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Association of Group Prenatal Care With Gestational Weight Gain

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Abstract

Objective—To compare gestational weight gain among women in group prenatal care to that of women in individual prenatal care.

Methods—In this retrospective cohort study, women who participated in group prenatal care from 2009 to 2015 and whose body mass index and gestational weight gain were recorded, were matched with the next two women who had the same payer type, were within 2kg/m^2 prepregnancy body mass index and 2-weeks gestational age at delivery, and had received individual prenatal care. Bivariate comparisons of demographics and antenatal complications were performed for women in group and individual prenatal care, and weight gain was categorized as "below," "met," or "exceeded" goals according to the 2009 Institute of Medicine guidelines. Logistic regression analysis estimated the association between excessive weight gain and model of care, with adjustment for confounders, stratified by body mass index.

Results—Women in group prenatal care (n=2117) were younger, and more commonly non-Hispanic black, nulliparous, and without gestational diabetes (p≤0.005 for all). Women in group prenatal care more commonly exceeded the weight gain goals (55% vs. 48%, p<0.001). The differences in gestational weight gain were concentrated among normal-weight (mean 34.2 vs. 32.1 pounds, p<0.001; 47% vs. 41% exceeded, p=0.008) and overweight women (mean 31.5 vs. 27.1 pounds, p<0.001; 69% vs. 54% exceeded, p<0.001). When adjusted for age, race–ethnicity, parity, education, and tobacco use, the increased odds for excessive gestational weight gain persisted among normal (OR 1.28, 95%CI 1.09–1.51) and overweight (OR 1.84, 95%CI 1.50–2.27) women. Nulliparity was associated with increased excessive gestational weight gain (OR

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1.49, 95%CI 1.33–1.68) whereas Hispanic ethnicity was associated with decreased excessive gestational weight gain (OR 0.68, 95%CI 0.59–0.78).

Conclusion—Among normal or overweight women, group prenatal care, compared to individual prenatal care, is associated with excessive gestational weight gain.

PRECIS

Women in group prenatal care were more likely to experience excessive gestational weight gain compared with women in traditional prenatal care.

Introduction

Gestational weight gain within the Institute of Medicine 2009 guidelines is associated with improved maternal and neonatal outcomes, such as a reduced rate of cesarean delivery and optimized birth weight.(1) Meeting gestational weight gain goals is also important for women and their offsprings' long-term health. Randomized and non-randomized studies of interventions to promote optimal weight gain have focused on a combination of dietary approaches (counseling, food diaries), weight monitoring (weight charts, feedback), and exercise programs. Nonetheless, many women who participate in health behavior intervention studies continue to have excessive gestational weight gain.(2)

CenteringPregnancy™, a form of group prenatal care, integrates the three major components of prenatal care (i.e., health assessment, education, and support) into a unified prenatal care model. In a group setting, women receive prenatal visits, build relationships with other women, and gain knowledge and skills in pregnancy and childbirth.(3) During the first group session, nutrition, including caloric requirements and macronutrient recommendations, are discussed. Women also receive a notebook that includes a food diary and a body mass index table labeled with the categories of normal, overweight, obese, and extreme obesity. Additionally, women chart their own weight over time in the notebooks. The curriculum overall encourages goal setting, including diet, exercise, and weight gain.

Some evidence suggests that participation in CenteringPregnancy improves health behaviors and perinatal outcomes. A randomized controlled trial of CenteringPregnancy in an urban clinic found less preterm delivery (9.8% vs. 13.8%, p=0.045) and more breastfeeding (66.5% vs. 54.6%, p=0.001) in the women who received CenteringPregnancy care.(3) Additional benefits associated with CenteringPregnancy include fewer ER visits, cesarean deliveries, and low birth weight offspring.(4–8) Given the improved health behaviors and outcomes associated with CenteringPregnancy, we hypothesized that this prenatal care model might also be expected to result in more appropriate gestational weight gain. However, information about the association between CenteringPregnancy and gestational weight gain is limited.(9) Thus, the objective of this study was to compare gestational weight gain in women in CenteringPregnancy and traditional, individual prenatal care.

