Prevalence and Predictors of Unhealthy Weight Gain in Pregnancy

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ABSTRACT

Importance: Weight gain during pregnancy affects obesity risk in offspring.

Objective: To assess weight gain among UW Health prenatal patients and to identify predictors of unhealthy gestational weight gain.

Methods: Retrospective cohort study of women delivering at UW Health during 2007-2012. Data are from the UW eHealth Public Health Information Exchange (PHINEX) project. The proportion of women with excess and insufficient (ie, unhealthy) gestational weight gain was computed based on 2009 Institute of Medicine guidelines. Multivariable logistic regression was used to identify risk factors associated with excess and insufficient gestational weight gain.

Results: Gestational weight gain of 7,385 women was analyzed. Fewer than 30% of prenatal patients gained weight in accordance with Institute of Medicine guidelines. Over 50% of women gained excess weight and 20% gained insufficient weight during pregnancy. Pre-pregnancy weight and smoking status predicted excess weight gain. Maternal age, race/ethnicity, smoking status, and having Medicaid insurance predicted insufficient weight gain.

Conclusions and Relevance: Unhealthy weight gain during pregnancy is the norm for Wisconsin women. Clinical and community interventions that promote healthy weight gain during pregnancy will not only improve the health of mothers, but also will reduce the risk of obesity in the next generation.

INTRODUCTION

Unhealthy weight gain during pregnancy creates health problems for both mother and child, including incident maternal obesity,[1] pediatric obesity,[2] and lifelong elevated cardiovascular and metabolic risk for mother and child.[3] The health risks associated with unhealthy weight gain during pregnancy are in addition to the risks posed by pre-pregnancy weight status, which are detailed elsewhere.[4,5] The current Institute of Medicine (IOM) guidelines attempt to balance the competing risks of insufficient versus excess weight gain during pregnancy and are tailored to reflect the different metabolic needs and risk profiles of women based on pre-pregnancy body mass index (BMI) and fetal number.[3] Fewer than half of pregnant women in the United States currently achieve a healthy gestational weight gain within IOM recommendations.[3,6]

The social ecological model provides a framework for understanding why so few women gain weight within IOM guidelines. It emphasizes that health outcomes are not solely the result of individual characteristics and behaviors, but also the various environments in which people work, live, play, and develop.[7] The model has been employed extensively and successfully in obesity prevention and health promotion research, yet individual- and community-level determinants of gestational weight gain are not well understood. Previous research suggests that gestational weight gain is patterned on demographic characteristics such as race and education.[8-10] A few studies have examined associations with individual-level psychological factors such as stress,[11,12] and behavioral factors such as diet and exercise.[13,14] However, little attention has been paid to environmental contexts that promote or inhibit healthy gestational weight gain. This study addresses this gap by identifying predictors of gestational weight gain across multiple levels of the social ecological model.

The purpose of this study was to use electronic health record data to evaluate the current prevalence of insufficient and excess (ie, unhealthy) gestational weight gain among pregnant women who received care in a large, statewide health system in the Midwest during 2007-2012. The study also connected clinical data about pregnancy-related weight gain to patient-, provider-,

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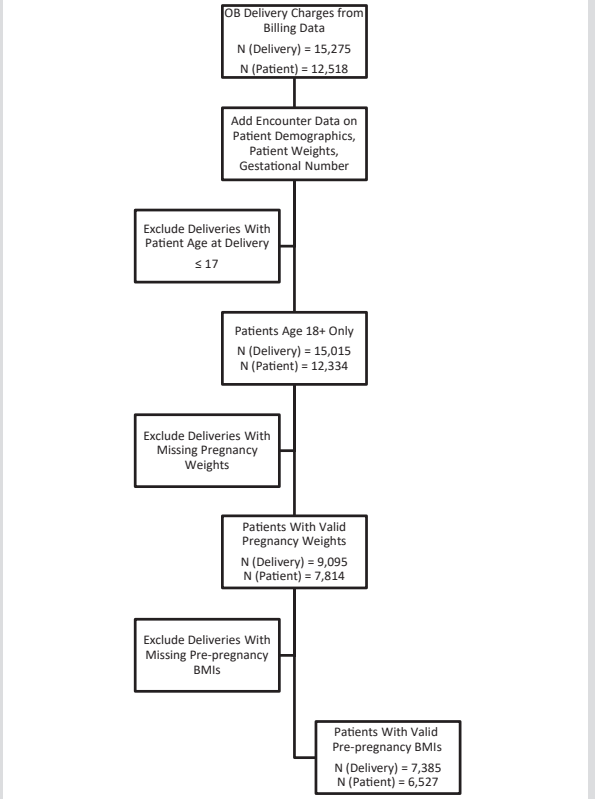
Figure 1. Sample Selection



