings of underweight (less than 18.5 kg/m^2); normal weight (18.6–4.9 kg/m^2); overweight (25–29.9 kg/m^2), and obese (30 kg/m^2 or greater).

Maternal age at conception was calculated by subtracting weeks of gestation from the childbirth date and computed using the maternal birth date. Age was used as a continuous variable.

Covariates

Parity was the self-reported number of children collected at each data collection point. This variable was categorized as one versus two or more pregnancies.

Smoking was defined as never having smoked, ever having smoked but not heavy, and ever having smoked heavy. (*Heavy* is defined as ever reporting 20 cigarettes or more within the past 30 days at any data collection point in the NMS.)

Socioeconomic status (SES) was not included in the analysis because of the limited variability in SES. All women who enrolled in the original study were low-income, and the variation that occurred over time precluded a true measure of SES. Likewise, education lacked variability and was not included for these analyses.

Outcome variables

Body mass index at 12 years and 18 years after delivery of the index child were calculated from a measured weight and height at each time point.

Statistical Analyses

Preliminary analyses involved examination of distributions, means, and standard deviations for continuous variables and frequency distributions of categorical variables. Participants were included if data were available for all variables at each time point. Comparison of mean BMI at different time points was conducted using *t*-tests. Multiple regression models were used to assess the effects of GWG, prepregnancy BMI, age, parity, and smoking on the outcome variables of BMI at 12 years and 18 years postdelivery of a first child. Treatment group was included as a covariate in the analyses and subsequently removed because it did not contribute to the models. Power analysis indicated that with a sample of 298 participants a 1.39 BMI unit change could be detected with power = 80% and $\alpha = .05$ (2-tailed test). All analyses were conducted using Statistical Package for the Social Science (SPSS, Version 17.0).

Results

Characteristics of the study participants are reported in Table 1. There were complete data for 298 women at 12 years and 18 years postdelivery of the first child. Of these women, 29% were younger than 16 years of age when they became pregnant; 44% were 16–17 years of age; and 27% were 18–19 years of age. Over the 18-year period participants reported from one to 10 total children: slightly more than 60% had a total of three children or less, and of the remaining 40%, the majority had no more than six children. The total sample experienced a significant BMI increase from prepregnancy BMI to BMI at 12 years and 18 years after childbirth ($P < .001$). There also was a significant increase in mean BMI from year 12 to year 18 ($P < .001$).

The percentage of women in this sample who were overweight or obese increased over time for the whole sample as well as within each prepregnancy BMI group (see Table 2). For those who were overweight or obese before pregnancy, the mean BMI increase from prepregnancy to 18 years later was 10.27 (standard deviation [SD] = 8.9) and ranged from 0.05 kg/m^2 to 50.5 kg/m^2 (see Table 1). In comparison, the mean BMI increase for the underweight and normal weight groups were 9.26 (SD = 4.99) and 10.64 (SD = 6.7) respectively, with a range from −0.91 kg/m^2 to 35.6 kg/m^2. More than 50% of the women had a BMI increase greater than 10 kg/m^2 over the 18-year period. Of the adolescents who were underweight at the time of conception (n=36), 19% gained excessive weight during their pregnancies. Of the normal weight adolescents (n = 192), 31% gained excessive weight. Of the overweight adolescents (n = 44), 55% gained excessive weight, and of the obese adolescents (n=26), 65% gained excessive weight (see Table 1).

Twelve years after birth of a first child

The main regression model that examined the effect of GWG, prepregnancy BMI, parity, smoking, and age on BMI at 12 years postdelivery of the first child was significant (F [6,291] = 62.80; P <.001), which explained 56% (adjusted R^2) of the variance of BMI. Gestational weight gain, prepregnancy BMI, and smoking predicted BMI at 12 years postdelivery (see Table 3). Prepregnancy BMI and GWG had a positive relationship with 12-year postdelivery BMI, while smoking had a negative effect on BMI. There was one correlation between smoking heavy and GWG. A regression model that included only women who smoked heavily and all the same variables as the main regression model was significant (F [4,179] = 62.57; P<.001). In this model GWG was not predictive of BMI at 12 years postdelivery (P=.619).