Materials and Methods

Greenville Health System Obstetrics Center began to offer group prenatal care using the CenteringPregnancy model in March 2009. This center is an approved site for

CenteringPregnancy and data on other outcomes (i.e., preterm birth, postpartum contraception) from women participating in CenteringPregnancy at this site at different time-points have been published.(10,11) At this site, nurse-practitioners and certified nurse midwives primarily provided the group prenatal care to women who were primarily low-income with racial diversity from urban (80%) and rural (20%) neighborhoods. Exclusion criteria for participation in group prenatal care include conditions such as medically-treated pregestational diabetes or chronic hypertension, multiple gestations, or a prepregnancy body mass index >45 kg/m^2. An additional exclusion criterion was entry to prenatal care after 24 weeks. Women attend a median of 7–8 CenteringPregnancy sessions during the course of the pregnancy at this site.

The present analysis is a cohort study of women receiving care in the Greenville Health System between 2009 and 2015 who had height, initial weight and final weight (last recorded weight during prenatal visit) available and were eligible for Medicaid coverage at the time of delivery. Women were excluded if they had a fetal demise or delivered outside of the Greenville Health System. If an eligible woman had more than one pregnancy during the period of study, only the first pregnancy was included in the analysis. Eligible women were grouped according to the type of prenatal care they received: CenteringPregnancy or individual, traditional care. Participation in CenteringPregnancy was defined by attending at least one group session. All women who received CenteringPregnancy were included in the analysis and then matched on a 1:2 basis with the next two women in traditional prenatal care who delivered with the same payer type, were within 2 kg/m^2 pre-pregnancy body mass index units, and within 2 weeks of gestational age at delivery. Demographic information, number of prenatal visits, antenatal complications (e.g., gestational diabetes, preeclampsia), total gestational weight gain, gestational age at delivery, delivery route, and birthweight were obtained from the South Carolina birth certificate files. Classification of body mass index category was based on pre-pregnancy values.

Bivariable comparisons of demographics and antenatal complications were performed for women in CenteringPregnancy vs. traditional prenatal care with either chi-square, t-tests, or non-parametric tests, as appropriate. Gestational weight gain, defined as the difference between the initial weight and the weight most proximate to delivery, was compared between groups as a continuous (mean ± standard deviation, median) and a categorical variable (below goal, met goal, exceeded goals; weight gain vs. loss) according to the 2009 Institute of Medicine recommendations (28–40 pounds for <18.5 kg/m^2, 25–35 pounds for 18.5–24.9 kg/m^2, 15–25 pounds for 25.0–29.9 kg/m^2, and 11–20 pounds for ≥ 30kg/m^2).(1) In order to standardize the weight gain regardless of the length of gestation, the weekly rate of gestational weight gain was calculated and then multiplied by 40 to estimate the amount of gestational weight gain had the pregnancy lasted 40 weeks.(12) Logistic regression analysis estimated the association between excessive gestational weight gain (dependent variable) and prenatal care model (CenteringPregnancy vs. traditional prenatal care, independent variable) with adjustment for other confounders, stratified by body mass index. Unadjusted and adjusted odds ratios (OR) with 95% CI were reported. All statistical analysis was performed with STATA statistical software (College Station, TX; Version 14). This study was approved by the Greenville Health System and Northwestern University IRB.

