Gestational Weight Gain:
Evaluation of an OB/GYN Office-Based Intervention

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Objective: To evaluate the effectiveness of a brief intervention to improve appropriate gestational weight gain among women presenting with normal and overweight/obese pre-pregnancy BMI.

Methods: Using a cohort design, we compared before- versus after-intervention rates of appropriate gestational weight gain (GWG; May – December 2011 versus 2012, respectively), according to 2009 IOM recommendations, among patients initiating care at <20weeks gestation. Chi square analysis and 2X3 ANOVA were used to examine rates of appropriate GWG by pre-pregnancy BMI (normal–NBMI and overweight/obese-OBMI) and mean GWG.

Results: We analyzed 45 NBMI women and 63 OBMI women per cohort. Before- versus after-intervention patients differed significantly on race/ethnicity but were similar in age, parity, insurance, comorbidities, and gestational age at entry and delivery.
Two-way ANOVA demonstrated a significant interaction between the pre-pregnancy BMI and our intervention; whether or not the intervention worked depended on the pre-pregnancy BMI. The intervention had a significant effect on appropriate GWG among OBMI women ($p = .035$), but not among women with NBMI ($p = .557$). Among NBMI women, appropriate GWG decreased (42.2% vs. 33.3%), and excessive GWG increased (37.8% vs. 48.9%). Among OBMI women, appropriate GWG decreased (20.6% vs. 14.3%), and excessive GWG decreased (66.7% vs. 54.0%). Insufficient GWG increased (12.7% vs. 31.7%).

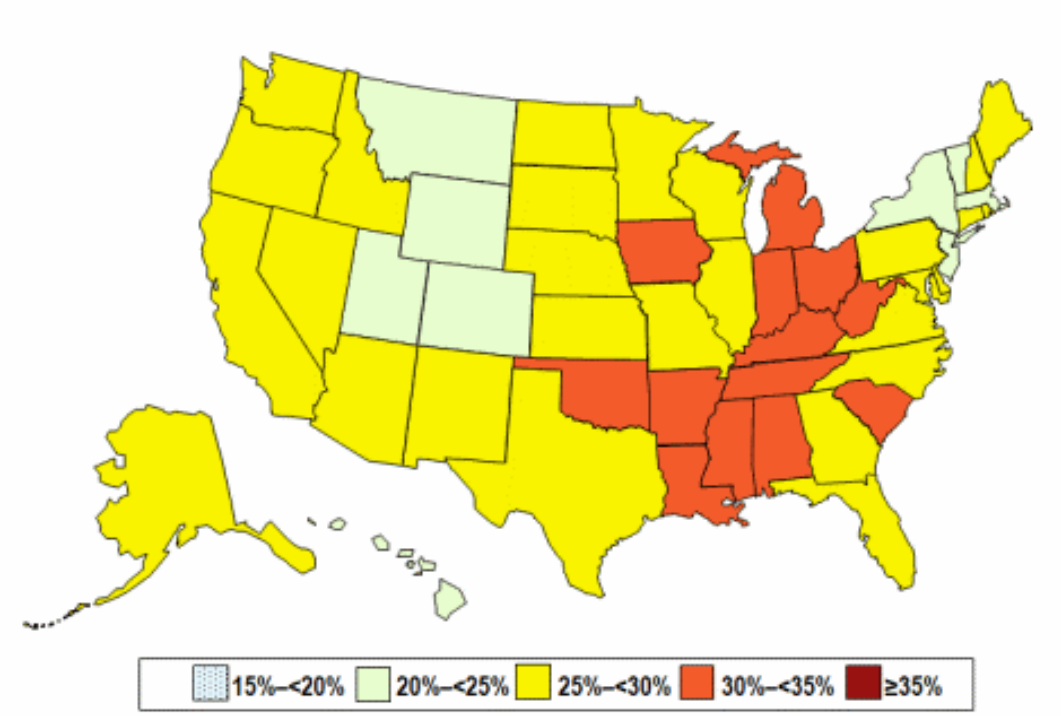
Conclusions: This intervention was simple, brief, and low-cost. In addition to significantly decreasing the mean GWG among OBMI women, use of the BMI grids created a culture of openness to discuss BMI and weight gain.

