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The Association of Maternal Obesity and Race with Pregnancy Weight Gain and Small for Gestational Age Infant Birth: The Effect of Prenatal Care

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Abstract

Objective: To examine the association of maternal obesity, race/ethnicity, and prenatal care on high gestational weight gain (GWG) and small for gestational age (SGA) infant birth.

Methods: This was a retrospective cohort study of births included in the PRAMS Phase 8 dataset (2016-2017). The study population was 53,893 non-diabetic women with a singleton in-hospital birth between 37 and 42 weeks gestational age.

Results: Only obese non-Hispanic white and Hispanic women showed a consistent decrease in adjusted odds of high GWG as prenatal care visit category increased. Only non-Hispanic white women showed a lower increase in adjusted odds of an SGA infant birth with more compared to intermediate prenatal care.

Conclusions: The effectiveness of prenatal care in reducing high GWG varies by race for women with a BMI outside a healthy range. More prenatal care did not reduce SGA infant births amongst overweight or obese women.

Policy implications: Interventions to improve prenatal care delivery for overweight or obese women should consider race.

Abbreviations and Acronyms

BMI – Body Mass Index
CDC- Centers for Disease Control and Prevention
GWG – Gestational Weight Gain
PRAMs - Pregnancy Risk Assessment Monitoring System
SGA – Small for Gestational Age

Introduction

Recommendations for appropriate weight gain during pregnancy were established in 2009 by the Institute of Medicine and endorsed by the American College of Obstetricians and Gynecologists.[1,2] Nevertheless, a large number of women gain more than recommended weight. This is particularly true for women with high pre-pregnancy body mass index (BMI).[3] High gestational weight gain (GWG) places the mother at risk for preeclampsia, gestational diabetes, and cesarean section.[4] For the infant, adverse outcomes include abnormal birth weight for gestational age, and longer infant hospital stay.[5,6]

Prenatal care provides pregnant women with education designed to reduce adverse pregnancy outcomes. High GWG is a potentially modifiable pregnancy risk factor. Current prenatal care practice recommends diet and exercise during pregnancy and trained lifestyle coaching to limit GWG.[7]

The prevalence of overweight and obesity is higher in Hispanic and non-Hispanic black women than in non-Hispanic white women.[8] Participation in prenatal care also varies by race: black women are more likely to be inadequate users of prenatal care services.[9] How race and maternal weight associate to predict risk for high GWG has not been fully determined.

The Pregnancy Risk Assessment Monitoring System (PRAMS) is a Centers for Disease Control and Prevention (CDC) surveillance project evaluating pregnancy and birth outcomes. We used the PRAMS Phase 8 dataset (2016-2017), to examine the association of maternal obesity, race/ethnicity, and prenatal care on GWG and small for gestational age (SGA) infant birth. We hypothesized that prenatal care would decrease excessive GWG and SGA infant births for all overweight and obese women and would be most significant for non-Hispanic white women.

Methods

Data Source: We performed a retrospective cohort study using the CDC PRAMS Phase 8 dataset (2016-2017). The population was non-diabetic women with a singleton in-hospital birth between 37 and 42 weeks gestational age. The University of Vermont Institutional Review Board has reviewed this project and determined that it qualifies as exempt from additional review.

Dependent variables: Gestational weight gain (GWG) was defined as low, as recommended, or high based on Institute of Medicine guidelines.[1] Small for gestational age (SGA) was defined as birth weight below the 10^{th} percentile for gestational age by sex.

Independent variables: Body Mass Index (BMI) was calculated using maternal pre-pregnancy height and weight and categorized as underweight (< 18.5), healthy weight (18.5-24.9), overweight (25-29.9) and obese ($\geq$ 30). Race was categorized as non-Hispanic white, non-Hispanic black, Hispanic and other.

Covariates: Several variables were analyzed with more than two categories. These variables included prenatal care (low: 8 or fewer visits, intermediate: 9-11 visits, high: 12 or more visits), maternal age (<20, 20-24, 25-29, 30-34, 35-39, >40 years), pregnancy intention (then/sooner, later/unsure, did not want), region (Northeast, South, Midwest, West, Puerto Rico), maternal insurance status during pregnancy (no insurance, Medicaid/government coverage, private insurance), and income (< $15,000, $15,000 – 29,999, $30,000 – 44,999, $45,000 – 59,999, $60,000 – 74,999, $75,000 – 89,999, >$90,000). The remaining analyzed variables were dichotomous: Women, Infants, and Children (WIC) (yes/no), marital status (married/other), and any maternal smoking (yes/no).

Data Analysis: We performed multivariable logistic regression analysis using SPSS. Adjusted odds ratios and 95% confidence intervals were calculated for the dependent variables and stratified by prenatal care category.

Results

PRAMS Phase 8 questionnaires were completed by 74,543 women. Of these, 5,343 were diabetic, 1,115 gave birth out of the hospital, 4,099 had a multiple birth, and 10,093 gave birth to a preterm or post-term infant. Thus, there were 53,893 questionnaires for analysis (supplemental file; Figure 1). Multivariable logistic regression analysis evaluated questionnaires with complete data for regressed variables.