Results

During the study time period, 2117 women who met inclusion criteria were identified from the CenteringPregnancy logs. These women were then matched in a 1:2 ratio with 4234 women who received traditional prenatal care and also delivered at the Greenville Health System during the same time period. Several differences were noted between the two groups including maternal age, parity, race/ethnicity, education level, and extent of prenatal care. (Table 1) There was a similar frequency of preeclampsia in the two groups, but a greater frequency of gestational diabetes in traditional prenatal care.(Table 2) As shown in Table 2, women in CenteringPregnancy had higher mean gestational weight gain and a higher proportion exceeded the 2009 Institute of Medicine gestational weight gain goals. When stratified by prepregnancy BMI, the differences in gestational weight gain between women in the two different models of prenatal care were concentrated among the normal weight and overweight women. The women in these two body mass index categories who participated in CenteringPregnancy had higher mean gestational weight gains and were more likely to have excessive gestational weight gain; whereas there were no significant differences among the women who were underweight or obese.(Table 3)

Overall, women in CenteringPregnancy had an increased odds of exceeding gestational weight gain goals (OR 1.32, 95%CI 1.19–1.47) compared to women in traditional prenatal care. When adjusted for maternal age, race/ethnicity, parity, education, WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) recipient, and tobacco use during pregnancy, the overall odds ratio was attenuated, but remained elevated (OR 1.25, 95%CI 1.11–1.39, Table 4). When the binary regression analysis was stratified by body mass index, the findings were similar to the univariable analysis with normal (OR 1.28, 95%CI 1.09–1.51) and overweight (OR 1.84, 95%CI 1.50–2.27) women in CenteringPregnancy having an increased odds for excessive gestational weight gain. Across all body mass index categories, factors significantly associated with excessive gestational weight gain were nulliparity (increased odds) and Hispanic ethnicity (decreased odds). Women in CenteringPregnancy had fewer cesarean deliveries overall ($p<0.001$) and lower mean birthweight ($p<0.01$) compared to women in traditional prenatal care, though the differences in birthweight were not clinically significant.(Table 2)

Discussion

In this matched retrospective cohort study, we found a higher rate of excessive gestational weight gain in normal and overweight women who participated in CenteringPregnancy compared to traditional prenatal care. Although the clinical significance of a 2 pound and 4 pound increase in mean weight gain in normal and overweight women, respectively, in CenteringPregnancy is limited, the findings from this study confirm several other studies on the topic of gestational weight gain in that the majority of women exceeded gestational weight gain goals.(13) Other notable similarities are lower gestational weight gain in Hispanic women, but increased gestational weight gain in nulliparas.

Overall, the contributing factors to gestational weight gain are complex. Associations between gestational weight gain and sociodemographic characteristics, health behaviors

such as diet and exercise, and obstetrical and medical complications such as hypertension, diabetes, and multiple gestations are well described. However, less is known regarding the relationship between psychological factors such as depression, stress, food access, and social support (peers, partner, family, etc.) and gestational weight gain. An advantage of group prenatal care such as CenteringPregnancy is that some of the 90-minute sessions are dedicated to health behavior topics such as diet and exercise in pregnancy whereby women not only gain knowledge in these areas, but also have the opportunity to discuss their questions with their peers and prenatal care providers. At the same time, the women in the group can help motivate each other to reach their pregnancy related goals, including gestational weight gain. Of further interest, commercial weight loss programs promote the concept of social support as critical to achieving goals.(14,15) It has been proposed that support from attending meetings enhances feelings of control and confidence and consequently group-based interventions result in greater weight loss compared to individual care.(14–18) For example, in a prospective, 2-year clinical trial that randomly assigned participants to either Weight Watchers® meetings or the self-help method, those assigned to Weight Watchers® meetings lost and kept off significantly more weight.(14)