Keywords: Gestational weight gain, obesity, BMI

Introduction

One of the major challenges facing health care providers today is what is broadly termed the 'obesity epidemic.' Increasingly, evidence suggests that obesity is associated with increased risk for multiple comorbidities, and for many years, obesity has been on the rise in the American population, as evidenced by the map below. According to the Centers for Disease Control (CDC), in 2011 the prevalence of obesity in North Carolina was 29.1%[1], as shown in Figure 1.

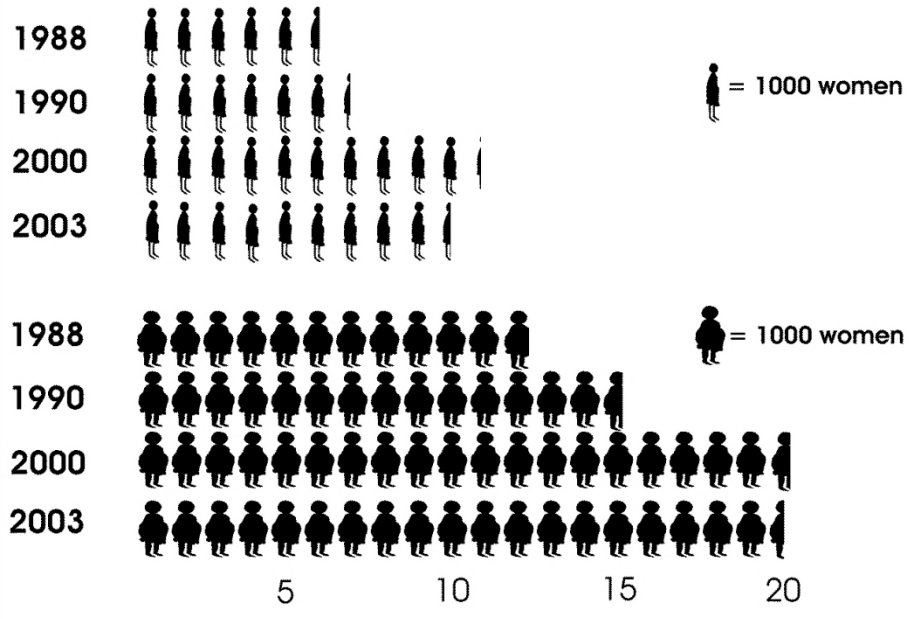
Figure 1. Prevalence of Self-Reported Obesity among U.S. Adults



Source: http://www.cdc.gov/obesity/data/adult.html

Rates of obesity and overweight are also on the rise among women of childbearing age.[2] Furthermore, the rate of women gaining excessive gestational weight- regardless of the pre-pregnancy body mass index - is also increasing.[3-5] See Figure 2.

Figure 2. Inadequate and Excessive Weight Gain During Pregnancy[5]



ACOG (American College of Obstetricians and Gynecologists) released a Committee Opinion on Obesity in Pregnancy in 2013 stating that "In the United States, more than one third of women are obese, more than one half of pregnant women are overweight or obese, and 8% of reproductive-aged women are extremely obese, putting them at a greater risk of pregnancy complications."[6] Overweight and obese women who gain excessive weight during pregnancy are at increased risk for developing gestational diabetes, gestational hypertension, preeclampsia during pregnancy, and stillbirth. During labor, these women face more difficulties with fetal monitoring as well as with anesthesia, and are more likely to have labor dystocias, shoulder dystocias, operative vaginal deliveries, failed vaginal birth after cesarean (VBAC), and cesarean deliveries. At the time of cesarean delivery, these women often face increased time in the operating room and higher surgical blood loss. After delivery, they have a higher risk for endometritis, venous thromboembolism, wound complications after cesarean delivery, and postpartum weight retention.[3-10]

These increased risks do not apply to the mother alone – fetuses of overweight and obese pregnant patients are also at greater risk for complications such as prematurity, stillbirth, congenital anomalies (especially neural tube defects), macrosomia, and childhood obesity.[3,10-11]

This brings us to the question of what constitutes appropriate versus excessive gestational weight gain? In 2009, the Institute of Medicine (IOM) released revised guidelines for gestational weight gain[12], as shown in Table 1.