The categorical GWG variable was entered into the analysis in place of continuous GWG to determine the effects of inadequate or excessive weight gain based on the IOM recommendations. The model was significant (F [7,290] = 48.17; P<.001), which explained 53% of the variance with inadequate weight gain having a negative effect on BMI at year 12 and excessive weight gain having a positive effect at year 12 (see Table 4). A comparison of BMI at 12 years for those who gained an excessive amount compared with those whose weight gain was appropriate to the IOM recommendations was significant (P< .001) with the mean BMI difference being 5.3 BMI units higher for those who gained an excessive amount of weight.

Eighteen years after birth of first child

The main regression model that examined the effects of GWG, prepregnancy BMI, parity, smoking, and age at conception on BMI at 18 years postdelivery of the first child was significant (F [6, 291] = 37.83; P<.001), which explained 43% (adjusted R^2) of the variance of BMI. Gestational weight gain, prepregnancy BMI, and smoking were predictive of BMI 18 years later (see Table 5). Prepregnancy BMI and GWG had a positive relationship with 18-year postdelivery BMI, whereas smoking had a negative relationship with BMI. There were no interaction effects.

As was done in the 12-year analysis, the categorical GWG variable was entered into the 18-year analysis in place of the continuous GWG. The model was significant (F [7,290] = 29.64; P<.001), which explained 40% of the variance with inadequate weight gain having a negative effect on BMI at year 18 and excessive weight gain having a positive effect at year 18 (see Table 4). A comparison of BMI at 18 years for those who gained an excessive amount compared with those whose weight gain was appropriate to the IOM recommendations was significant (p < .001) with the mean BMI difference being 5.4 BMI units higher for those who gained an excessive amount.

Discussion

Both GWG and prepregnancy BMI had long-term effects on BMI later in life for Black women who were adolescents when they had their first children. A higher GWG and a higher prepregnancy BMI predicted a higher BMI later in life. This effect extended out to 18 years beyond delivery of the first child. This finding suggests that adolescent long-term weight changes are consistent with known adult weight changes after pregnancy: high prepregnancy BMI and excessive GWG both contribute to postpartum weight retention and long-term BMI increase in women (Fraser et al., 2011; Nehring et al., 2011; Rasmussen & Yaktine, 2009). The current findings go beyond prior reports for adolescents (Groth, 2008; Joseph et al., 2008) by demonstrating long-term effects of GWG on BMI up to 18 years later. To our knowledge no other researchers have used the 2009 IOM recommendations to

examine the long-term effects of adolescent GWG in an Black adolescent population that extend years beyond the index pregnancy.

Extrapolation of the findings suggests that for every pound gained during pregnancy there was a 0.148 BMI increase 18 years later. Therefore, if an adolescent gains 30 pounds (the approximate average gain across all BMI categories), it translates to a 4.4 BMI increase, the equivalent of approximately 25 pounds for an average height woman. This independent effect of GWG on BMI so many years later emphasizes the clinical importance of GWG, especially if it is excessive, because there are resultant increases in pregnancy complications (DeVader, Neeley, Myles, & Leet, 2007), weight retention (Simas et al., 2011), and offspring risk of obesity (Oken, Taveras, Kleinman, Rich-Edwards, & Gilman., 2007).

The distribution of inadequate, appropriate, and excessive weight gain during pregnancy was roughly a third of the sample in each category, with slightly more participants gaining excessive weight (36%). The number of excessive weight gainers is lower than has been noted in adult women, where nearly 50% gained more than the recommendations (Simas et al., 2011). A probable explanation for this is that our sample had a higher number of underweight and normal weight adolescents compared with the adult women assessed by Simas et al. (2011). Overweight women are more likely to gain more than the recommendations, whereas underweight women are the least likely to do so (Rasmussen & Yaktine, 2009). Few of the underweight adolescents gained excessive weight during pregnancy (19%), and 31% of the normal weight girls gained excessive weight. The overweight and obese group was above adult percentages with 59% gaining an excessive amount of weight.

An excessive amount of weight gain compared with an appropriate amount of weight gain resulted in a significantly higher mean BMI 12 years and 18 years later. In a 2011 meta-analysis, researchers compiled findings of GWG and postpartum weight retention, and the results indicated that women who gained more than the recommendations retained 4.7 kg more weight than those who gained within the recommendations at 15 or more years postpartum (Nehring et al., 2011). All of the studies in which the authors examined long-term effects (i.e., more than three years postpartum) and were included in that analysis were based on the 1990 IOM recommendations, which were adjusted in 2009. Nonetheless, excess weight gain increased obesity risk 15 years later (Amorim, Rossner, Neovius, Lourenco, & Linne, 2007), even as long as 21 years after pregnancy in adults (Mamun et al., 2010). Our findings indicated that adolescents experience the same weight retention effects that women do as a result of excessive weight gain during pregnancy. Adolescents who gained an excessive amount of weight in this sample retained more weight than has been reported for women, with the mean BMI being more than 5 kg/m^2 higher compared with those who gained appropriately according to the IOM recommendations. This suggests that excessive weight gain is a critical factor in the long-term weight of Black women who become pregnant during their teenage years.

