

Body Mass Index, Provider Advice, and Target Gestational Weight Gain

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OBJECTIVE: To study the relationships among prepregnancy body mass index (BMI), women's target gestational weight gain, and provider weight gain advice.

METHODS: Project WISH, the acronym for Women and Infants Starting Healthy, is a longitudinal cohort study of pregnant women in the San Francisco Bay area. We excluded subjects with preterm birth, multiple gestation, or maternal diabetes.

RESULTS: Among overweight women (pregnancy BMI 26.1–29.0), 24.1% reported a target weight gain above the Institute of Medicine (IOM) guidelines, compared with 4.3% of normal weight women ($P < .001$). Among women with a low prepregnancy BMI (< 19.8), 51.2% reported a target weight gain below the guidelines, compared with 10.4% of normal weight women ($P < .001$). These patterns persisted in a multivariate analysis. Latina ethnicity, lower maternal education, low prepregnancy BMI (< 19.8), lack of provider advice about weight gain, and provider advice to gain below guidelines were all independently associated with a target weight gain below IOM guidelines. Prepregnancy BMI more than 26, multiparity, lower age, and provider advice to gain above guidelines were all associated with a target gain above IOM guidelines.

CONCLUSION: Women's beliefs about the proper amount of weight gain and provider recommendations for weight gain vary significantly by maternal prepregnancy BMI. Many women report incorrect advice about gestational weight gain, and women with high or low prepregnancy BMI are more likely to have an incorrect target weight gain. New approaches to provider education are needed to implement the IOM guidelines for gestational weight gain. (*Obstet Gynecol* 2005;105:633–8. © 2005 by The American College of Obstetricians and Gynecologists.)

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In 1990, the Institute of Medicine (IOM) issued guidelines for weight gain during pregnancy (Table 1).¹ These guidelines, which recommend an optimal weight gain range for women based on their prepregnancy body mass index (BMI), are widely endorsed by obstetric organizations in the United States and many other countries. The guidelines have been validated by several studies demonstrating that weight gain in accordance with the guidelines is associated with optimal birth weight and obstetric outcomes. Women gaining either above or below IOM guidelines have higher risks of many adverse outcomes.^{2–6} Several studies of U.S. women have found that 30% to 40% of women gain above or below the IOM guidelines, even after more than 10 years of their widespread use.^{7–9} Overweight women are more likely to gain above the guidelines, and underweight women are more likely to gain below the guidelines.⁹

The objective of our study was to measure the influence of prepregnancy BMI on women's target weight gain (the amount of weight a woman says she plans to gain) in a diverse cohort of pregnant women. Women at either extreme of prepregnancy BMI are likely to benefit the most from gaining within the IOM guidelines.¹ Ideally, women at BMI extremes would be advised by their prenatal care providers to target a weight gain within the guidelines. Underweight women should aim to gain relatively more weight, and overweight women should aim to gain relatively less, as recommended by the guidelines.

One might ask: why study women's target weight gain, when actual weight gain is the more clinically important outcome? Actual gestational weight gain is affected by multiple factors, including maternal energy balance (diet and exercise), placental function, and genetics. Some of these factors are not modifiable. A woman's target gain is potentially modifiable and has been shown to be strongly associated with her actual weight gain.⁹ The only large, published study of target weight gain in American women to date examined medically advised, target, and actual weight gain in a cohort of predomi-



Table 1. Institute of Medicine Recommendations for Weight Gain in Pregnancy¹

Initial Body Mass Index	IOM Recommended Gestational Weight Gain (lb/kg)
< 19.8 (low)	28–40/12.5–18
19.8–26.0 (normal)	25–35/11.5–16
26.1–29.0 (high)	15–25/7–11.5
> 29.0 (obese)	At least 15/At least 6*

IOM, Institute of Medicine.

* In our analyses, excessive weight gain for obese women was defined as greater than 25 lb (same as for the “high” body mass index category).

nantly white, middle-class women delivering more than 10 years ago.⁹ Because actual and medically advised weight gain were the primary outcomes in that study, the investigators did not report a multivariate analysis of predictors of target weight gain. We sought to examine the relationship between maternal prepregnancy BMI and target weight gain in a diverse, multiethnic group of women. Given the current obesity epidemic, we felt it was also worthwhile to reexamine target weight gain in a cohort of recent births. Our hypothesis was that women with a high prepregnancy BMI would be more likely to have a target gain above the IOM guidelines, and those with a low BMI would be more likely have a target gain below the guidelines. Our diverse cohort also allowed us to control for and evaluate the effects of maternal race and ethnicity on target weight gain.