Nonetheless, reported associations between gestational weight gain and CenteringPregnancy are inconsistent. A randomized controlled trial in a military setting from 2005–2007 found no difference in gestational weight gain between CenteringPregnancy and traditional prenatal care participants (33.0 vs. 33.6 lbs., p=0.7), but the authors did not specify the pre-pregnancy body mass index.(19) Tanner et al, who studied a predominantly non-Hispanic black population, also found that women in CenteringPregnancy more frequently had excessive gestational weight gain than their counterparts receiving traditional prenatal care (36% vs. 27%). It was only after propensity score matching that CenteringPregnancy appeared to be associated with a lower risk of excessive gestational weight gain.(20) Most recently, Magriples et al analyzed data from a cluster randomized controlled trial and found that, in multi-level modeling, women in CenteringPregnancy gained less weight during pregnancy and retained less weight at 12 months postpartum ($P<0.001$); the differences remained when groups were stratified by body mass index < 30 kg/m^2 or ≥ 30 kg/m^2.(21) Our findings differ from Tanner et al and Magriples et al., due to either unmeasured confounding factors in our study or over-controlling for factors in their studies. Another study aimed to determine whether food security (i.e., quality, variety, and desirability of a diet) differed among women in CenteringPregnancy and traditional prenatal care.(22) Among women who were initially food-insecure, women in CenteringPregnancy were more likely to become food-secure later in pregnancy ($p<0.001$), which could be a mechanism for improved nutrition during pregnancy.

We recognize several limitations to our study. At Greenville Health System, approximately 30% of women participate in CenteringPregnancy. Group prenatal care participants typically are comprised of younger, nulliparous minority women with a lower socioeconomic status, but fewer high-risk medical conditions. These differences were also seen in the current study.(Table 1) With respect to the matching within 2 pre-pregnancy body mass index units, the findings in Table 1 suggest this was effective given the similarities in the mean body mass index and body mass index categories between the two groups. Also, topics such as nutrition and weight gain are typically discussed at the very first group session. If women

joined CenteringPregnancy after that session, they would have missed this interactive discussion. Furthermore, counseling on gestational weight gain may have varied among providers and groups and among women with gestational diabetes. However, CenteringPregnancy providers also practice traditional prenatal care at this site, so we expect the counseling approach would be similar in either group. Accounting for gestational age at delivery by converting to a weekly rate of gestational weight gain assumes that weight gain is linear and may have introduced additional errors into the calculation of gestational weight gain, yet the current guidelines also assume that gestational weight gain is linear.(1) Lastly, we recognize the limitations of using administrative databases such as birth certificate files for research purposes. Given that non-differential misclassification typically biases findings towards the null hypothesis, our finding of significant differences in gestational weight gain between women in CenteringPregnancy and traditional prenatal care diminishes this limitation.(23) Conversely, the large sample size from an approved CenteringPregnancy site with a longstanding history of providing group prenatal care and model fidelity strengthens our findings.

In conclusion, increases in excessive gestational weight gain among normal and overweight women in CenteringPregnancy requires further investigation. It was encouraging that CenteringPregnancy was not associated with excessive gestational weight gain in obese women, yet 54–57% of obese women had excessive gestational weight gain.

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Table 1

Sociodemographics and other maternal characteristics in CenteringPregnancy vs. traditional prenatal care

Variable (n,% or mean ± standard deviation)	CenteringPregnancy (n=2117)	Traditional Prenatal Care (n=4234)	P-value
Age (years)	23.6±5.2	26.1±5.8	<0.001
Race/ethnicity			<0.001
White	786 (37)	2225 (53)	
Non-Hispanic black	801 (38)	996 (23)	
Hispanic	516 (24)	929 (22)	
Other/Unknown	14 (1)	84 (2)	
Education level			<0.001
<High school	718 (34)	1442 (34)	
High school diploma/GED	699 (33)	1147 (27)	
>High school	700 (33)	1645 (39)	
WIC recipient	1920 (91)	2979 (70)	<0.001
Medicaid insurance *	1750 (83)	3500 (83)	1.0
Nulliparous	1262 (60)	1426 (34)	<0.001
Month prenatal care began			
Mean ± SD	1.5±0.6	1.9±0.8	<0.001
0–2 months	1226 (58)	1429 (34)	<0.001
3–4 months	810 (38)	1751 (41)	
>4 months	81 (4)	1047 (25)	
Chronic hypertension	4 (0.19)	17 (0.40)	0.16
Pregestational diabetes	15 (0.71)	52 (1.2)	0.06
Prior preterm birth (denominator restricted to multiparas)	57 (6.7)	258 (9.2)	0.02
Prior cesarean delivery	204 (9.6)	809 (19)	<0.001
Initial weight (pounds)	154±40	154±40	0.94
Initial body mass index (kg/m^2) *			
Mean ± SD	26.7±6.4	26.8±6.3	0.51
Underweight <18.5	100 (5)	168 (4)	1.0
Normal 18.5–24.9	871 (41)	1785 (42)	
Overweight 25.0–29.9	596 (28)	1179 (28)	
Obese ≥30	550 (26)	1102 (26)	
Class I 30–34.9	288 (14)	608 (14)	
Class II 35–39.9	170 (8)	320 (8)	