For adolescents who gained less than the recommended amount of weight, GWG had a negative effect on BMI 12 years and 18 years later. This finding is also consistent with adult women: Fraser et al. (2011) reported a lower BMI 16 years after an index pregnancy in women who gained less than the recommended amount of weight. Results from a meta-analysis suggest that women who gain an inadequate amount of weight retain less weight than those who gain within the recommendations (Nehring et al., 2011). The effect appears to be similar for the adolescents in this sample even though it is likely they were still growing.

The average gestational weight gain for adolescents in each prepregnancy BMI category was similar. The standard deviation was much larger for the overweight and obese category than the other categories, especially the underweight category. This explains the extent to which there was excessive weight gain by overweight and obese adolescents compared with the underweight and normal weight adolescents: The apparent tendency was to gain in the range of 30 pounds, even though weight gain should be less based on the higher prepregnancy BMI in the overweight and obese group. Historically, when the adolescents in this sample were pregnant there had been a shift away from limiting GWG and the reported average gain was approximately 33 pounds (IOM, 1990). It is unknown if this finding is a result of that clinical approach or if there are implications for clinical practice with overweight and obese adolescents because it suggests it might require conscious effort to limit GWG to the recommended range.

Prepregnancy BMI contributed to BMI 12 years and 18 years later. More of the overweight (84%) and obese (89%) adolescents were obese later compared with the underweight (22%) and normal weight (56%) adolescents. This result is due in part to overweight and obese adolescent excessive weight gain (59%) during pregnancy, which is consistent with a study of primiparous adolescents that reported excessive weight gain increased as BMI increased (Harper, Chang, & Macones, 2011). A BMI increase is to be expected as many of the adolescents were still growing, and women typically gain weight as they get older, especially during the 20–29-year age bracket (Nooyens et al., 2009). However, our findings suggested that excessive weight gain during pregnancy contributes to the long-term risk of overweight and obesity in Black adolescents.

It is established that smokers tend to have a lower BMI than nonsmokers (Chiolero, Faeh, Paccaud, & Cornuz, 2008). The smoking variable in this study was a compilation of smoking over time such that we know participants reported smoking, be it heavy or not, at least once during the longitudinal study. The literature suggests that one third of people who try smoking become daily smokers and those who reported heavy smoking at any time point are most likely regular smokers (U.S. Department of Health and Human Servies, 2010). Although the extent of smoking over the 12–18-year period is not known, whether women ever smoked or smoked heavily had a negative effect on long-term BMI and the more women smoked the greater the effect. Heavy smoking during the first 12 years diminished the effect of greater GWG on 12-year BMI. It appears that GWG did not affect 12-year BMI if they were heavy smokers, although the size of this subsample (n=36) did not provide strong evidence for or against this association.

Implications

These results suggest that excessive pregnancy weight gain is likely to contribute to long-term weight retention in adolescents, especially if they are overweight or obese when they become pregnant with their first children. Interventions to prevent excessive gestational weight gain have focused primarily on nutrition, physical activity, and weight tracking in samples that were mostly White adult women (Oteng-Ntim, Varma, Croker, Poston, & Doyle, 2012). Studies conducted in the United States are limited in number, and those in which the authors reported successful limitation of GWG and included Black women used interventions, such as diet and activity counseling in various formats (such as one-on-one sessions, and/or seminars).

Whether these approaches are applicable to a minority adolescent population is unknown. Evidence is lacking for how best to intervene with pregnant low-income Black adolescents to prevent excessive GWG. Based on adult studies it appears that nurses can focus on ensuring that pregnant adolescents are provided with appropriate information about nutrition, physical activity, and healthy weight gain during pregnancy. Monitoring weight

gain during pregnancy may prove to be useful as it has been with overweight adult women (Olson, Strawderman, & Reed, 2004). Dietary interventions appear to be the most effective for women (Thangaratinam et al., 2012), and this also may be the case for Black low-income adolescents who are at risk of poor diets in relation to dietary guidelines (Kirkpatrick, Dodd, Reedy, & Krebs-Smith., 2012). Pregnant women desire to have healthy infants and may be more likely to respond to education and advice about healthy behaviors during pregnancy if this advice focuses on infant health is a central component (Groth & Morrison-Beedy, 2013).

