

# Preventing Excessive Weight Gain among Publicly Insured Pregnant Women

Laura Rosenbloom · Elizabeth Buchert ·  
Rosanne Vasiloff · Joseph Feinglass ·  
Xinqi Dong · Melissa Simon

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**Abstract** The purpose of this study is to develop an intervention to help women meet weight gain goals during pregnancy. From 2007 to 2008, pregnant women were recruited at a clinic in Chicago. Intervention participants received an educational pamphlet at their first prenatal visit. At follow up visits, provider counseling was encouraged via a weight gain trend graph and targeted feedback checklist. The primary outcome was the total weight gained over the course of prenatal care. We analyzed 57 intervention group participants and 109 controls. Demographic composition was similar between the groups except for parity. Patients in the intervention group and routine care group gained similar weight (24.5 + 13.5 lb vs. 25.3 + 14.0 lb,  $P = 0.71$ ). After controlling for baseline weight, the intervention was associated with 4.6 pounds lower follow-up weight ( $P = 0.029$ ). After controlling for baseline BMI and other covariates, participants who received the intervention were only 34% as likely to gain weight exceeding IOM guidelines ( $P = 0.009$ ). This pilot prenatal care obesity prevention project was associated with lower weight gain in pregnancy. The feedback checklist, weight gain graph, and educational pamphlet on

weight gain proved to be favorable components of this project and merit further examination in a larger intervention trial.

**Keywords** Obesity · Prenatal counseling · Patient education · Pregnancy · Weight gain

## Background

According to the practice guidelines established by the Institute of Medicine (IOM) in 2009 for weight gain in pregnancy, underweight women (BMI <18.5) should gain 28–40 lbs, normal weight women (BMI 18.5–24.9) should gain 25–35 lbs, overweight women (BMI 25.0–29.9) should gain 15–25 lbs, and obese women (BMI >30.0) should gain 11–20 lbs [1]. However, only 28% of women actually adhere to the guidelines, with over half gaining in excess of these recommended weight gains [2].

Most cases of gestational weight gain have a linear relationship with infant birthweight and the risk of macrosomia is especially noted in women with prepregnant BMI's in the overweight and obese categories [18, 20]. Furthermore, maternal BMI and gestational weight gain have been found to be predictors for infant fat mass and percent body fat leading to the ever increasing concern about the rise in childhood obesity in the United States [14]. Other potential complications during pregnancy for overweight and obese women including gestational diabetes, gestational hypertension and preeclampsia, difficult assessment of estimated fetal weight (EFW), difficult external monitoring of fetal heart rate and contraction pattern in labor, increased likelihood of requiring cesarean delivery, difficult surgery if an emergent cesarean section is required, increased likelihood of postpartum infection,

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L. Rosenbloom · E. Buchert · R. Vasiloff · J. Feinglass ·  
M. Simon  
Department of Obstetrics and Gynecology, Northwestern  
University Feinberg School of Medicine, Chicago, IL, USA

X. Dong  
Department of Medicine, Rush University School of Medicine,  
Chicago, IL, USA

M. Simon (✉)  
680 North Lake Shore Drive, Suite 1015, Chicago, IL 60611,  
USA  
e-mail: m-simon2@northwestern.edu

difficult anesthesia, and fetal risks including prematurity, stillbirth, neural tube defects, and macrosomia [15–17, 19].

Despite the risks to both mother and child, providers do not adequately and consistently counsel pregnant patients regarding optimum weight management in pregnancy [11]. In one report, providers only gave advice for weight gain within IOM guidelines about 50% of the time, above the guidelines 10% of the time, and no advice at all 33% of the time [3]. Nearly 10% of women reported a target weight gain above the guidelines, with obese women most likely to do so. With the aim of preventing excessive weight gain in pregnancy (defined as weight gain greater than IOM guidelines), we designed a low-cost and practical clinical intervention to educate women and providers with simple informational handouts and counseling graphs and checklists in the medical record. We based our intervention in a clinic serving low-income women (uninsured or receiving public aid) and predominantly racial minorities, both of which are known risks for increased weight gain in pregnancy [4]. Our primary study hypothesis was that pregnant women who received the outlined intervention would overall gain less weight in pregnancy and would be less likely to gain weight exceeding the IOM guidelines, as compared to historical controls.