Table 1. IOM 2009 Revised Guidelines for Gestational Weight Gain

Prepregnancy BMI	BMI (kg/m^2)	Total Weight Gain Range (lbs)	Rates of Weight Gain, 2nd and 3rd Trimester (lbs/week)
Underweight	< 18.5	28-40	1 (1-1.3)
Normal weight	18.5-24.9	25-35	1 (0.8-1)
Overweight	25.0-29.9	15-25	0.6 (0.5-0.7)
Obese (all classes)	≥ 30.0	11-20	0.5 (0.4-0.6)

Note. Assumes 1.1-4.4lbs weight gain in first trimester.

Following the release of these recommendations, multiple studies have been undertaken to learn more about weight gain in pregnancy and to try to help pregnant women gain weight appropriately. Success of gestational weight gain (GWG) interventions is limited; intensive interventions may actually be counter-productive for obese women.[4,19-26] However, for many low income women of normal or overweight BMI, a few multi-component interventions have been shown to be moderately effective.[21-24] As multidimensional as overeating is,[2] a one-size-fits-all approach to weight management during pregnancy may be unrealistic.

The interventions that have be shown to be effective in specific cohorts of pregnant women include visually tracking weight gain on gestational weight gain grids adapted specifically for pre-pregnancy BMI cohorts while also providing patient education both during office visits and with intermittent newsletters on nutrition, exercise, and weight gain in pregnancy. [21-22] The most intensive intervention, designed by Polly et al, utilized graduate-level psychologists and/or nutritionists in an individualized, stepped-care approach that intensified as women fell short of

behavioral goals. While this approach was effective in reducing the percentage of women with normal BMI who gained excessive weight (33% vs. 58% of controls), women with overweight BMI in the intervention group tended to put on excessive weight at a rate greater than controls (59% vs. 32%, respectively).[21] Olson, et al had voluntary providers trained to utilize the BMI grids and provide guidance to women gaining inappropriately; details about dissemination of the educational materials were not provided. They found that fewer low income women of both normal and overweight BMI in the intervention group gained excessive weight than controls (normal BMI: 44% vs. 72%, respectively; overweight BMI: 29% vs. 45%, respectively).[22]

In the absence of a GWG intervention, 27% - 48% of pregnant women receive no information about gestational weight gain, 36% receive incorrect advice, and 50% of overweight/obese pregnant women are advised to gain in excess of current recommendations.[13-16] Further, health care providers find counseling patients on weight gain in pregnancy to be complicated and time consuming. They perceive the topic as highly sensitive and many believe counseling to be ineffective. Other barriers to consistent and effective counseling on gestational weight gain include provider ignorance of or disagreement with IOM guidelines.[13,16-18]

Widespread skepticism among providers of prenatal care regarding their own ability to affect patients' weight gain during pregnancy[17-18] seems warranted given the limited effectiveness of published interventional trials.[21-22] Providers' concerns about questionable motivation and sensitivity or shame regarding weight and weight gain among their patients[17-18] may also be limiting factors. However, many providers do not address weight gain during pregnancy until it has already become an issue,[14,18] and many do not have knowledge of the appropriate guidelines to educate patients.[18]

Despite limitations of the available interventions and variability in providers' approaches to weight gain during pregnancy, some pregnant patients report that advice from their healthcare provider does influence their diet and exercise patterns,[13-14] and some patients do respond favorably to provider-initiated interventions.[21-22] And while variability in providers' knowledge regarding weight gain recommendations and BMI as well as their confidence in their ability to counsel can be improved through CME,[18] education is necessary but often insufficient to create individual and systemic behavioral changes.

Thus, we hoped to find a better intervention that is relatively inexpensive, time-efficient, and that incorporates components from successful interventions while addressing providers' concerns and reasons for not wanting to discuss weight gain. The objective of this project is to evaluate the effectiveness of our brief intervention to improve appropriate gestational weight gain among women with normal and with overweight/obese pre-pregnancy BMI.

Methods

Intervention

In early 2012, we initiated an office-based, brief intervention modeled on successful programs.[21-22] Implementation of our intervention included pre-post testing of providers' knowledge, educational sessions (initial and booster) for nurses and providers, and a 4-week phase-in period with weekly feedback on appropriate implementation.

Nurses weighed a patient at her first prenatal care visit and initiated use of the appropriate grid based on a self-reported pre-pregnancy BMI; both the provider and the patient received a copy of the appropriate grid. After completing the initial dating ultrasound, the provider calculated GWG to date, plotted the first point on the grid, and discussed appropriate GWG based on IOM recommendations using the grid as an educational tool with the patient. At subsequent visits, nurses plotted weight gain on the grid and answered patients' questions, and providers tracked and discussed GWG; referral to the nutritionist was made as needed.