The study population was 46.9% non-Hispanic white, 18.1% non-Hispanic black, 17.8% Hispanic, and 15.5% other race from the Northeast (35.1%), Midwest (24.2%), West (21.5%), South (18.0%), and Puerto Rico (1.2%). The majority were 20-29 years of age (50.3%); married (59.1%); non-smokers (91.7%); and did not receive WIC (58.7%). Of the population, 48.9% had private insurance; 48.7% had Medicaid/government coverage (supplemental file; Table 2).

Adjusted odds ratios (AOR) and 95% confidence intervals (CI) of high GWG and SGA infant birth are presented by race and BMI, and stratified by prenatal care category, in Table 1. Overweight women of all races in all prenatal care categories had high GWG. Compared with intermediate prenatal care, more prenatal care reduced adjusted odds of high GWG for obese non-Hispanic white women [AOR=2.34, 95% CI (2.13-2.58); AOR= 2.70, 95% CI (2.37-3.09)] and Hispanic women [AOR=2.57, 95% CI (2.13-3.10); AOR = 2.99 95% CI (2.38-3.76)].

For all races of overweight and obese women with low prenatal care, adjusted odds of an SGA birth were not significant. With intermediate and high prenatal care, adjusted odds of SGA birth were increased for obese non-Hispanic white women [AOR=1.36, 95% CI (1.08-1.72); AOR=-1.38, 95% CI (1.14-1.67)]. For overweight non-Hispanic white women, SGA infant births were increased but trended lower from intermediate to high prenatal care [AOR=1.52, 95% CI (1.22-1.90); AOR=1.21, 95% CI (1.10-1.44)].

Underweight women in all race and prenatal care categories had lower adjusted odds of high GWG. Compared with intermediate prenatal care, more prenatal care reduced adjusted odds of SGA infant birth for underweight non-Hispanic whites [AOR=0.45, 95% CI (0.33-0.62); AOR=0.35, 95% CI (0.27-0.46)] and Hispanics [AOR=0.68, 95% CI (0.19-0.69); AOR=0.31, 95% CI (0.18-0.53)].

Discussion

Our large, population-based study of US women provides generalizable findings on the race specific effectiveness of prenatal care for GWG and SGA birth for women with a BMI outside a healthy range. This study also adds to the literature describing how adverse pregnancy outcomes vary when race and obesity are combined.[6]

When compared to women with healthy BMI, overweight and obese women of all race categories and all prenatal care categories had higher odds of high GWG. However, only obese non-Hispanic white and Hispanic women showed a decrease in high GWG with an increase in prenatal care visits. This suggests the impact of prenatal care varied by race for obese women and had no effect on GWG for overweight women regardless of race.

For obese women of all races, more prenatal care was not associated with trending lower adjusted odds of an SGA birth. For overweight women, more prenatal care was associated with a lower increase in adjusted odds of an SGA birth only for non-Hispanic white women, again showing varying association by race.

For underweight women of all races, all prenatal care categories were associated with lower adjusted odds of high GWG. Among underweight women who had 12 or more prenatal visits, all races except “other” were less likely to have an SGA infant birth. Whether GWG was low or appropriate for underweight women needs further evaluation.

Our study is limited by systemic biases in the PRAMS survey, missing data and issues with data categorization. We attempted to mitigate missing data issues by selecting only mothers for whom complete data for dependent and independent variables were available. Still, data on confounding variables could be missing from this selected population. The potential for recall bias during completion of the survey is likely. Finally, post survey categorization of variables may have had an impact on results. For example, mixed race is poorly accounted.

Public Health Implications

Our study reflects the variable effectiveness of prenatal care by race for women with a BMI outside a range considered healthy. Interventions to improve prenatal care for overweight or obese women should consider race.[10]

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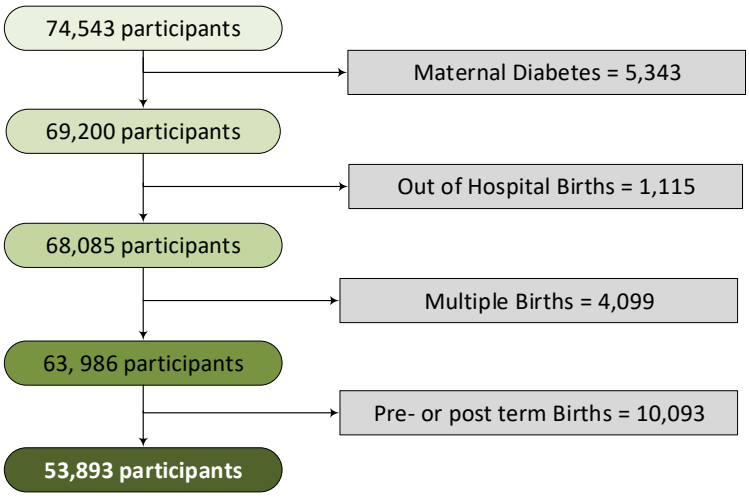
Table 1. Adjusted odds ratios (95% CIs) comparing outcomes by maternal BMI and race stratified by prenatal care.

