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Provider Adherence to Recommended Prenatal Care Content: Does It Differ for Obese Women?

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Abstract

Objective—To examine provider adherence to prenatal care (PNC) content in obese and non-obese women and perinatal outcomes in obese women experiencing low and medium versus high adherence to PNC content.

Methods—Provider adherence to PNC content (low <50%, medium 50–79%, and high 80%) was compared between obese (n=69) and non-obese (n=128) women in a linked database of deliveries to low-income, minority women from 2003–2004. Sample content items included procedures delivered at every visit (blood pressure, urinalysis, maternal weight, fetal heart rate check), timed screenings for birth defects and gestational diabetes, prenatal vitamin prescriptions, and depression screening. Weight gain, preterm deliveries, cesareans, and birthweight were compared between obese women with low and medium versus high adherence to PNC content using multivariable logistic regression.

Results—High provider adherence to an eight-item PNC content score (56.3% vs. 66.5%, $p=0.02$) and depression screening (2.0% vs. 11.4%, $p=0.001$) were both lower for obese versus non-obese women. Among obese women, there were no differences by level of provider adherence to PNC content in preterm delivery, cesareans, and low birth weight, but obese women experiencing low and medium versus high adherence were more likely to gain 20lbs (aOR 5.5, 95% CI 1.3–23.3).

Conclusion—Providers may be administering PNC differently to obese and non-obese women. PNC for obese women who are at high risk of adverse perinatal outcomes needs to be addressed especially as it relates to depression screening and gestational weight gain.

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Keywords

obesity; pregnancy; prenatal care content; perinatal outcomes

Introduction

In 2009–2010, the prevalence of obesity among adult women was 35.8%.⁽¹⁾ Obesity is an epidemic among all racial/ethnic groups, but the problem is particularly marked among female minorities. In 2009–2010, 40.7% of Hispanic and 58.6% of non-Hispanic black women were obese compared to 33.4% of non-Hispanic whites.⁽¹⁾ The impact of obesity on health is impressive as no organ system is spared its effects. Among pregnant women, obesity increases the risk for adverse outcomes. . Although the etiology is not always known, obese women are more likely to have a fetus with a birth defect, develop preeclampsia and gestational diabetes, experience a stillbirth, or deliver by cesarean.⁽²⁻⁴⁾ Cesarean deliveries (CD) increase risk in obese women as postpartum hemorrhage and compromised wound healing more frequently complicate their postpartum course.⁽⁵⁻⁶⁾

Although evidence suggests that the way in which prenatal care (PNC) is currently delivered is insufficient to meet the needs of women of color even for those who enter PNC early, PNC is still considered one of the most important public health interventions for women and children partially because it is associated with improvements in adverse outcomes such as preterm delivery (PTD), low birth weight (LBW), and infant mortality.⁽⁷⁻¹³⁾ For obese women, several guidelines suggest the need for modifications to the PNC they receive, including early screening for gestational diabetes and nutrition counseling with the goal of improving perinatal outcomes.^(4,14-16) However, it is not known if obese women are receiving the basic components of PNC recommended for all women. For example, blood pressure may not be taken or may be inaccurately taken if the correct size blood pressure cuff is not available. Likewise, weight might not be obtained if it exceeds the scale manufacturer's limitations.

Given the increased risks for adverse outcomes in pregnancies complicated by obesity, it is particularly important to provide the basic components of PNC to this population. Although there are limitations in studying the content of PNC prior studies that have evaluated PNC content have either used patient reports based on questionnaires such as those in the Pregnancy Risk Assessment Monitoring System (PRAMS) or have reviewed medical records. Differences in the content of PNC have been described based on race/ethnicity^(4,17-19), PNC provider⁽⁴⁾, and PNC site⁽²⁰⁾. However, to our knowledge, no studies have examined whether PNC content differs for women of varying weight.

The objective of this study was to compare PNC content for obese and non-obese women using a linked data source of medical records, birth certificates, and Medicaid claims that was created for a prior study of provider adherence to recommended PNC content in predominantly low-income, minority women. In addition, outcomes such as weight gain, CD, PTD, and birthweight were compared for obese women whose providers had low and medium versus high adherence to recommended PNC content.