We used the four color-coded weight gain grids developed by the Utah Department of Health (DoH) modified to include our logo and appropriate credit to the Utah DoH (see Figures 3a and 3b).[27] While grids were only available in English, certified medical interpreters accompanied patients during all phases of their prenatal visits and provided GWG education in the patients' first language.

Figure 3a. Modified BMI specific GWG Grid – Pre-Pregnancy BMI ≥30, 11-20 pounds

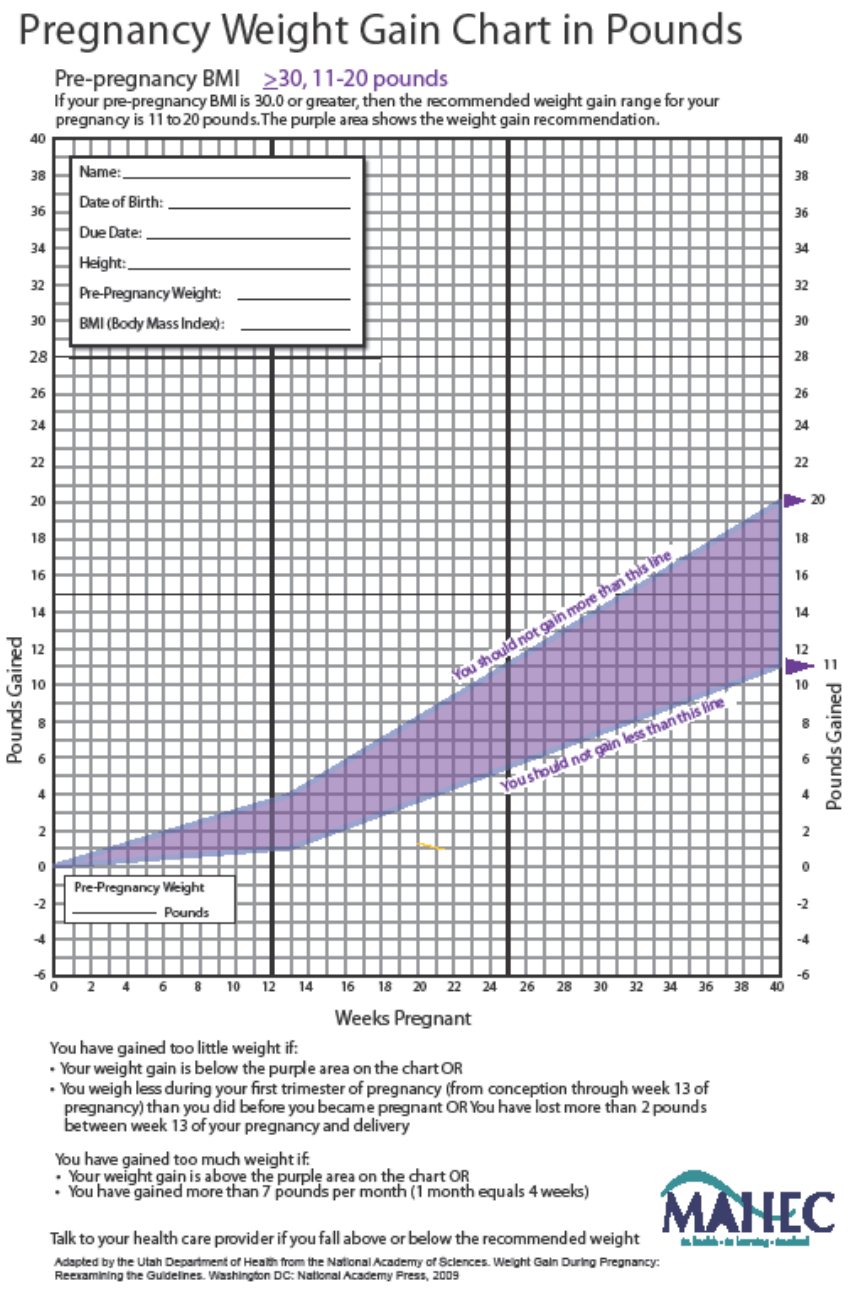
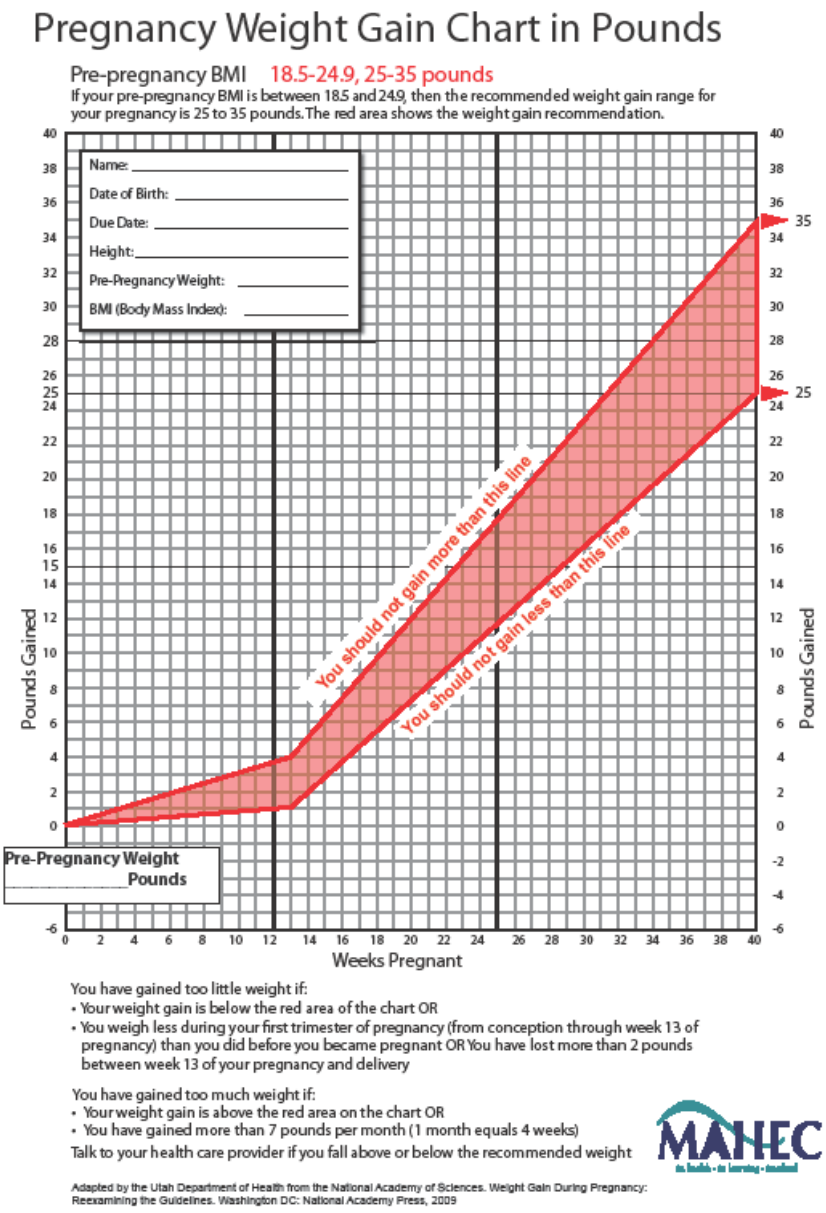