and community-level data to describe multiple determinants that contribute to risk for insufficient and excess gestational weight gain.

METHODS

Data Source—Data are from the UW eHealth Public Health Information Exchange (PHINEX), which combines patient- and clinic-level data from UW Health electronic health records with community-level data from commercially available datasets, eg, US Census data. The resulting dataset contains information on over 11 million encounters with more than 500,000 patients during 2007-2012. The study was reviewed and approved by the University of Wisconsin–Madison Health Sciences Institutional Review Board.

Participants—Billing data identified 15,275 deliveries to 12,518 patients. Participants were excluded from this analysis if the patient was a minor, if they had no recorded pre-pregnancy BMI, or if they had no recorded pregnancy weights (Figure 1). Our final analytic sample comprised 7,385 deliveries to 6,527 patients. Sample characteristics are in Table 1.

Measures—The primary outcome—gestational weight gain—was calculated as the last weight prior to delivery (within 8 weeks of delivery) minus the pre-pregnancy weight. If pre-pregnancy weight was missing, it was imputed from the most recent ambulatory visit up to 12 months prior to the patient's last menstrual period (so long as the weight did not overlap with a previous pregnancy). Gestational weight gain was classified as insufficient, ideal, or excess based on the patient's pre-pregnancy BMI, gestational number, and IOM guidelines.[3]

Independent variables included age, race/ethnicity, pre-pregnancy BMI, gestational number, smoking status, payor, neighborhood median income, neighborhood economic hardship index, and neighborhood urbanicity. Age was defined as the patient's age at delivery. Race/ethnicity was classified as non-Hispanic white, non-Hispanic black, Hispanic, or non-Hispanic other. Pre-pregnancy BMI was classified as underweight (BMI < 18.5), normal weight (BMI 18.5-24.9), overweight (BMI 25.0-29.9), Class I obesity (BMI 30.0-34.9), Class II obesity (BMI 35.0-39.9), or Class III obesity (BMI > 40.0). Smoking status was classified as never, current, former, or passive. Payor was classified as commercial, Medicaid/Medicare, or no insurance. Neighborhood median income was classified as < $50,000, $50,000 to $75,000, or > $75,000. Neighborhood economic hardship was based on an economic hardship index comprising variables such as unemployment, crowded housing, percentage of households below the poverty line, and percentage of households with less than a high school education.[15] For the purpose of this analysis, neighborhood economic hardship was classified as low hardship (Index < 20), moderate hardship (Index 20-30), or high hardship (Index > 30). Neighborhood urbanicity was classified as urban, suburban, or rural using the Esri Tapestry classification method for Census Block Groups.[16]

Data Analyses

The proportion of patients with insufficient, ideal, and excess gestational weight gain was computed. Then multivariable logistic regression analyses were conducted to identify predictors of insufficient and excess gestational weight gain. Separate regression models were run predicting insufficient gestational weight gain and excess gestational weight gain. Each regression model used a stepwise forward selection procedure based on Fischer's scoring optimization to select from our candidate predictors all that independently predicted gestational weight gain.[17]

RESULTS

Approximately half of the 7,385 deliveries between 2007 and 2012 were to women who were overweight or obese at the time of conception (Table 1). Pre-pregnancy BMIs ranged from 14.7 to 82.1. Less than half (48.1%) of the sample was normal weight at conception, with 2.0% underweight, 26.5% overweight, 13.2% Class I obese, 5.8% Class II obese, and 4.3% Class III obese.