Variable (n,% or mean ± standard deviation)	CenteringPregnancy (n=2117)	Traditional Prenatal Care (n=4234)	P-value
Class III ≥40	92 (4)	174 (4)	
Tobacco use during pregnancy	331 (16)	762 (18)	0.02
Total number of prenatal visits	13.6±3.2	10.3±3.9	<0.001

* Matching criteria included insurance type and within 2 body mass index units

GED general educational development or high-school equivalent degree
WIC The Special Supplemental Nutrition Program for Women, Infants, and Children

Table 2

Antenatal complications, gestational weight gain, and other perinatal outcomes in CenteringPregnancy vs. traditional prenatal care

Variable (n,% or mean ± SD)	CenteringPregnancy (n=2117)	Traditional Prenatal Care (n=4234)	P-value
Antenatal complications			
Preeclampsia	247 (12)	438 (10)	0.11
Gestational diabetes	82 (4)	233 (6)	0.005
Gestational weight gain or loss (pounds)			
Median and interquartile range	30 (18–38)	28 (20–40)	<0.001
Weight loss (n,%)	52 (2.5)	104 (2.5)	1.0
2009 IOM Gestational weight gain goals			<0.001
Below	429 (20)	1114 (26)	
Met	533 (25)	1106 (26)	
Exceeded	1155 (55)	2014 (48)	
Gestational age at delivery (weeks) *			
Mean ± SD	38.9±1.7	38.8±1.6	0.03
Preterm delivery	150 (7)	245 (5.8)	0.04
Year of delivery *			0.99
2009	71 (3)	140 (3)	
2010	294 (14)	581 (14)	
2011	415 (20)	830 (20)	
2012	405 (19)	816 (19)	
2013	452 (21)	885 (21)	
2014	470 (22)	956 (22)	
2015	10 (<1)	26 (<1)	
Delivery route			<0.001
Vaginal (includes forceps/vacuum)	1598 (75)	2987 (70)	
Cesarean delivery	519 (25)	1247 (30)	
Birthweight (g)	3250±523	3285±524	0.01

* Matching criteria for control group included ± 2 weeks of delivery date

SD standard deviation
IOM Institute of Medicine

Table 3

Gestational weight gain by body mass index and prenatal care type

Variable (n,% or mean ± SD)	CP Underweight n=100	TPNC Underweight n=168	P-value	CP Normal n=871	TPNC Normal n=1785	P-value	CP Overweight n=596	TPNC Overweight n=1179	P-value	CP Obese n=550	TPNC Obese n=1102	P-value
Gestational weight gain (pounds)	33.9±12.8	34.6±13.0	0.64	34.2±14.8	32.1±13.9	<0.001	31.5±15.2	27.1±16.8	<0.001	23.0±18.0	22.2±18.4	0.38
2009 IOM goals			0.57			0.008			<0.001			0.14
Under	30 (30)	49 (29)		211 (24)	508 (28)		66 (11)	263 (22)		122 (22)	294 (27)	
Met	42 (42)	62 (37)		254 (29)	554 (31)		120 (20)	274 (23)		117 (21)	216 (20)	
Exceeded	28 (28)	57 (34)		406 (47)	723 (41)		410 (69)	642 (54)		211 (57)	592 (54)	
Weight loss	0	0	--	6 (0.7)	8 (0.5)	0.42	9 (1.5)	28 (2.4)	0.23	37 (6.7)	68 (6.2)	0.66