## Materials and Methods

The study was approved by the Institutional Review Board of Northwestern Memorial Hospital and had a prospective cohort design with historical controls. Women were recruited from the Low Risk Prentice Ambulatory Care Clinic at Prentice Women's Hospital (PWH) in Chicago, an urban hospital-based clinic serving low-income women who are uninsured or receiving public aid. All participants in the intervention group gave written informed consent prior to enrollment. Participants for the intervention group were enrolled at their first or second prenatal visit. Inclusion criteria were: (1) pregnant women; (2) age >18 years old; (3) fluent in speaking and reading English; (4) 20 weeks gestational age or less at enrollment; (5) singleton pregnancy; (6) delivery at Prentice Women's Hospital. Exclusion criteria were: (1) BMI <19.8 (underweight); (2) complicated pregnancy including untreated thyroid disease, diabetes, or hypertension; and (3) unwillingness to participate in the study. Subjects were enrolled from October 2007 through October 2008 and followed through their 6-week postpartum visit.

Historical controls were obtained from all patients who, in the year prior to the intervention received routine prenatal care at Prentice Ambulatory Clinic and met all study inclusion criteria. The controls received standard prenatal care from the PAC clinic, which included (1) information

given to patients at their first prenatal visit by the intake registered nurse (general guidelines to gain 25–35 pounds, and a chart describing distribution of weight gain in pregnancy); (2) recording of weight in chart form at each visit by the RN; (3) unstructured/unmonitored provider advice by the residents. Participants in the intervention group received more structured and thorough education, counseling, and feedback. They received a packet of information including: (1) nutrition guidelines, (2) exercise guidelines, (3) a pamphlet with weight guidelines with self-goal planning and calculation of target gain, and (4) maternal and fetal risks of excess weight gain. All patients had routine history and physicals performed by their providers and otherwise routine obstetric care in the clinic. At subsequent follow up OB visits, weight gain trend was graphed on a standardized IOM weight gain graph in the chart.

Participants were provided feedback by viewing the graphed trend with the provider and noting if she was in or out of range. She was also provided feedback via a checklist in the chart used by the provider to address if she was meeting weight gain, nutrition, and exercise goals, and discussing potential complications of pregnancy if not meeting goals. A registered nurse or patient care technician in the clinic measured initial heights and weights at each visit. Measured weight at first visit is not necessarily equivalent to true pre-pregnancy weight, however these two weights (and thus BMIs), were highly correlated in our study population ( $R = 0.97$ ); we therefore refer to measured weight in all analyses, including calculation of early pregnancy BMI.

The primary outcome measure was the total weight gained over the course of prenatal care by patients in the intervention group, as compared to historical controls. Total weight gain was defined as the difference between measured weight at the last visit just prior to delivery and measured weight at the first visit. We also evaluated the percentage of women in each early pregnancy BMI group who gained weight exceeding IOM guidelines in the intervention group versus the control group.

The research team entered raw data responses into a password-protected Excel spreadsheet. These data were then imported into SPSS statistical package. Potential differences between the intervention and control groups were analyzed using  $X^2$ -tests for categorical and  $t$  tests for continuous variables. Pearson product-moment correlation coefficient was used to evaluate the association between reported pre-pregnancy weight and weight measured at first visit. Multivariate linear and logistic regression models were estimated to test the effect of the intervention on follow-up weight controlling for baseline weight, and early pregnancy BMI using SPSS Version 17. A  $P$  value of less than 0.05 was used to define statistical significance.

## Results

In this study, we analyzed 57 participants in the intervention group and 109 participants in the control group. Of the initial 72 patients initially enrolled, 15 were subsequently excluded: 4 patients did not meet initial enrollment criteria (one twin pregnancy, 2 underweight, one more than 20 weeks gestational age). Seven were lost to follow up after few visits and did not deliver at Prentice Women's Hospital, 3 became unwilling to participate after initial acceptance of enrollment, and one had few visits and delivered at 18 weeks gestational age with preterm premature rupture of membranes (PPROM). Of the intervention participants, 34 returned for their postpartum visit as scheduled.