Mean gestational weight gain was 30.5 pounds (SD = 13.7), but there was substantial variation (range: 52 pounds lost to 135

pounds gained). Gestational weight gain varied by pre-pregnancy BMI, such that patients who began pregnancy at lower BMIs tended to gain more weight than those who began pregnancy at higher BMIs (Table 2). Overall, 19.8% of the sample gained insufficient weight, 29.5% gained ideal weight, and 50.8% gained excess weight during pregnancy. The prevalence of insufficient, ideal, and excess weight differed significantly by pre-pregnancy BMI, $P < .0001$. Based on the more restrictive guidelines for overweight and obese women, these groups actually were more likely to exceed target weight gain recommendations (Figure 2) despite having gained less weight on average than those who were underweight or normal weight before pregnancy (Table 2). Overweight and obese women were particularly likely to gain excess weight, with 65.5% of overweight women and 65.6% of Class I obese women gaining excess weight, compared to 50.8% of Class II obese, 42.8% of Class III obese, 40.2% of normal weight, and 22.2% of underweight women gaining excess weight, respectively. In contrast, women at either extreme of BMI were most likely to gain insufficient weight, with 36.9% of underweight women and 37.5% of Class III obese women gaining insufficient weight, compared to 22.7% of normal weight, 12.2% of overweight, 13.8% of Class I obese, and 25.5% of Class II obese women gaining insufficient weight.

Results of the multivariable logistic regression analyses are summarized in Figure 3. The effect of pre-pregnancy BMI on the risk of insufficient and excess gestational weight gain remained robust after controlling for the other predictors. In addition, age, gestational number, smoking status, payor, and neighborhood economic hardship uniquely contribute to the likelihood that a woman will gain insufficient or excess weight during pregnancy. Factors that increased risk for excess weight gain included maternal age 20-29; non-Hispanic white race/ethnicity; overweight, Class I or Class II obesity prior to pregnancy; single fetus (vs twins); past smoking; commercial insurance; and living in a neighborhood with low economic hardship. Factors that increased risk for insufficient weight gain included maternal age > 40, non-Hispanic black or other race/ethnicity, underweight or Class III obesity prior to pregnancy, multiple gestation, current smoking, Medicaid insurance, and living in a neighborhood with high economic hardship.

Table 1. Clinical, Demographic, and Community-Level Characteristics of the UW eHealth Public Health Information Exchange (PHINEX) Analytic Sample

Patient-Level Characteristics	N	%
Age		
18-19	196	2.7
20-24	909	12.3
25-29	2275	30.8
30-34	2671	36.2
35-39	1112	15.1
40+	222	3.0
Race/Ethnicity		
Non-Hispanic white	5758	81.8
Non-Hispanic black	423	6.0
Hispanic	367	5.2
Non-Hispanic other	491	7.0
Pre-pregnancy BMI		
Underweight	149	2.0
Normal weight	3549	48.1
Overweight	1959	26.5
Class I Obese	977	13.2
Class II Obese	431	5.8
Class III Obese	320	4.3
Multiple Gestation		
No	7285	98.7
Yes	100	1.4
Smoking		
Never	4736	64.1
Former	2056	27.8
Current	519	7.0
Passive	73	1.0
Payor		
Commercial	5930	80.3
Medicare/Medicaid	1388	18.8
No Insurance	67	0.9
Community-Level Characteristics		
Median Income		
< $50,000	1275	18.1
$50,000-$75,000	3598	51.0
> $75,000	2179	30.9
Economic Hardship		
Low	507	7.2
Moderate	5971	84.7
High	576	8.2
Urbanicity		
Urban	2370	33.6
Suburban	3669	52.0
Rural	1013	14.4

Abbreviation: BMI, body mass index.