CP CenteringPregnancy
TPNC Traditional prenatal care
IOM Institute of Medicine

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Table 4

Logistic regression analysis for excessive gestational weight gain by body mass index reporting odds ratios and 95% CI

Variables	Overall (n=6351)	Underweight (n=268)	Normal (n=2656)	Overweight (n=1775)	Obese (n=1652)
CenteringPregnancy (unadjusted)	**1.32 (1.19–1.47)**	0.76 (0.44–1.30)	**1.28 (1.09–1.51)**	**1.84 (1.50–2.27)**	1.12 (0.91–1.38)
Adjusted regression analysis *					
Traditional prenatal care	**Ref**	Ref	**Ref**	**Ref**	Ref
CenteringPregnancy	**1.25 (1.11–1.39)**	0.68 (0.38–1.22)	**1.24 (1.04–1.48)**	**1.65 (1.31–2.06)**	1.02 (0.82–1.28)
Maternal age (years)	1.01 (1.0–1.02)	1.00 (0.93–1.06)	1.00 (0.98–1.02)	1.02 (1.00–1.04)	0.98 (0.96–1.00)
Not a WIC recipient	**Ref**	Ref	Ref	Ref	Ref
WIC recipient	**1.13 (1.01–1.26)**	1.37 (0.79–2.38)	1.06 (0.90–1.24)	1.08 (0.87–1.33)	1.12 (0.88–1.42)
Multiparous	**Ref**	**Ref**	**Ref**	**Ref**	**Ref**
Nulliparous	**1.49 (1.33–1.68)**	**1.96 (1.03–3.73)**	**1.62 (1.35–1.95)**	**1.81 (1.42–2.29)**	**1.40 (1.11–1.77)**
No tobacco	Ref	Ref	Ref	Ref	Ref
Tobacco	0.96 (0.84–1.11)	0.71 (0.37–1.36)	1.04 (0.84–1.28)	0.87 (0.65–1.17)	1.23 (0.92–1.64)
Race					
Non-Hispanic White	Ref	Ref	Ref	Ref	Ref
Non-Hispanic Black	**0.80 (0.71–0.91)**	0.51 (0.25–1.03)	**0.72 (0.59–0.87)**	0.94 (0.73–1.20)	**0.63 (0.50–0.79)**
Hispanic	**0.68 (0.59–0.78)**	**0.26 (0.08–0.83)**	**0.52 (0.41–0.66)**	**0.59 (0.45–0.78)**	0.99 (0.73–1.34)
Other/Unknown	**0.61 (0.40–0.92)**	0.53 (0.08–3.36)	1.07 (0.61–1.87)	0.61 (0.23–1.58)	**0.19 (0.06–0.60)**
Education					
<High school	Ref	Ref	Ref	Ref	Ref
High school	1.08 (0.94–1.22)	0.69 (0.34–1.38)	1.03 (0.83–1.26)	1.03 (0.80–1.33)	**1.36 (1.05–1.76)**
>High school	**1.23 (1.08–1.41)**	0.90 (0.44–1.87)	1.06 (0.87–1.33)	**1.45 (1.11–1.89)**	**1.52 (1.17–1.99)**

* Regression analysis adjusted for maternal age, WIC (The Special Supplemental Nutrition Program for Women, Infants, and Children) recipient, nulliparas, tobacco use, race/ethnicity, and education

Bolded items indicate statistical significance.