Figure 3a. Modified BMI specific GWG Grid – Pre-Pregnancy BMI 18.5-24.9, 25-35 pounds



We worked with our nutritionist to develop counseling strategies in situations when the GWG was excessive at the first prenatal visit. Further discussion with patients by providers and/or the nutritionist often resulted in revised self-report of immediate pre-pregnancy weight; in some cases, the weight at the first prenatal visit was used.

Evaluation

An IRB-approved, retrospective cohort study was conducted to compare rates of appropriate GWG pre- versus post-intervention: May – December of 2011 versus 2012, respectively. All patients who began prenatal care with us at < 20 weeks gestation, with a pre-pregnancy BMI of normal, overweight or obese and a weight gain grid in their medical record were included in the review.

Data was extracted manually from outpatient paper charts and electronic hospital charts. Variables included pre-pregnancy weight and BMI, weight and gestational age at five intervals: first prenatal visit, second trimester (16-18 weeks), third trimester (27-29 weeks), last prenatal visit, and weight prior to delivery. We also recorded: basic socio-demographics (age, race, gravidity and parity), medical conditions during pregnancy (diagnoses, gestational age at diagnoses, and pharmacotherapy), number of prenatal visits that included weight assessment, use of correct GWG grid, number of plots on GWG grid, referral and receipt of nutritional counseling. Birth outcomes included route of delivery, indication for operative delivery, birth weight, gestational age, and complications.