No statistically significant difference was detected in demographic composition between the intervention and routine care groups in age, race/ethnicity, substance use (including tobacco, alcohol, and marijuana), gestational age at enrollment, early pregnancy BMI category, early pregnancy weight, and weeks observed over course of prenatal care. There were, however, significantly more nulliparous patients in the intervention group (Table 1).

Overall, participants in the intervention group and in the routine care group gained a similar amount of weight over the course of their prenatal care (mean value of 24, SD 13.5 lb, compared with a mean value of 25.3, SD 14.0 lb,  $P = 0.71$ ). After controlling for baseline weight, however, the women in the intervention group had a mean of 4.6 pounds lower follow-up weight as compared with control group women ( $P = 0.029$ ).

We also evaluated the percentage of women in each early pregnancy BMI group that who gained weight exceeding IOM guidelines in the intervention group versus the control group (Table 2). Across intervention and control groups, a lower percentage of women with a normal early pregnancy BMI gained weight above the IOM guidelines. In the overweight and obese early pregnancy BMI groups, a lower percentage of women who received the intervention gained weight beyond their recommendations, however these findings did not reach statistical significance ( $P = 0.19$  for overweight group,  $P = 0.16$  for obese group) in our study population.

After controlling for baseline BMI, through logistic regression analysis of the likelihood of out-of-range weight gain, participants who received the intervention were only 34% as likely to gain weight exceeding IOM guidelines ( $P = 0.009$ ). Compared to women with a normal early pregnancy BMI, women with an obese early pregnancy BMI were 9.7 times more likely to gain more than the recommended range. Women with an overweight BMI were 5.7 times more likely to gain more than the recommended range of weight over the course of pregnancy. Women of Hispanic ethnicity had an odds ratio of 8.34 of

**Table 1** Characteristics of intervention and control participants

	Intervention ( <i>N</i> = 57)	Routine care ( <i>N</i> = 109)	<i>P</i>
Age			0.18
≤21 y.o.	18 (31.6)	22 (20.2)	
22–34 y.o.	35 (61.4)	82 (75.2)	
≥35 y.o.	4 (7.0)	5 (4.6)	
Ethnicity			0.34
African American	32 (56.1)	62 (56.9)	
Hispanic	17 (29.8)	39 (35.8)	
White/other	8 (14.0)	8 (7.3)	
Substance use			0.35
None	52 (91.2)	94 (86.2)	
Use in pregnancy	5 (8.8)	15 (13.8)	
Parity			0.01
0	28(49.1)	31 (28.4)	
1 or more	29 (50.9)	78 (71.6)	
Gestational age at enrollment			0.12
<14 weeks	38 (66.7)	59 (54.1)	
14–20 weeks	19 (33.3)	50 (45.9)	
Early pregnancy BMI			0.96
Normal (19.8–26.0)	21 (36.8)	38 (34.9)	
Overweight (26.1–29.0)	12 (21.1)	23 (21.1)	
Obese (>29.0)	24 (42.1)	48 (44.0)	
Early pregnancy	168.1 ± 38.5	175.8 ± 51.9	0.32
Weeks observed in prenatal care	24.9 + 4.0	24.9 + 3.8	0.99

gaining weight exceeding IOM guidelines compared to white or other race participants.

## Discussion

In this study, we examined a low cost and practical intervention designed to decrease excessive weight gain during pregnancy in our study population: low-income women (uninsured or receiving public aid), predominantly of racial minority, and the majority overweight or obese, all of which are risks for increased weight gain in pregnancy [4–7, 13]. We developed educational materials for both patients and providers and encouraged consistent counseling and feedback for weight gain goals with graphs and checklists in the medical record. This standardized charting is important because at least one study showed that BMI is not calculable in 41% of charts, do to lack of height or weight documentation [12]. We included education about the risks of obesity in pregnancy to both mother and infant, as this is a counseling recommendation [4, 8] and has not been emphasized in prior intervention trials. Furthermore,

**Table 2** Adherence to IOM guidelines

	Intervention <i>N</i> = 57 <i>N</i> (%)		Routine care <i>N</i> = 109 <i>N</i> (%)	
	Within guidelines	Above guidelines	Within guidelines	Above guidelines
All BMI Categories	36 (63%)	21 (37%)	55 (50%)	54 (50%)
Early pregnancy BMI				
Normal	17/21 (81%)	4/21 (19%)	30/39 (80%)	9/39 (20%)
Overweight	7/11 (64%)	4/11 (36%)	9/22 (41%)	13/22 (59%)
Obese	12/25 (48%)	13/25 (52%)	16/48 (33%)	32/48 (67%)

an emphasis was made on improving provider counseling, as obstetricians do not consistently or adequately counsel patients on weight gain in pregnancy [3, 11].