Materials and Methods

Overview

This is a secondary analysis of a dataset developed for a study of adherence to recommended PNC content among PNC providers who receive reimbursement from the State of Illinois' Medical Assistance Program. Additional details of the original study are provided elsewhere.(20) Briefly, trained abstractors reviewed 396 medical records of women who had a delivery paid by Medicaid in four low-income communities in Chicago from January 1, 2003–June 30, 2004. The eligibility criteria for the initial sample, which was drawn from Medicaid claims files, included women who delivered either a preterm (<37 weeks gestation) or a term infant weighing >2000g without major problems. During the initial sampling process, a stratified random sample was drawn to oversample preterm deliveries.

Sample

Of the original 396 deliveries, 21 with missing linked birth certificate data and 14 multiple births were excluded. For the remaining 361 deliveries, 25 were missing both height and weight of the women, 135 were missing height only, and 4 were missing weight only. The final sample of 197 women had both the initial weight and height available which were then used to calculate the initial body mass index (BMI) in kg/m^2 . Women were categorized as obese ($\text{BMI} \geq 30 \text{ kg/m}^2$, $n=69$, 35.0%) and non-obese ($\text{BMI} < 30 \text{ kg/m}^2$, $n=128$, 65.0%).

Measures

For the medical record abstraction, a committee of PNC providers, researchers, and staff of the Illinois Department of Healthcare and Family Services (state Medicaid agency) developed an abstraction form that focused on documented procedures, tests, and education provided during PNC. The abstraction form was based on the American College of Obstetricians and Gynecologists' (ACOG) *Guidelines for Perinatal Care* (21) and expert opinions of committee members. Medicaid claims and birth certificate data were then linked to the abstracted medical record data.

The dependent variable was provider adherence to PNC content, measured as the percentage of 17 ACOG recommendations completed as documented in the medical record (Table 1). This included items such as checking blood pressure and fetal heart rate at every visit, ordering a 50g glucola and ultrasound, and providing prenatal education. Measurement of providers' adherence to PNC content was categorized as follows: low (<50%), medium (50–79%), and high (≥ 80%), following the methodology of prior studies.(21,22) Of note, the denominator for the PNC content items varied for each woman as not all content items were appropriate for all women (e.g., screening for gestational diabetes in women with pre-pregnancy diabetes). Given the increased risk for specific adverse outcomes (e.g., birth defects, stillbirth, preeclampsia, diabetes, excessive weight gain) in obese women, the first author developed a subset of eight PNC content items particularly appropriate for obese women based on literature reviews conducted prior to analysis.(4,23) This included items 1-3, 6, 7, 9, 12, and 17 in Table 1 as these were considered especially important for obese women. Because the study population were low-income, minority women at high risk for adverse outcomes, other important, but not ACOG recommended, measures of content

included enrollment in the Women, Infants, and Children (WIC) program (documented as yes/no), referral to Family Case Management [(FCM), Illinois' prenatal case management program, documented as yes/no], appropriate referral to/consultation with a specialist (e.g., perinatologist, pulmonologist, endocrinologist, etc.) at the beginning of and during the pregnancy, and depression screening (documented as yes if performed either with a depression screen or by asking the woman about the presence of depressive symptoms) (Table 1). Adequacy of prenatal care utilization (APNCU, Kotelchuck index) was also calculated.

Outcomes for the analysis of the effect of low provider adherence included weight gain, PTD, CD, and birthweight. The data source for all of these outcomes was the birth certificate. Covariates were age, race/ethnicity, parity, education, preexisting risk factors or medical conditions (chronic hypertension, diabetes, anemia, prior adverse pregnancy outcome [PTD, fetal demise, LBW, or birth defects], tobacco use, asthma, abnormal urinalysis, and abnormal blood pressure), provider site (physician's offices, hospital outpatient clinic, or federally qualified health center [FQHC]), gestational age at first prenatal visit, and number of prenatal visits as documented in any of the three data sources.