DISCUSSION

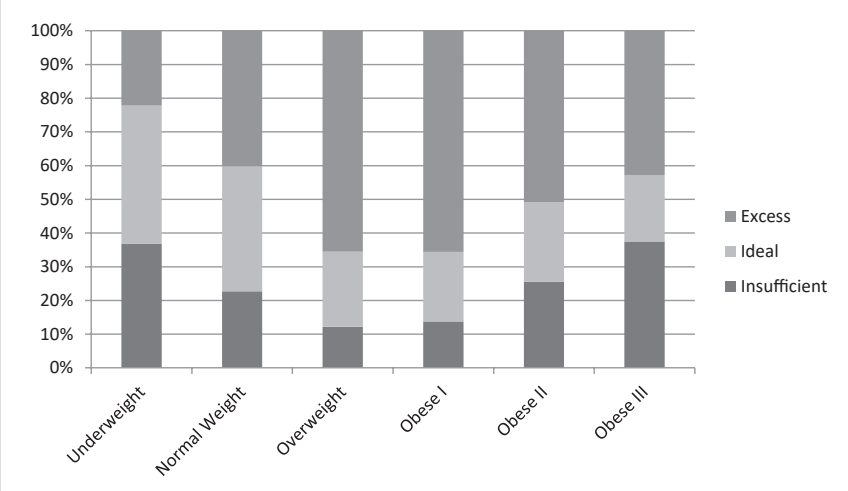
Our finding that 2 out of 3 obstetric patients in this regional, population-based sample gained an unhealthy amount of weight during pregnancy is consistent with other US samples.[18,19] Predictors of excess and insufficient gestational weight gain included both individual- and community-level risk factors.

Like previous studies,[6,19] we found that women who began pregnancy overweight and obese were at greater risk for excess gestational weight gain compared to normal weight women. A novel contribution of this study is that our large sample allowed us to disaggregate risk estimates by obesity severity. Women who began pregnancy with Class II or III obesity had lower risk for excess weight gain than with Class I obesity. This trend suggests that providers and patients may already be attempting to manage weight gain in response to severe obesity, and perhaps these women were being advised to gain less than guidelines, as some new evidence supports.[20]

Table 2. Gestational Weight Gain (in Pounds) by Pre-pregnancy Body Mass Index

	n	Minimum	Maximum	Mean ± SD	Guideline[3]
Underweight	149	5.0	90.0	33.0 ± 11.7	28-40
Normal weight	3549	-14.5	130.5	33.4 ± 11.7	25-35
Overweight	1959	-17.0	134.5	31.2 ± 14.4	15-25
Obese Class I	977	-34.0	132.4	26.7 ± 15.9	11-20
Obese Class II	431	-52.0	79.2	21.1 ± 16.9	11-20
Obese Class III	320	-29.4	86.2	17.6 ± 17.6	11-20
Overall	7385	-52.0	134.5	30.5 ± 13.7	

Figure 2. Prevalence of Insufficient, Ideal, and Excess Gestational Weight Gain by Pre-pregnancy Body Mass Index



Previous research on the link between smoking and gestational weight gain has been inconsistent.[9,12,19] Our findings clarify that former smokers are at increased risk for excess gestational weight gain and current smokers are at increased risk for insufficient weight gain, relative to people who have never smoked.

Racial/ethnic disparities in patterns of gestational weight gain have been demonstrated previously, but with different patterns in different communities.[21,22] In this region, ethnic minority women are at elevated risk for insufficient weight gain rather than excess weight gain. This finding may partially explain regional disparities in preterm birth and adverse birth outcomes.[23]

Our findings regarding risk patterns across age groups likely reflect the strong association between maternal age and parity. Women over age 40 are at greater risk for insufficient weight gain than younger women, whereas women ages 20-29 had greater risk for excess weight gain. This trend is consistent with evidence that women gain more weight with their first baby and less for each subsequent pregnancy.[18]