There may be a tendency of adolescents in all prepregnancy BMI categories to gain in the range of 30 pounds, which is more than the recommendations for overweight and obese women and adolescents. This has the potential to increase the challenge of limiting GWG to an appropriate level for optimal pregnancy outcomes. Nurses can monitor GWG on a regular basis and encourage pregnant adolescents to pay attention to weight gain while they are pregnant, encourage appropriate weight gain according to prepregnancy BMI, and promote healthy diets and regular physical activity.

Limitations

There are several limitations to this study. The variables available in this dataset limited what could be included in the analyses. However, despite the limited number, more than 50% of the variance in BMI was accounted for in the analyses. Prepregnancy weights were self-reported. The tendency to under-report weight could contribute to an over-estimation of actual GWG. Lack of data regarding physical activity and diet during and after pregnancy as well as no data regarding GWG at subsequent pregnancies limited our ability to take those factors into account. This dataset included nearly 300 Black women from one geographic region who were adolescents at the time of their first pregnancies. Further study is warranted to examine other populations of pregnant adolescents and their GWG and BMI change patterns beyond pregnancy.

Conclusion

This study contributes to the current knowledge regarding the effects of gestational weight gain on long-term BMI in a minority, adolescent population. This information points out the need to be cognizant of, concerned about, and proactive for healthy gestational weight gain in adolescents. Excessive pregnancy weight gain is likely to contribute to long-term weight retention, especially if adolescents are overweight or obese when they become pregnant with their first child. There may be a tendency of adolescents in all prepregnancy BMI categories to gain in the range of 30 pounds, which is above the recommendations for overweight and obese women and adolescents. This has the potential to increase the challenge of limiting GWG to an appropriate level for optimal pregnancy outcomes. The evidence for effective interventions to prevent excessive gestational weight gain in minority populations is limited and further study is needed to provide nurses with the evidence to effectively intervene with minority adolescents during pregnancy.

The extent of obesity in this sample 18 years after childbirth has major health implications. These women were still relatively young with an age range of 30–37 years. Yet with their levels of obesity greater than 59%, and overweight and obesity at 85%, these women faced a high risk of overweight and obesity-related health issues, such as hypertension, CVD, diabetes mellitus, and osteoarthritis (Centers for Disease Control and Prevention, 2011). Furthermore, obesity is costly (with medical costs $1,429 higher per year than for individuals of normal body weight) and is correlated with reduced worker productivity and chronic absence from work. Intervention at the time of pregnancy to limit GWG to

appropriate amounts has the potential of limiting the long-term negative health consequences that result from overweight and obesity in minority populations.

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Table 1

Characteristics of Women (N =298) at 12 Years and 18 Years Postdelivery of First Children

	Total Sample		Prepregnant Underweight		Prepregnant Normal Weight		Prepregnant Overweight and Obese	
Variable	**(N=298)**		**(n=36)**		**(n=192)**		**(n=70)**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Prepregnancy BMI	22.83	4.66	17.56	0.72	21.41	1.66	29.41	4.63
BMI year 12	31.88	8.19	24.6	4.58	30.48	6.41	39.48	8.53
BMI year 18	33.15	8.52	26.35	4.95	31.98	6.97	39.84	9.6
GWG	30.61	15.43	30.88	9.51	30.63	13.84	30.43	21.19
Age at conception	16.34	1.65	15.78	1.57	16.2	1.64	17.01	1.55
Parity at 12 years	3.25	1.52	3.5	1.42	3.3	1.59	2.97	1.34
Parity at 18 years	3.4	1.65	3.81	1.67	3.43	1.72	3.11	1.41
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Never smoked	184	62	26	72	125	65	33	47
Smoked ever/not heavy	77	26	10	28	22	12	23	33
Smoked ever & heavy	36	12	0	0	45	23	14	20
Gained within IOM	94	31.8	14	39	61	32	19	27
Gained above IOM	108	36.4	7	19	60	31	41	59
Gained below IOM	95	31.8	15	42	71	37	10	14

Note. BMI=body mass index; IOM=Institute of Medicine.