MATERIALS AND METHODS

Project WISH, the acronym for Women and Infants Starting Healthy, is a longitudinal cohort study of pregnant women who received their prenatal care at a practice or clinic affiliated with one of 6 delivery hospitals in the San Francisco Bay area. The delivery sites were chosen to provide socioeconomic and ethnic diversity and included an urban public hospital, an urban community hospital, a university hospital, and 3 medical centers within a large group-model managed care organization. Women were eligible to participate in Project WISH if they 1) received prenatal care at one of the practices or clinics associated with these delivery hospitals and planned to deliver at one of these hospitals, 2) were at least 18 years old at the time of recruitment, 3) spoke English, Spanish, or Cantonese, 3) presented for prenatal care at one of the participating facilities before 16 weeks gestational age, and 4) could be contacted by telephone.

For purposes of this study, women were excluded if they had missing information on target weight gain or provider-advised weight gain, had multiple gestation pregnancies, gestational or pregestational diabetes, or if

they described their race and ethnicity as other than Asian, African American, Latina, or white.

Potentially eligible women were sent an informational letter explaining the study and requesting their participation. This mailing also included a prestamped, preaddressed “opt-out” postcard that a woman could return if she did not wish to be contacted. If no “opt-out” postcard was returned within 2 weeks of the mailing, the woman was contacted by telephone. When a woman was reached, verbal informed consent was obtained using a standard script. Women were enrolled between May 2001 and July 2002. The research protocol was reviewed and approved by the institutional review boards of the participating institutions.

Women who agreed to participate were asked to complete four telephone surveys: 1) before 20 weeks gestation, 2) 24 to 28 weeks, 3) 32 to 36 weeks, and 4) 8 to 12 weeks postpartum. In the first survey, the women were asked “How much weight do you think you should gain during this pregnancy?” The response to this question became our outcome variable for this study, the “target weight gain.” In the third survey, subjects were asked “Did a doctor, nurse, or nutrition counselor give you advice about how much weight you should gain during this pregnancy?” and “How many pounds were you told to gain from the beginning to the end of this pregnancy?” The response to this question became our variable “medically advised weight gain.” Target and medically advised weight gain were placed into categories that corresponded as closely as possible to the IOM guidelines. Because the IOM guidelines do not give an upper limit for women with prepregnancy BMI more than 29, we used 11.25 kg (25 lb) (the IOM upper limit for women of BMI 26–29) as the upper limit for obese women.

Bivariate and multivariate analyses were performed with target weight gain below or above the guidelines as the primary outcome variables. The logistic regression model included the following variables: site of delivery, maternal race or ethnicity, age, education, prepregnancy BMI, parity, and provider advice about weight gain. These variables were selected because they were significantly associated with target gain in the bivariate analyses and have been associated with gestational weight gain or target weight gain or both in other studies.

RESULTS

The number of women completing survey 3, with the questions about target and medically advised weight gain, was 1,460, and these women were eligible for this analysis. A total of 168 women were excluded because of missing information on target weight gain or provider-



Table 2. Description of Sample (N = 1,198)

Characteristic	%
Maternal race or ethnicity	
Asian	16.6
African American	16.6
Latina	29.1
White	37.7
Parity	
Nulliparous	45.8
Multiparous	54.2
Married or living with partner	
Yes	89.0
No	11.0
Prepregnancy body mass index	
Low	10.6
Normal	56.4
High	14.2
Obese	18.8
Provider advice	
Below guidelines	7.3
Within guidelines	48.7
Above guidelines	10.9
No advice	33.1
Maternal education	
Less than high school	11.1
High school graduate or some college	41.1
College graduate	47.7

Median age of the sample was 30 (range 18–45) years.

advised weight gain, 18 women were excluded for multiple gestation pregnancies, 72 were excluded for gestational or pregestational diabetes, and 4 were excluded because they described their race or ethnicity as other than Asian, African American, Latina, or white. The final sample size was 1,198. Descriptive data from the sample are shown in Table 2.

Bivariate analyses are displayed in Table 3. Four-fifths of women (78.9%) had a target gain within IOM guidelines, 11.9% had a target gain below, and 9.3% had a target gain above IOM guidelines. Prepregnancy BMI was strongly associated with women's target weight gain ($P < .001$, χ^2 test). Other factors associated with target weight gain in the unadjusted analyses were provider weight gain advice, parity, education, age, and race/ethnicity.