Analysis

Analysis was performed with SAS software (version 9.2, Cary, N.C.), using survey procedures to account for the complex sampling procedure and weighting of the data set. Sociodemographic factors, provider site, preexisting risk factors or medical conditions, and APNCU index were compared between obese and non-obese women. The proportion of women experiencing each of the 17 items in the adherence score, as well as the proportions enrolled in WIC, referred to FCM, referred to/consultation with a specialist, and having depression screening, were compared between obese and non-obese women. Outcomes, including weight gain, PTD, CD, and birthweight were then compared between obese women with low and medium (<80%) versus high (≥80%) provider adherence to PNC content. For all these comparisons, either Chi-square or t-tests were used.

To estimate odds ratios (OR) and 95% confidence intervals (95% CI) for the relationship between the BMI category (obese vs. non-obese) and adherence scores (17 and 8-item content), generalized logit models were run to account for the three-level outcomes (<50%, 50–79% and ≥80% adherence). Among obese women, unadjusted and adjusted binary logistic regression models were used to estimate the odds of each perinatal outcome (weight gain ≥20 pounds, PTD, CD, and LBW) for women receiving PNC with provider adherence <80% versus ≥80%. Unadjusted and adjusted linear regression models were used to estimate p-values for each perinatal outcome measure on a continuous scale (weight gain and birthweight). In addition to the indicator for BMI category, all adjusted models also included socio-demographic factors, provider site, the composite measure for preexisting risk factors or medical conditions, and initiation of PNC (i.e., first trimester vs. later).

Given the high proportion of missing values for BMI, we compared socio-demographic factors, preexisting risk factors or medical conditions, provider site, total adherence score, and perinatal outcomes between women missing a BMI (n=164) versus not missing a BMI (n=197) to assess the potential impact of excluding women with missing BMI. BMI was

most often missing because height was not documented in the prenatal record, but weight was available. Therefore, a sensitivity analysis was conducted comparing total adherence scores between 200 pound (n=66) and <200 pound women (n=268) and comparing perinatal outcomes by levels of adherence among women weighing 200 pounds. This designation served as a proxy for “obese” and “non-obese” categories. For all analyses, a p-value <0.05 was considered statistically significant. IRB approval at the University of Illinois at Chicago was obtained.

Results

Obese women were older, had more hypertension (5.2% vs. 2.6%, $p=0.04$) and more prior CD (22.4% vs. 5.4%, $p=0.01$) compared to non-obese women (Table 2). Each of the 17 PNC content items was less frequently performed with obese women; exceptions were urinalysis at every visit, prescription of prenatal vitamins, and delivery planning (Table 3). However, except for the transfer of prenatal records for obese compared to non-obese women (18.0% vs. 38.8%, respectively, $p=0.02$) the adherence to each PNC content item was not significantly different ($p>0.05$) between the groups. There was no significant difference in provider adherence to the 17-item PNC content score for obese compared to non-obese women (42.6% vs. 56.1% high and 7.4% vs. 5.7% low adherence, respectively, $p=0.37$). Compared to non-obese women, obese women had an increased odds of low and medium vs. high scores in the adjusted analysis (aORs 1.9, 95% CI 0.7, 5.1 and 2.2, 95% CI 0.3, 16.9, respectively), but the difference was not statistically significant. However, obese women were less likely than non-obese women to have high adherence scores for the eight-item PNC content score (56.3% vs. 66.5%), but also less likely to have low scores (2.0 vs. 8.6%, respectively, $p = 0.02$) (Table 3). These differences also persisted in the adjusted analysis such that obese women had significantly higher odds of medium versus high (aOR 2.7, 95% CI 1.1, 6.6) scores and non-significant lower odds of low versus high scores (aOR 0.3, 95% CI 0.1, 1.4) compared to non-obese women. In addition, fewer obese women were referred to FCM (0.7% vs. 5.8%, $p=0.01$), and fewer were screened for depression (2.0% vs. 11.4%, $p=0.001$) than non-obese women.