Our intervention was associated with a lower 6 week postpartum weight when compared to historical controls, as well as a lower risk of gaining more weight than the recommended range in the IOM guidelines after controlling for other factors. Furthermore, a lower percentage of overweight and obese women who received the intervention gained more than IOM guidelines, although this was not statistically significant in our study population. Consistent with prior reports [4, 5, 9] we found that baseline weight was the most significantly predictive factor for increasing weight gain in pregnancy, and that women with overweight and obese early pregnancy BMIs had a significantly higher risk of gaining more than IOM guidelines. Additionally, it has been shown that women with overweight and obese early pregnancy BMIs are more likely to overestimate their target weight gain in pregnancy [10]. This seems to indicate that, at baseline, women with good habits for weight maintenance before pregnancy are more likely to continue them during pregnancy. As in at least one prior study [9], we found nulliparity to be significantly associated with increased pregnancy weight gain. Furthermore, we found Hispanic ethnicity was associated with increased pregnancy weight gain, although being African American was not, in comparison to the White/other racial group in our study. Along this line, prior research has indicated racial minorities to be at risk for postpartum weight retention [6], and the socioeconomic risk factor for maternal obesity has crossover with being a racial minority. Thus, women who seem to be most at risk for excess pregnancy weight gain and its associated complications are above normal weight at baseline, nulliparous, and of racial minority. This demographic, as represented by the majority of our study population, are most at need of consistent education and provider counseling.

Our study has several limitations. First, we used a non-randomized intervention with historical controls, potentially resulting in selection bias. Second, our intervention

results are limited by our small sample size, decreasing the power of our study to detect differences in weight gain between groups. Third, as we enrolled women up to 20 weeks gestational age, obtaining a pre-pregnancy weight (and thus pre-pregnancy BMI upon which counseling is directed) was difficult and based on patient self-report and potentially unreliable. We ultimately used presenting measured weight to determine weight gain calculations in our study, and despite its high correlation with reported pre-pregnancy weight in our population, we may not have accurately captured the true pre-pregnancy weight of the participants. Fourth, this study focused on women who had low risk pregnancies and who received care in an urban hospital based clinic serving low-income women who were uninsured or receiving public aid. As such, we are unable to generalize our results to the population of adult women who have insurance and are cared for by private obstetric practices. We also are unable to generalize our results to high-risk obstetric patients.

Despite these limitations, we believe this study has essential implications for health care delivery and future research. As other weight gain interventions have found, this intervention was associated with some reduction in weight gain during pregnancy at least for some women, which is critical in light of today's obesity epidemic [21]. Thus efforts made to improve education and counseling to pregnant women do have significant positive impact. Furthermore, as demonstrated by our study, the intervention can be as low cost as distributing educational pamphlets to patients and providers, and encouraging obstetricians to give consistent feedback counseling through simple additions to the medical record. Finally, with the dawn of the electronic medical record, reminder systems and weight trend graphs can easily be integrated into the electronic medical record to trigger providers to give the feedback and counseling that patients clearly benefit from and providers do not currently adequately provide.

These materials should be developed for women of various education levels and socioeconomic status, so as to reach women in populations most at risk for excess weight

gain and retention, such as our patient demographic. We also suggest further study of the inclusion of provider weight gain counseling triggers in the standard antenatal medical record, such as weight gain trend graphs and feedback checklists, to encourage routine weight gain counseling by all obstetric providers. A randomized controlled trial should be the next step in evaluation whether this intervention can be generalized. Our study, as well as prior intervention trials [21], demonstrates the utility of improving patient and provider education and counseling on maternal weight gain in pregnancy, and is a vital public health issue that demands attention amongst our country's obesity epidemic.

**Conflict of interest** The authors have nothing to disclose and no conflicts of interest.

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