In the multivariate logistic regression (Table 4), maternal prepregnancy BMI was the strongest predictor of target weight gain. Women with low prepregnancy BMI were much more likely to report target gain below IOM guidelines compared with women with normal prepregnancy BMI. Women with high prepregnancy BMI were nearly four times more likely to report target weight gain above IOM guidelines, compared with women with low or normal prepregnancy BMI. Other statistically significant risk factors for low target gain in the multivariate analysis were Latina race or ethnicity, low educational

status, provider advice to gain below guidelines or lack of provider advice. For high target gain, statistically significant risk factors were lower age, multiparity, and provider advice to gain above the guidelines.

DISCUSSION

We found that prepregnancy BMI was the strongest predictor of maternal target weight gain outside the IOM guidelines in a diverse cohort of pregnant women. Women with low BMI had the highest risk for inadequate target weight gain. Conversely, women with high BMI had the highest risk for excessive target weight gain.

Women with less education or who reported provider advice to gain less than the guidelines were significantly more likely to have a target weight gain below the IOM guidelines. Research has shown that patients with poor health literacy have lower health knowledge, health status, and use of health services.¹⁰ Clinicians should pay special attention to patients with lower educational status with regard to weight gain and nutritional counseling. We also found that African-American and Latina women were more likely than white women to report a target weight gain below the IOM guidelines, even when controlling for educational status. More research is needed to examine potential cultural factors that may influence target weight gain.

There is scant literature regarding predictors of women's target weight gain. In a study of 2,237 predominantly white, middle-class women, Cogswell et al⁹ examined the relationship between medically advised weight gain, women's target weight gain, and actual weight gain. They found that 19% of women reported target gains less than the IOM guidelines and 22% reported gains higher than the guidelines. Only 59% of their subjects reported a target gain that was within the IOM guidelines, compared with 79.4% of our cohort. Based on the characteristics associated with appropriate target weight gain in our study (white race, higher educational status), one might expect that the cohort examined by Cogswell et al would have better compliance with IOM guidelines than our cohort. However, the women in the Cogswell cohort delivered in 1993, and the IOM guidelines were issued in 1990. It is possible that the guidelines are more widely applied, accepted, or both today than they were in 1993.

Limitations of our study include the fact that prepregnancy BMI was determined by self-report, particularly because overweight women tend to underestimate their body weight.^{11,12} If obese women were misclassified as normal weight, our findings would likely underestimate the relationship between BMI and target weight gain. With regard to medically advised weight gain, we did



Table 3. Target Maternal Weight Gain During Pregnancy—Unadjusted Rates (N=1198)

	n	Target Below Guidelines (n = 142)	Target Within Guidelines (n = 945)	Target Above Guidelines (n = 111)
Maternal race or ethnicity*				
Asian	199	16.1	77.9	6.0
African American	199	10.1	75.4	14.6
Latina	348	15.5	73.6	10.9
White	452	8.0	85.0	7.1
Parity*				
Nulliparous	584	12.2	82.1	5.7
Multiparous	649	11.6	76.1	12.3
Married or living with partner†				
Yes	1066	11.5	79.6	8.8
No	132	14.4	72.7	12.9
Prepregnancy body mass index*				
Low	127	51.2	46.5	2.4
Normal	676	10.4	85.4	4.3
High	170	0.6	75.3	24.1
Obese	225	2.7	80.4	16.9
Provider advice*				
Below guidelines	87	35.6	60.9	3.5
Within guidelines	584	9.8	84.8	5.5
Above guidelines	131	1.5	80.0	27.5
No advice	396	13.1	76.8	10.1
Maternal age (y)‡				
18–23	179	19.5	67.0	13.4
24–29	361	9.7	79.8	10.5
30–35	450	11.8	80.9	7.3
36–47	208	9.1	83.2	7.7
Maternal education*				
Less than high school	133	16.5	67.7	15.8
High school graduate or some college	493	14.4	74.7	10.9
College graduate	572	8.6	85.1	6.3

Values are percentages. Rows, not columns, in this table add up to 100%.

* $P < .001$ for χ^2 analysis.

† $P > .05$ for χ^2 analysis.

‡ $P < .05$ for χ^2 analysis.

not query providers, only pregnant women, and thus women may incorrectly recall how much weight they were advised to gain. Another limitation of our study is that it was limited to California. However, the racial, ethnic, and socioeconomic diversity of our cohort may mean that our findings are applicable to the broader U.S. population.

It is possible that completing the survey caused the subjects to pay closer attention to weight gain guidelines than they would have otherwise, although weight gain was not the focus of the survey. If that is the case, our findings may underestimate the degree to which women reported inappropriate target weight gain.