There were no differences in PTD, CD, and LBW among obese women with low and medium versus high provider adherence to PNC content ($p>0.05$) based on the 17-item and 8-item adherence scores (Table 4). In the adjusted analysis of the 17-item adherence score, obese women experiencing PNC with low and medium provider adherence had a higher odds of gaining 20 pounds during pregnancy than those experiencing high adherence (aOR 5.5, 95% CI 1.3, 23.3).

In comparing women missing to not missing a BMI, women missing a BMI were more likely to be non-Hispanic black, less educated, more likely to have an FQHC as a PNC site, and have fewer prenatal visits, $p = 0.03$. The proportion of women experiencing high provider adherence (80%) to PNC content (17-item score) was lower among those with missing a BMI compared to those with a BMI (18.8% vs. 46.7%, $P<0.001$). The 17-item adherence score was not significantly different for women weighing 200 versus <200 pounds (41.9% vs. 39.9% had high-adherence scores, respectively). Among women weighing 200 pounds, those with low and medium adherence scores were more likely to gain 20 pounds during

pregnancy (aOR 5.1, 95% CI 1.3, 19.1). None of the other outcomes differed by weight status, as in the original analysis.

Comment

In this study, provider adherence to PNC content was similar for obese and non-obese women as determined by a score of 17 PNC content items. However, when limiting the analysis to an eight-item adherence score that focused on content items especially important for obese women, high provider adherence to PNC content was lower for obese compared to non-obese women. It is possible that the greater occurrence of comorbidities in obese women (e.g., increased maternal age, chronic hypertension, prior cesarean deliveries) prompted providers to focus on the management of these issues instead of the routine aspects of PNC as measured here. In these instances, either longer visits or a greater frequency of visits for obese women may assure that all PNC content items are covered and documented.

Perinatal outcomes (PTD, CD, and LBW) were similar in obese women with low and medium compared to high adherence to PNC content. The socio-demographics of the cohort likely explain the overall high occurrences of PTD, CD, and LBW compared to national averages. Importantly, we noted lower weight gain in obese women receiving PNC with high provider adherence to recommended PNC content. If higher adherence to PNC content could be translated into more appropriate weight gain for obese women, then this would have the potential to affect perinatal outcomes significantly. At the time women were receiving PNC in this study (2003–2004), the recommendation for weight gain in obese women was “at least 15 pounds,” but no upper limit was given.⁽²⁴⁾ Meeting weight gain guidelines, which is now 11–20 pounds for obese pregnant women, has been shown to reduce the occurrence of immediate outcomes such as CD and infants who are large for gestational age as well as long-term outcomes such as maternal weight retention and childhood obesity.⁽²⁵⁾ For obese women, weight gain lower than these recommendations and even weight loss have also been shown to improve immediate perinatal outcomes.^(26–29)

Overall, depression screening was low in this study, but significantly lower for obese compared to non-obese women (2.0% vs. 11.4%, respectively). Current ACOG guidelines do not have a recommendation for universal antepartum screening for depression, but since the benefits of screening are known, ACOG also states that screening for depression “should be strongly considered.”⁽³⁰⁾ It is also known that mental health problems such as depression increase as BMI increases in pregnant and non-pregnant women.^(31,32) In one study, the risk for major depression during pregnancy increased significantly (OR 2.6, 95% CI 1.4, 4.3) for obese women compared to those with a BMI of 18kg/m² and for every 1kg/m² rise in BMI, the risk for major depression increased by 7%.⁽³¹⁾ Furthermore, depression during pregnancy may increase the risk for PTD and LBW and has been associated with neonatal effects (e.g. irritability, less activity and attentiveness, and fewer facial expressions).⁽³³⁾ Given the negative consequences of depression during pregnancy and the potential difference in screening for obese compared to non-obese women, attention should be paid to the rate of depression screening for obese pregnant women. Of note, perinatal depression

risk assessment is now reimbursed in the State of Illinois, though this was not the practice at the time of this study.

