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Racial disparities in pregnancy outcomes in obese women

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Abstract

Objective—To estimate the effect of race on perinatal outcomes in obese women.

Methods—Retrospective cohort study of birth records linked to hospital discharge data for all live born singleton infants ≥37 weeks gestation born to African-American or Caucasian Missouri residents from 2000 to 2006. We excluded major congenital anomalies and women with diabetes or chronic hypertension. Obesity was defined as pre-pregnancy body mass index ≥30 kg/m^2.

Results—There were 312 412 births meeting study criteria. 27.1% (11 776) of African-American mothers and 19.1% (49 415) of Caucasian mothers were obese. There were no differences in cesarean delivery or preeclampsia between obese African-American and obese Caucasian women. Infants of obese African-American women were significantly less likely to be macrosomic (0.9% vs. 2.2%, adjusted odds ratio [aOR] 0.5, 95% confidence interval [CI] 0.4 0.6) and more likely to be low birth weight (3.4% vs. 1.8%, aOR 1.9, 95% CI 1.7, 2.2) compared to infants of obese Caucasian women. Compared to their normal weight peers, obese Caucasian women had a greater relative risk of developing preeclampsia (aOR 3.1, 95% CI 2.9, 3.2) than obese African-American women (aOR 2.1, 95% CI 1.9, 2.4).

Conclusion—Racial disparities impact obesity-related maternal and neonatal complications of pregnancy.

Keywords

Obesity; perinatal outcomes; race; racial disparities

Introduction

The majority of reproductive aged women in the United States are now overweight or obese [1]; and within the African-American community, over 75% of reproductive aged women have a body mass index (BMI) >25. Obesity is associated with numerous pregnancy

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complications including cesarean delivery, gestational diabetes, preeclampsia and macrosomia [2–4]. While significant racial differences have been identified in perinatal outcomes [5,6], especially in terms of birth weight [7,8], the impact of obesity on racial disparities in pregnancy outcomes is less clear.

Few studies have directly examined the relationship between obesity and race and its effect on perinatal outcomes. For example, the literature remains divided as to whether African Americans are at increased risk for preeclampsia [9–14]. Although obesity is a known risk factor for preeclampsia [15,16] and African Americans are more likely to be obese [1], only two studies on pre-eclampsia controlled for maternal obesity [17,18], both of which found no increased risk of preeclampsia for obese African Americans compared to Caucasians. Interestingly, neither study excluded or controlled for chronic hypertension, a known risk factor for preeclampsia [14,19] which is also independently associated with African-American race and obesity [14,20]. Similarly, although obesity is a clear risk factor for cesarean [4,17,21], limited studies have looked at the independent and combined impact of race and obesity on cesarean [17,18].

In order to better provide individualized perinatal risk counseling, we sought to examine the relationship between race and obesity in pregnancy outcomes. The objective of this study was to estimate (1) the impact of race on perinatal outcomes in obese women and (2) the impact of obesity on perinatal outcomes compared to normal weight women of the same racial group.

Methods

This is a population-based retrospective cohort study of all live born singleton infants ≥37 weeks gestation born to African-American or Caucasian Missouri residents between 1 January 2000 and 31 December 2006 (N = 312 412). Data were obtained from the Missouri Vital Records database. Exclusion criteria were as follows: (1) fetuses with major congenital anomalies (n = 7188) and (2) women with diabetes or chronic hypertension (n = 6004).

The primary predictors of interest were maternal race and BMI, as determined from Missouri Vital Records data. Maternal race was identified by self report on birth certificate records. Only Caucasian and African-American womenwere studied due to limited numbers of women of other races. BMI was calculated by weight in kilograms divided by height in meters squared. Obesity was defined as body mass index (BMI) ≥30 kg/m^2. Morbid obesity was defined as BMI ≥40 kg/m^2. The primary outcomes of interest were cesarean delivery, preeclampsia, macrosomia (birth weight >4500 g), low birth weight (<2500 g), and composite neonatal morbidity, which included low Apgar score (<7 at 5 min), birth trauma, neonatal infection, neonatal hypoglycemia, respiratory distress syndrome, neonatal seizures, neonatal length of stay >5 d and/or meconium aspiration syndrome.

Various maternal socio-demographic characteristics have been shown to be independently associated with maternal obesity and were evaluated as potential confounders in this study, including maternal age, education, nulliparous versus multiparous, Medicaid status, adequate prenatal care, smoking status, married versus single, prior cesarean, primary elective cesarean and infant gender. Maternal education was categorized as high, average or low, based on age and years of education [22]. Greater than 12 years of education was considered high, regardless of maternal age. The Revised Graduated Index of Prenatal Care Utilization (R-GINDEX) was used to categorize prenatal care as no care, inadequate, adequate, intermediate, intensive or missing, based on initiation of prenatal care, total number of visits and gestational age at delivery [23]. Gestational age at birth was determined by the clinical estimate of gestational age on the birth certificate [24–26]. Smoking status was determined by maternal self report on birth certificate records. Diagnoses such as preeclampsia, birth trauma or respiratory distress syndrome were obtained from either the birth certificate or hospital discharge data.