Our study also is limited in that only patients, not providers, were surveyed about provider advice. Most studies of provider advice during prenatal care use patient reports.^{9,13,14} One study of smoking cessation advice over a 2-year period found that 68% of provider-patient dyads agreed about advice given (this study was in a community clinic and did not study pregnant sub-

jects).¹⁵ We could find no such data about gestational weight gain advice, but because the Project WISH surveys were done closer to the time when the advice was given, we might expect a higher rate of agreement than the 68% reported in the smoking study. Future research should also survey providers to find out whether they are giving patients correct advice about gestational weight gain and should examine the correlation between provider advice and patient recall of such advice.

Although the Project WISH survey did not question providers, there is a strong suggestion from our findings that prenatal care providers are not following the IOM guidelines when they advise patients. Whereas 87% of women with normal prepregnancy BMI reported advice to gain an appropriate amount of weight, 50% of high-BMI subjects reported advice to overgain, and 35% of low-BMI subjects reported advice to undergain ($P < .001$, χ^2 test comparing BMI categories, excluding women who reported no weight gain advice). Cogswell et al⁹ also found an association between BMI and ad-



Table 4. Predictors of Target Weight Gain Outside Institute of Medicine Guidelines

Variable	Adjusted OR* for Target Gain Below Guidelines (95% CI)	Adjusted OR* for Target Gain Above Guidelines (95% CI)
Maternal race or ethnicity		
Asian	1.47 (0.79–2.72)	0.83 (0.40–1.72)
African American	2.09 (0.97–5.0)	1.12 (0.59–2.213)
Latina	3.18 (1.62–3.23) [†]	0.69 (0.36–1.33)
White	Reference	Reference
Age (continuous)	1.01 (0.96–1.06)	0.95 (0.91–0.99) [†]
Education		
Less than high school graduate	2.42 (1.04–5.65) [†]	1.79 (0.80–3.99)
High school graduate or some college	2.37 (1.33–4.23) [†]	1.04 (0.58–1.87)
College graduate or higher	Reference	Reference
Prepregnancy body mass index		
Low	12.63 (7.40–21.54) [†]	
Normal	Reference	Reference [‡]
Overweight	0.05 (0.01–0.34) [†]	3.79 (2.15–6.66) [†]
Obese	0.18 (0.07–0.44) [†]	2.39 (1.34–4.27) [†]
Parity		
Nulliparous	0.86 (0.53–1.40)	0.38 (0.23–0.65) [†]
Multiparous	Reference	Reference
Provider advice		
Within guidelines	Reference	Reference
Below guidelines	3.17 (1.70–5.92) [†]	0.52 (0.12–2.30)
Above guidelines	0.52 (0.11–2.48)	3.39 (1.89–6.08) [†]
No advice	1.72 (1.06–2.78) [†]	1.49 (0.88–2.50)

OR, odds ratio; CI, confidence interval.

* Adjusted for all variables listed in table, plus site of delivery.

† Statistically significant result.

‡ Reference group includes both low and normal body mass index subjects.

vised weight gain: in their study; women with a high prepregnancy BMI had an adjusted odds ratio of 31.8 (95% confidence interval 21.2–47.7) for receiving advice to gain above the IOM guidelines. The percentage of women who reported receiving no weight gain advice from their prenatal care provider was similar in the 2 studies: 27% in the Cogswell study and 33% in our cohort. Why might providers fail to adhere to weight gain guidelines when advising patients? Cabana et al¹⁶ described barriers to guideline adherence, including lack of awareness, familiarity, and agreement with guidelines. Optimal gestational weight gain remains controversial, and some clinicians may disagree with the guidelines.¹⁷ However, because women of higher BMI were more likely to receive advice to overgain, and women of lower BMI were more likely to be advised to undergain, this suggests that some providers are not aware of the BMI-specific weight gain guidelines and are advising all women to gain within the same range. In both our study and the Cogswell article, high prepregnancy BMI (BMI of 26.1–29.0) was a stronger predictor of inappropriate target and advised weight gain than women who had very high or obese prepregnancy BMI (BMI > 29). This finding suggests that clinicians and patients are likely to reduce their weight gain goals according to IOM guide-

lines when there is obvious obesity, but that more moderate degrees of overweight may be overlooked. Greater public health efforts should be made to educate providers and the public about BMI-appropriate weight gain in pregnancy, particularly for women of moderately high or low prepregnancy BMI.

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