Prior to conducting this study, there were several reasons to suspect that PNC content may differ for obese women. Obese women are more likely to have irregular menses and ovulatory dysfunction.(34,35) As such, pregnancy may not be detected until later in the gestation and the initiation of PNC can be delayed. Information about PNC utilization by obese women is sparse. However, one study showed that adequate PNC utilization [as defined by GINDEX (36)] was similar in normal (38.1%), overweight (37.9%), and obese (36.5%) women, but intensive utilization was more common in obese (18.2%) compared to normal (11.3%) and overweight (13.7%) women.(37) Of note, the APNCU index was similar in obese and non-obese women in the current study, suggesting that PNC utilization was similar in the two weight groups and, therefore, not an explanation for the differences in provider adherence scores.

A provider bias has also been described in the management of obese patients.(38,39) There may be an assumption that obese women are not capable of changing their behaviors, and, therefore, important education such as nutrition and weight gain in pregnancy is omitted. Clinicians may also feel uncomfortable discussing weight issues as well.(40) However, our database did not specifically measure provider discussion of nutrition and weight gain. Conversely, clinicians may perform specific screening procedures (e.g., blood tests or ultrasounds for birth defects, 50g glucola for diabetes) more frequently in obese women given the increased risk for these outcomes in pregnancy. In a study of non-pregnant patients with diabetes, Chang et al. reviewed performance measures on eight common outpatient procedures (e.g., eye exam, lipid screening, cervical cancer screening, etc.) by weight status. Obese or overweight patients did not receive inferior care when compared with normal-weight patients. Furthermore, being obese or overweight was actually associated with a marginally higher rate of recommended care on several measures.(41)

We recognize several limitations to this study, many of which were the result of using existing data from a previous study that was designed to examine a different research question. One of these limitations is a selection bias in excluding those with a missing BMI. The differences between PNC records missing and not missing BMI information most likely represent a continuum of poor documentation of PNC content items, including the woman's height and initial weight. The results of the sensitivity analysis suggest that the overall conclusions of the study would not have changed if we had been able to include the women with missing data for height in our comparison of obese to non-obese women. Furthermore, given that the women included in this study were more likely to have high provider adherence compared to those with missing BMI information, the differences in provider adherence found between obese and non-obese women is likely a conservative estimate.

As a study that utilized patient medical records to document provider adherence, it is likely that the measurement of provider adherence to PNC content was underestimated, particularly if providers inadequately documented the screening procedures and counseling they actually performed. In particular, documentation of the procedures and counseling may differ for obese and non-obese women. Issues such as chronic hypertension and prior

cesarean deliveries, which require greater attention during a prenatal visit, were higher in obese compared to non-obese women. This may have limited the time the providers had to document routine PNC elements. However, we did adjust for risk status in final models to account for these potential differences. Finally, we acknowledge that this study had low power to detect differences in provider PNC adherence and perinatal outcomes. A greater sample size could clarify the relationship between provider adherence to PNC content for obese women and perinatal outcomes.

In conclusion, this study of low-income, predominantly minority women suggests that PNC providers may be administering PNC content differently to obese and non-obese women. In particular, the findings of lower depression screening for obese versus non-obese women and lower weight gain in obese women when there was a high provider adherence to PNC content highlights the need to address the delivery of standard PNC for a group of women at high risk for adverse outcomes during pregnancy. According to ACOG, PNC content for obese women should also involve a discussion of the risks of obesity in pregnancy as well as early screening for gestational diabetes and nutrition and anesthesia consults.⁽²¹⁾ Future studies should evaluate whether contemporary PNC practices are incorporating this additional content and, if so, whether this practice improves perinatal outcomes for obese women.