Most previous studies examining predictors of gestational weight gain were limited to singleton pregnancies. A novel finding of this study is that that women carrying a single fetus were more likely to gain excess weight but less likely to gain insufficient weight than those carrying twins. One possible explanation is that women carrying multiples may be receiving more or better guidance about nutrition and weight gain in pregnancy. Nonetheless, the elevated risk for insufficient weight gain among twin pregnancies is notable, given that insufficient weight gain has been associated with shorter gestations and lower twin birth weights.[3]

Previous studies were inconsistent about the link between socioeconomic status and gestational weight gain.[8,10,13] In this study, we found that both individual-level and neighborhood-level economic indicators independently predicted weight gain, even after controlling for race, pre-pregnancy BMI, and other confounding factors. Specifically, low socioeconomic status increased risk for insufficient weight gain, whereas high socioeconomic status increased risk for excess weight gain.

These findings should be considered in light of some limitations, which suggest questions for further research. First, the volume of missing data in this sample may raise concerns about selection bias. However, a recent validation study in the same sample showed obesity risk gradients similar to National Health and Nutrition Examination Study (NHANES), a national gold standard.[24] A second limitation is the racial homogeneity of this sample, with a large majority consisting of non-Hispanic white patients. We are confident that these data are representative of the health system and the region, but some findings may not generalize to other populations in other regions or other countries with greater diversity. Moreover, these limitations are outweighed by the many assets of this data source, eg, the inclusion of community-level data, the substantial sample size, and the utility of electronic health record data for surveillance of this large, population-based, low-risk cohort.

This study demonstrates that clinical, sociodemographic, and community-level factors converge to predict weight gain during pregnancy. Combined with the high prevalence of unhealthy weight gain during pregnancy, this suggests the need for multilevel, multicomponent intervention strategies, including both clinical and community strategies to promote healthy weight gain in women,[25-27] thereby curbing obesity risk of the next generation.

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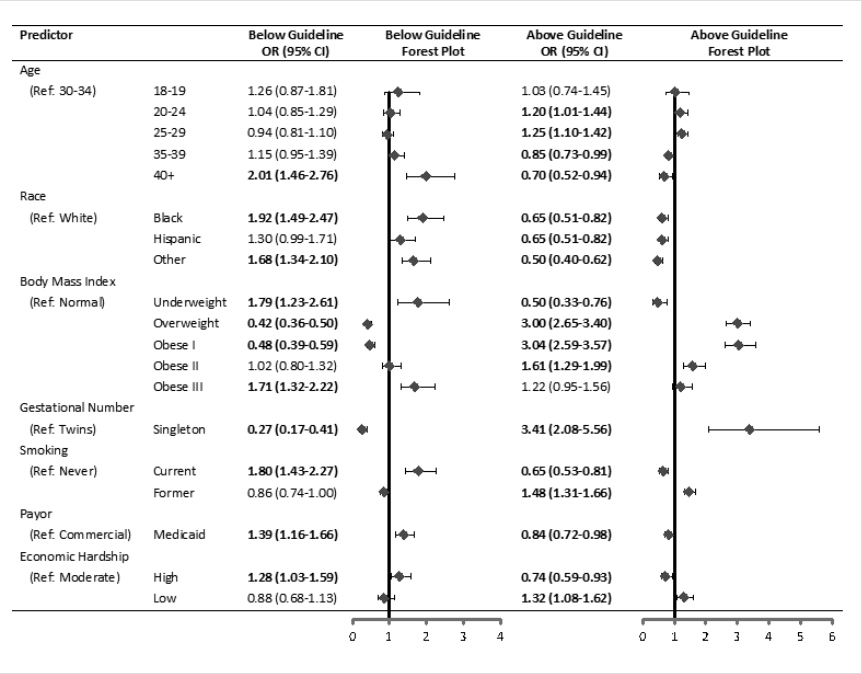
Figure 3. Adjusted Odds of Unhealthy Gestational Weight Gain (ie, Above or Below Guidelines), Based on Multivariable Regression Analyses



Boldface text denotes $P < .05$.

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