GWG was calculated by subtracting the self-reported pre-pregnancy weight from the weight at delivery. Using the 2009 IOM recommendations, patients were categorized as having gained weight within versus outside of the recommended ranges: insufficient, appropriate, or excessive according to the IOM guidelines for the pre-pregnancy BMI.

Weight at delivery was calculated for nine women by adding the last recorded prenatal weight to the average daily weight gain for the third trimester multiplied by the number of days between the last prenatal care and the delivery. Classification of GWG appropriateness did not change for any of these nine women when using the calculated total weight gain at delivery or the last measured weight at the last prenatal visit.

Using an intent-to-treat analysis strategy, a 2X3 Analysis of Variance (ANOVA) was used to examine the effect of the intervention (before-after) and the pre-pregnancy BMI (normal, overweight, obese) on GWG. Least squared difference post hoc analyses were used to further examine significant differences. We used Chi square analysis to compare the percentage of women gaining appropriately or inappropriately pre/post the intervention.

Based on an expected increase of appropriate GWG, power analyses (2-tailed Chi-square, $p = .80$, $p < .05$) indicated: 1. Normal BMI: 45 women/cohort (NBMI), 2. Overweight/Obese BMI: 80 women/cohort (OBMI).

Results

Data was extracted from a total of 216 charts: 90 NBMI and 126 OBMI. Patients in our before- and after-intervention groups differed significantly only in race/ethnicity, with slightly more white and 'unknown' patients in the before-intervention group and slightly more black, Hispanic and 'other' in the after-intervention group (see Table 2). There were no differences in percentages of women with medical complications, or in how often or how long patients were seen in prenatal care (see Table 3).

In general, the correct pre-pregnancy BMI grid was used for patients in this study. The median number of visits at which patient weight was recorded was 13, and the median number of weights plotted was 8; 67% of visits involved interaction about GWG.

The percentage of patients in the NBMI categories was identical by design; the percentage of obese patients in the after-intervention time period was slightly greater than in the before-intervention period; this difference was not statistically significant (see Figure 4).

Gestational Weight Gain Analyses

We examined GWG categorized as insufficient, appropriate, or excessive before versus after the intervention. We found an inconsistent pattern of GWG for NBMI women and OBMI women. Among NBMI women, the percentage with appropriate GWG decreased (-8.9%) while the percentage with excessive GWG increased (+11.1%); the difference in GWG category did not reach statistical significance, $p = 0.676$ (see Figure 5). Among OBMI women, however, we noted a significant reduction in the percentage of women with excessive GWG: 11.3% fewer (5.5% fewer overweight and 15% fewer obese) gained weight excessively after the intervention. OBMI women,

however, did not improve appropriate GWG. Instead, significantly more women gained less than the IOM recommendations (see Figure 6).

Table 2. Patient Characteristics

	Before (n=108)	After (n=108)	P
Age Median (min-max)	26 (18-41)	27.5 (15-42)	.693
Parity n(%)			.555
Primaparous	31 (28.7)	35 (32.4)	
Multiparous	77 (71.3)	73 (67.6)	
Race/Ethnicity n(%)			
White	89 (82.4)	79 (73.1)	.031
Black	11 (10.2)	16 (14.8)	
Hispanic	4 (3.7)	6 (5.6)	
Other	0	7 (5.6)	
Unknown	4 (3.7)	0	
Insurance n(%)			1.0
Medicaid	89 (82.4)	89 (82.4)	
Private	19 (17.6)	19 (17.6)	

Table 3. Perinatal Characteristics

	Before (n = 108)	After (n = 108)	P
Medical Complications n(%)			.379
Diabetes	15 (13.9)	19 (17.6)	
Hypertension	18 (16.7)	22 (20.4)	
Tobacco use	27 (25)	27 (25)	
Other	42 (40.8)	41 (37.9)	
Any	71 (65.7)	77 (71.3)	
Total Visits w/Pt Weight n(%)	14 (3-32)	13 (3-27)	.271
EGA @ New OB Median (min-max)	9 (5[4]-20)	10 (6[5]-20)	.240
EGA @ Delivery n(%)			.514
Preterm < 37	11 (10.2)	13 (12)	
Term 37-40[6]	88 (81.5)	90 (83.3)	
Post-dates ≥ 41	9 (8.3)	5 (4.6)	