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Table 1

Prenatal Care Content Items

	Content Items
1 ^a	Blood pressure taken every visit
2 ^a	Weight measured every visit
3 ^a	Fetal heart rate (FHR) checked every visit after 10 weeks
4	Fundal height (FH) checked at each visit after 1 st trimester
5	Gestational age assessed at every visit
6 ^a	Urine checked at every visit
7 ^a	Triple screen done
8	Abnormal triple screen addressed
9 ^a	50g glucola done between 24–28 weeks
10	Rhogam given if Rh negative
11	Group B streptococcus (GBS) screening done at 36 weeks
12 ^a	Prenatal vitamins prescribed
13	Prenatal education given
14	Documentation of delivery planning
15	Patient informed about labor signs and symptoms
16	Prenatal care records transferred
17 ^a	Ultrasound ordered
	High-risk referral or consultation
	Women, Infants, and Children (WIC) Program enrollment
	Family case management referral
	Depression screening done

^aDenotes content items designated for subset score

Table 2

Sample Characteristics by Body Mass Index Status

Variable	Obese n=69 Weighted % or Mean (SE)	Non-obese n=128 Weighted % or Mean (SE)	p-value ^a
Body mass index (kg/m ²)	36.0 (0.70)	23.7 (0.37)	<0.0001
Maternal age at delivery (years)			
<18	1.2	14.6	0.03
18-24	57.1	59.3	
25-34	32.6	22.6	
>35	9.0	3.5	
Race/Ethnicity			
Non-Hispanic black	74.6	61.5	0.19
Hispanic	18.3	33.9	
Non-Hispanic white	7.1	4.6	
Parity			
Nullipara	30.8	37.1	0.06
1-2 prior live births	15.3	30.3	
3 prior live births	53.9	32.7	
Education			
<High school	26.6	34.8	0.62
High school graduate	30.8	30.4	
>High school	42.6	34.8	
Provider site			
Physician office	36.3	33.9	0.92
Hospitals	33.4	37.3	
Federally qualified health center (FQHC)	30.3	28.8	
Risk status prior to pregnancy ^{b,c}			
Chronic hypertension	6.1	2.5	0.04
Diabetes	11.1	3.5	0.11
Anemia	6.2	10.0	0.51
History of adverse pregnancy outcome (preterm delivery, fetal demise, low birth weight, or birth defects for n=85 multiparas)	21.8	11.7	0.26
Prior cesarean delivery (n=85 multiparas)	22.4	5.4	0.01
Risk status during pregnancy ^{b,c}			
Tobacco use	13.3	5.1	0.22
Asthma	17.2	8.6	0.06
Abnormal urinalysis (defined as 2+protein or bacteria)	6.9	0.6	<0.01
Abnormal blood pressure	10.9	2.7	0.02
Risk factors present ^c	74.4	63.6	0.23

Variable	Obese n=69 Weighted % or Mean (SE)	Non-obese n=128 Weighted % or Mean (SE)	p-value ^a
First trimester initiation of prenatal care ^d	80.0	79.2	0.92
Month of 1 st prenatal visit ^d	2.2 (0.20)	2.6 (0.18)	0.26
Total number of prenatal visits ^d	11.7 (0.56)	11.8 (0.58)	0.91
Adequacy of prenatal care utilization ^{d,e}			
Inadequate	8.9	15.3	0.48
Adequate/Intermediate	62.8	52.1	
Adequate plus	28.3	32.6	
Number of visits to this provider	9.7 (0.56)	9.9 (0.50)	0.75
Number of missed visits	0.34 (0.10)	0.24 (0.06)	0.42

^a Chi-square test for categorical variables and t-test for continuous variables.

^b Risk factors were identified as any of the following from Medicaid claims, medical record, or birth certificate data: anemia, current substance use (alcohol, tobacco, illicit drugs), asthma, cancer (breast, cervical, ovarian, or uterine), diabetes mellitus, neuro/cardiovascular disease, hepatitis, preeclampsia, seizure disorder, sickle cell disease, thyroid disorder, hypertension, history of miscarriages or ectopic pregnancy, premature delivery, fetal death, preterm labor, low birth weight, macrosomia, birth defects, abnormal glucose tolerance test, abnormal urinalysis, abnormal blood pressure, preeclampsia.

^c Data source is the individual patient medical record.

^d Data source is the linked birth certificate.