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Table 2

Percentage of Women in Each Body Mass Index Category

BMI category	Prepregnancy (%)	12 Years After Delivery (%)	18 Years After Delivery (%)
Total sample (N=298)			
Underweight	12	1	<1
Normal weight	64	17	14
Overweight	15	30	26
Obese	9	52	59
Prepregnancy BMI underweight (n=36)			
Underweight	100	3	3
Normal weight	-	50	42
Overweight	-	36	33
Obese	-	11	22
Prepregnancy BMI normal weight (n=192)			
Underweight	-	<1	-
Normal weight	100	17	14
Overweight	-	38	30
Obese	-	45	56
Prepregnancy BMI overweight (n=44)			
Underweight	-		
Normal weight	-	5	
Overweight	100	9	16
Obese	-	86	84
Prepregnancy BMI obese (n=26)			
Underweight	-	-	-
Normal weight	-	-	4
Overweight	-	4	7
Obese	100	96	89

Note. BMI=body mass index.

Table 3

Predictors of Body Mass Index 12 Years Postdelivery

	12-Year BMI (N=298)		
		Model 2	
Variable	**Model 1 *B***	***B***	**95% CI**
Constant	2.311	1.231	[−6.958, 9.419]
Prepregnancy BMI	1.304**	1.319**	[1.181, 1.457]
Gestational weight gain	0.141**	0.174**	[0.122, 0.227]
Maternal age at conception	−0.323	−0.340	[−0.727, .0.047]
Parity	0.993	1.089	[−1.148, 3.139]
Smoking ever heavy	−3.645**	−3.592**	[−4.168, −1.239]
Smoking ever not heavy	−2.662**	−2.704**	[−4.137, −1.188]
Smoking ever heavy X GWG		−0.162**	[−0.285, −0.040]
Smoking ever not heavy X GWG		−0.040	[−0.133, 0.052]
R^2 (adjusted)	.56		.56
F	62.80**		48.76**
ΔR^2 (adjusted)			.008
ΔF			14.05

Note. BMI=body mass index.

*$P < .01$;

**$P < .001$.

Table 4

Predictors of Body Mass Index at 12 Years and 18 Years Postdelivery for Females Who Gain Less or More Than the Appropriate Amount of Weight Based on Institute of Medicine Recommendations

	12 Years (N=298)		18 Years (N= 298)	
Variable	***B***	**95% CI**	***B***	**95% CI**
Constant	10.512	[2.207, 18.818]	13.743	[4.004, 23.483]
Prepregnancy BMI	1.200**	[1.055, 1.346]	1.052**	[0.882, 1.222]
Under-gain	−2.361*	[−3.987, −.736]	−2.418*	[−4.317, −0.520]
Over-gain	0.818*	[0.241, 3.463]	2.276*	[0.396, 4.155]
Maternal age at conception	−0.399	[−0.802, 0.004]	−0.334	[−0.805, 0.137]
Parity	0.900	[−1.336, 3.136]	1.030	[−1.724, 3.783]
Smoking ever heavy	−3.671**	[−5.737, −1.606]	−4.236**	[−6.654, −1.818]
Smoking ever not heavy	−2.667**	[−4.198, −1.135]	−2.507*	[−4.296, −0.718]
R^2 (adjusted)	0.53		0.40	
F	48.17		29.64	

Note. BMI=body mass index; CI=confidence interval. There were no interaction effects in these analyses, and testing for interactions was excluded from this table.

** $P \leq .001$;

* $P < .05$.

Table 5

Predictors of 18-Year Post Delivery Body Mass Index

	18-Year Postdelivery BMI (N=298)	
Variable	***B***	**95% CI**
Constant	5.437	[−4.284, 15.157]
Prepregnancy BMI	1.167**	[1.003, 1.331]
Gestational weight gain	0.148**	[0.100, 0.196]
Maternal age at conception	−0.250	[−0.711, 0.210]
Parity	0.950	[−1.739, 3.639]
Smoking ever heavy	−4.243**	[−6.594, −1.892]
Smoking ever not heavy	−.2.529*	[−4.271, −0.78]
R^2 (adjusted)	0.43	
F	37.83**	

Note. BMI=body mass index; CI = confidence interval. Model 2 for 18-year postdelivery BMI had no significant interactions so testing for interactions was excluded from the table.

*$P < .01$;

**$P < .001$