Figure 4. Pre-pregnancy BMI Category Distribution

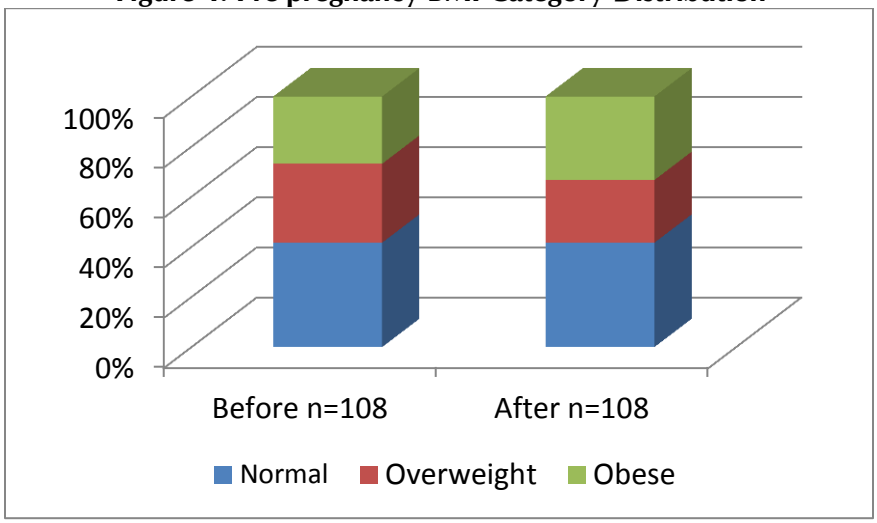


Figure 5. NBMI: Normal Pre-Pregnancy BMI Group (n = 90)

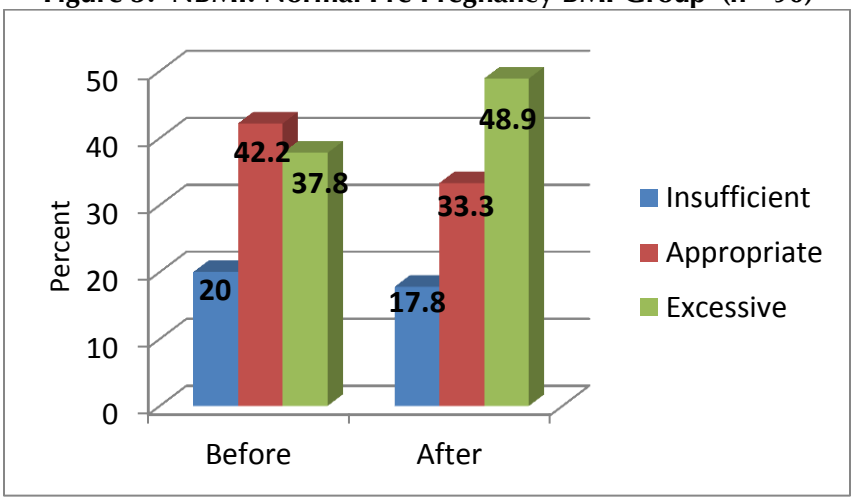
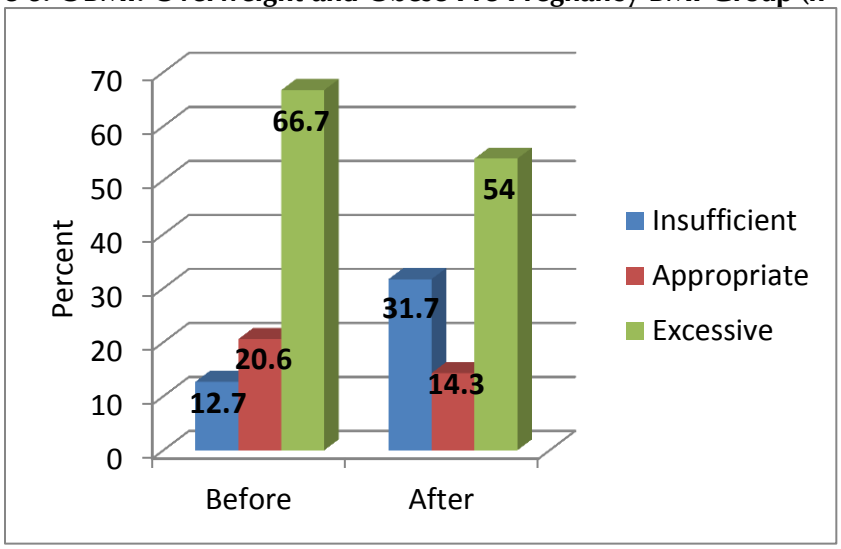
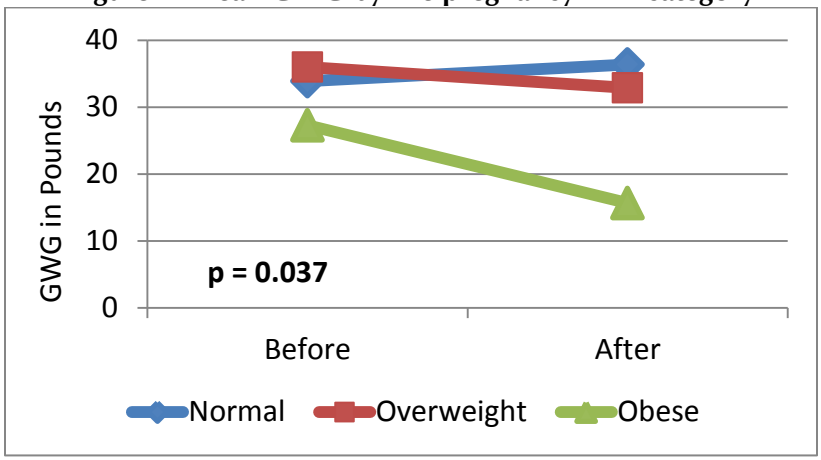