		8 or fewer Prenatal Care Visits				9-11 Prenatal Care Visits				12 or more Prenatal Care Visits			
OUTCOME	MATERNAL BMI	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other
High GWG	Underweight	0.39 (0.24-0.64)	0.32 (0.14-0.71)	0.45 (0.20-1.03)	0.56 (0.27-1.13)	0.45 (0.33-0.62)	0.36 (0.19-0.69)	0.68 (0.37-1.23)	0.32 (0.19-0.54)	0.35 (0.27-0.46)	0.41 (0.25-0.68)	0.31 (0.18-0.53)	0.37 (0.24-0.57)
	Healthy	REFERENCE				REFERENCE				REFERENCE			
	Overweight	3.40 (2.79-4.21)	2.38 (1.80-3.14)	3.46 (2.56-4.69)	3.15 (2.38-4.17)	3.51 (3.09-3.98)	2.65 (2.13-3.30)	3.71 (2.96-4.65)	3.36 (2.68-4.21)	3.33 (3.03-3.65)	2.87 (2.40-3.43)	2.40 (2.01-2.87)	2.74 (2.27-3.31)
	Obese	2.95 (2.38-3.66)	2.28 (1.76-3.00)	3.69 (2.65-5.13)	3.09 (2.25-4.25)	2.70 (2.37-3.09)	2.06 (1.68-2.55)	2.99 (2.38-3.76)	3.25 (2.55-4.16)	2.34 (2.13-2.58)	2.10 (1.78-2.48)	2.57 (2.13-3.10)	2.59 (2.11-3.16)
SGA	Underweight	0.40 (0.26-0.63)	0.61 (0.30-1.25)	0.51 (0.24-1.07)	0.74 (0.33-1.68)	1.01 (0.67-1.50)	0.59 (0.31-1.13)	1.64 (0.48-2.36)	0.36 (0.21-0.62)	0.40 (0.36-0.67)	0.50 (0.26-0.96)	0.75 (0.38-1.47)	0.67 (0.36-1.24)
	Healthy	REFERENCE				REFERENCE				REFERENCE			
	Overweight	1.17 (0.85-1.62)	1.30 (0.86-1.97)	0.91 (0.57-1.45)	1.45 (0.87-2.44)	1.52 (1.22-1.90)	1.24 (0.87-1.78)	1.64 (1.11-2.43)	1.01 (0.66-1.55)	1.21 (1.10-1.44)	1.03 (0.73-1.47)	1.13 (0.80-1.60)	1.19 (0.78-1.82)
	Obese	1.09 (0.80-1.50)	1.51 (1.00-2.29)	1.15 (0.84-1.86)	2.98 (1.37-6.45)	1.36 (1.08-1.72)	1.43 (1.00-2.03)	1.17 (0.81-1.69)	0.95 (0.59-1.54)	1.38 (1.14-1.67)	1.10 (0.79-1.54)	0..98 (0.69-1.39)	1.32 (0.82-2.11)

Supplemental File

Figure 1. Derivation of the study sample.



Supplemental File

Table 2. Maternal Demographics and Characteristics

Maternal Age (years)	**Frequency**	**Percent**
< 20	2,931 / 53,891	5.4%
20-29	27,109 / 53,891	50.3%
30-39	22,338 / 53,891	41.5%
≥ 40	1,513 / 53,891	2.8%
Maternal Education		
Less than High School	2,269 / 21,769	10.4%
High School or more	19,500 / 21,769	89.6%
Marital Status		
Married	31,844 / 53,857	59.1%
Other	22,013 / 53,857	40.9%
Maternal Smoking		
Yes	4,350 / 52,591	8.3%
No	48,241 / 52,591	91.7%
Pregnancy Intention		
Then/sooner	30,233 / 53,030	57.0%
Later/unsure	19,429 / 53,030	36.6%
Did not want	3,368 / 53,030	6.4%
Prenatal Care		
8 or fewer visits	8,723 / 52,223	16.7%
9 – 11 visits	16,490 / 52,223	31.6%
12 or more visits	27,010 / 52,223	51.8%
Income		
< $15,000	11,377 / 48,895	23.2%
$15,000 – 29,999	11,786 / 48,895	24.1%
$30,000 – 44,999	5,282 / 48,895	10.8%
$45,000 – 59,999	3,794 / 48,895	7.7%
$60,000 – 74,999	2,596 / 48,895	5.3%
$75,000 – 89,999	13,070 / 48,895	26.7%
> $90,000	1,080 / 48,985	2.2%

Maternal Insurance		
Medicaid/Government	26,037 / 53,503	48.7%
Private	26,174 / 53,503	48.9%
Self-Pay or Other	1,292 / 53,503	2.4%
WIC		
Yes	21,938 / 53,137	41.3%
No	31,201 / 53,137	58.7%
Region		
Northeast	18,892 / 53,893	35.1%
South	9,731 / 53,893	18.0%
Midwest	13,019 / 53,893	24.2%
West	11,597 / 53,893	21.5%
Puerto Rico	654 / 53,893	1.2%