^e 25 missing values

Table 3

Provider Adherence to Prenatal Care Content in Obese and Non-obese Women

Content Item	Obese n=69 Weighted %	Non-obese n=128 Weighted %	P-value ^a
Blood pressure taken every visit	93.2	93.6	0.94
Weight measured every visit	88.0	91.0	0.65
Fetal heart rate checked every visit after 10 weeks	82.3	87.8	0.42
Fundal height checked at each visit after 1st trimester	68.2	78.0	0.28
Gestational age assessed at every visit	90.3	94.8	0.35
Urine checked at every visit	86.7	76.9	0.26
Triple screen done	57.5	66.7	0.40
Abnormal triple screen addressed	19.1	24.9	0.75
50g glucola done between 24–28 weeks	80.9	86.1	0.46
Rhogam given if Rh negative	14.8	37.7	0.16
Group B streptococcus screening done at 36 weeks	79.2	81.6	0.80
Prenatal vitamins prescribed	77.1	73.5	0.63
Prenatal education given	63.4	71.6	0.35
Documentation of delivery planning	48.0	45.3	0.80
Patient informed about labor signs and symptoms	49.5	61.1	0.25
Prenatal care records transferred	18.0	38.8	0.02
Ultrasound ordered	86.0	86.1	0.99
Total adherence score (n=17 content items)			
80%	42.6	56.1	0.37
50–79%	50.0	38.2	
<50%	7.4	5.7	
Obesity-focused total adherence score ^b (n=8 content items)			
80%	56.3	66.5	0.02
50–79%	41.7	25.0	
<50%	2.0	8.6	
Referral to or consult with a specialist (n = 54 with high-risk conditions, 24 obese, 30 non-obese)	27.3	44.5	0.20
Women, Infants, and Children (WIC) Program enrollment	15.6	15.7	0.99
Family case management referral	0.7	5.8	0.01
Depression screening done	2.0	11.4	0.001

^aChi-square test for categorical variables.^bIncludes a subset of 8 procedures that were considered particularly important for obese women (blood pressure taken every visit, weight measured every visit, fetal heart rate checked every visit after 10 weeks, urine checked at every visit, triple screen done, 50g glucola done between 24-28 weeks, prenatal vitamins prescribed, and ultrasound ordered).

Table 4

Unadjusted and Adjusted Odds for Perinatal Outcomes in Obese and Non-obese Women for the 17- and 8-Item Scores

Outcome Mean (SE) or %	Obese women w/Low +Medium Provider Adherence (<80%) (n = 42)	Obese women w/High Provider Adherence (80%) (n = 27)	Unadjusted OR (95% CI) or p-value	Adjusted OR (95% CI) ^{a,b} or p-value
17-items				
Weight gain (lbs)	29.8 (7.4)	18.4 (6.4)	p=0.26	p=0.09
Range	-48 to 100	-24 to 45		
20 pounds	82.6	56.8	3.8 (0.8, 17.1)	5.5 (1.3, 23.3)
Preterm delivery	16.9	16.3	1.0 (0.4, 2.8)	1.0 (0.3, 3.5)
Cesarean delivery	42.1	43.3	0.9 (0.2, 3.3)	0.9 (0.2, 3.9)
Birth weight (g)	3128 (107)	3314 (118)	p = 0.30	p = 0.14
<2500g	15.8	12.7	1.2 (0.4, 3.7)	1.5 (0.4, 6.2)
8-items				
Weight gain (lbs)	24.5 (8.7)	25.4 (6.1)	p = 0.93	p = 0.71
Range	-48 to 70	-24 to 100		
20 pounds	77.1	67.4	1.7 (0.4, 7.1)	1.6 (0.4, 6.7)
Preterm delivery	14.3	18.4	0.7 (0.3, 2.0)	0.5 (0.1, 2.1)
Cesarean delivery	38.3	46.0	0.7 (0.2, 2.6)	0.7 (0.2, 2.8)
Birth weight (g)	3186 (112)	3224 (112)	p = 0.86	p = 0.64
<2500g	13.5	15.2	0.8 (0.3, 2.4)	0.7 (0.2, 3.4)

^a Adjusted for age, race, education, parity, high risk status, first trimester initiation of prenatal care, and provider site.

^b n= 68 as one obese woman had missing information on education and was excluded from adjusted models.