Figure 6. OBMI: Overweight and Obese Pre-Pregnancy BMI Group (n = 126)



We examined change in mean weight gain for each pre-pregnancy BMI group. A significant interaction of pre-pregnancy BMI and intervention was found on GWG ($p = 0.037$; see Figure 7). On average, women with an obese BMI gained significantly less weight during the intervention than before the intervention: 27.5 ± 17.2 lbs versus 14.8 ± 21 lbs.

Figure 7. Mean GWG by Pre-pregnancy BMI category



CONCLUSION

We found a significant reduction in excessive weight gain during pregnancy among overweight and obese women. Upon further examination, this significant reduction in GWG was limited to the women who began pregnancy in the obese BMI category.

However, we did not increase the percentage of women gaining weight appropriately during pregnancy for any pre-pregnancy BMI group. In fact, almost a third of women who were obese at the beginning of pregnancy did not reach the minimum recommendations for GWG from the IOM.[12] The consequences of not meeting the minimum threshold of GWG recommendations are under debate among some researchers. However, in a January 2013 Committee Opinion, ACOG stated, "For the overweight pregnant woman who is gaining less than the recommended amount but has an appropriately growing fetus, no evidence exists that encouraging increased weight gain to conform with the current IOM guidelines will improve maternal or fetal outcomes."[6]

While we were able to encourage discussion of a sensitive topic and increase resources available to our providers, our intervention did not affect our patients who began pregnancy at normal or overweight BMIs. These mixed results are consistent with the interventions we used as models,[21-22] and support the need for alternate interventions rather than a one-size fits all model.

Our study has several limitations. We terminated the project prematurely due to the incorporation of electronic medical records that did not have any GWG grids. Nevertheless, post hoc power analysis indicated an observed power of .784 among the OBMI women. The study was small and conducted at one site only. Our intervention was implemented robustly, but we still fell short of our goal to discuss weight gain with all women at every visit. It is unclear whether additional contact around GWG would have improved our results with women of normal and overweight BMIs prior to pregnancy. We did not control for confounding variables including but not limited to the publication of the 2013 ACOG Committee Opinion that may have influenced providers to counsel obese patients against gaining even the minimum weight the IOM recommended.[6]

Our intervention is simple, and low-cost, and it is associated with a significant reduction in GWG among obese women. While easily implemented, our intervention was paper-based, and it does not work for everyone. We will continue to struggle with how best to help our pregnant patients to limit the weight gained while pregnant.

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