Bivariate analyses were completed using χ^2 or Fisher's exact tests as appropriate. Outcomes were assessed using Cochrane-Armitage test for linear trend and multivariable regression for adjusted risk. Multivariable logistic regressions were used to calculate adjusted odds ratios (aOR) and 95% confidence intervals (95% CI) for the associations. Regression models were adjusted for the previously described confounders. All analyses were completed using SAS version 9.2 (SAS Institute Inc., Cary, NC). Approval for human subject research and a waiver of informed consent were received from the Institutional Review Board at Saint Louis University and the Missouri Department of Health and Senior Services, Section for Epidemiology for Public Health Practice.

Results

There were 312 412 births meeting all study criteria. 27.1% (11 776) of African-American mothers and 19.1% (49 415) of Caucasian mothers were obese. In addition to BMI, there were several additional significant differences between the groups (Table 1). African-American women were more likely to be younger, have lower education levels, be single, have Medicaid support, have lower use of prenatal care and have increased severity of obesity compared to Caucasian women, who were more likely to smoke.

There were no differences in cesarean delivery (aOR 1.1, 95% CI 1.0, 1.1) or preeclampsia (aOR 1.0, 95% CI 0.9, 1.1) between obese African-American women and obese Caucasian women (Table 2). Infants of obese African-American women were significantly less likely to be macrosomic (0.9% vs. 2.2%, aOR 0.5, 95% CI 0.4 0.6) and more likely to be low birth weight (3.4% vs. 1.8%, aOR 1.9, 95% CI 1.7, 2.2) compared to infants of obese Caucasian women. African-American infants of obese mothers were more likely to have a low Apgar score at 5 min (aOR 1.5, 95% CI 1.2, 1.9), require a length of stay >5 d (aOR 1.6, 95% CI 1.6, 1.8), or have composite neonatal morbidity (aOR 1.1, 95% CI 1.1, 1.2) compared to infants of obese Caucasians. These relationships persisted for morbidly obese women with infants of morbidly obese African-American women more likely to be low birth weight, have low Apgar scores, have neonatal length of stay >5 d and have composite neonatal morbidity compared to morbidly-obese Caucasian women, who were more likely to have a macrosomic infant (Table 2).

In comparison with their normal weight peers, obese African-American and Caucasian women were at increased risk of cesarean delivery, preeclampsia, macrosomia, composite neonatal morbidity and decreased risk of low birth weight (Table 3). Only the infants of obese Caucasian women were at increased risk of birth trauma (aOR 1.2, 95% CI 1.1, 1.2) and have low Apgar score at 5 min (aOR 1.2, 95% CI 1.1, 1.4) compared to non-obese Caucasians. Compared to their normal weight peers, obese Caucasian women had a greater risk of developing preeclampsia (aOR 3.1, 95% CI 2.9, 3.2) than obese African-American women (aOR 2.1, 95% CI 1.9, 2.4).

Discussion

In contrast to earlier studies [17,18], we did not find an increased rate of cesarean delivery in obese African-American women compared to obese Caucasian women. A strength of our study was the ability to obtain statewide data rather than from a single institution. Although it is clear that socio-economic factors play a role in the incidence of cesarean section [27], our large sample size and multivariate analysis allowed us to control for many of these factors and focus on the relationship between race and obesity.

Obesity is a well-recognized risk factor for preeclampsia [11,12,15], but there are little data as to whether there is a racial difference in the prevalence of preeclampsia in obese women. Steinfeld et al. [18] reported no difference in preeclampsia rates in 168 obese women based on race. The largest study to date examined 2150 obese women in San Francisco and found no increased incidence of preeclampsia in African-American women compared to Caucasian women [17]. Interestingly, these studies did not exclude or control for chronic hypertension, which is more prevalent in African-American women and would have been anticipated to result in an increased risk of preeclampsia. After excluding women with chronic hypertension and controlling for socio-economic factors with a larger sample size and population base, we did not find a difference in the incidence of preeclampsia in obese African-American women compared to obese Caucasian women. However, we did find that obese Caucasian women had a higher risk of developing preeclampsia compared to their normal weight peers than obese African-American women compared to their peers (aOR 3.1 vs. aOR 2.1), suggesting that obesity may play a larger role in the development of preeclampsia in Caucasian women than African-American women. Additional studies are needed to further explore the relationship between race, obesity and preeclampsia.

African-American race remains a strong risk factor for decreased birth weight [7,8], regardless of maternal obesity and despite controlling for socioeconomic status. Alexander et al. used US national data to examine birth weight differences in extremely low-risk women and found that the risk for small-for-gestational age infants was 2.64 times greater in African-American mothers compared to Caucasian mothers, and that, on average, there was a 150 g birth weight difference at 38 weeks, 200 g difference at 40 weeks and nearly 250 g difference at 42 weeks with Caucasian infants persistently heavier at birth than African-American infants [7]. Similarly, Hulsey et al. found a mean birth weight difference of 214 g, of which a 100 g difference persisted after controlling for demographic factors and medical complications, resulting in 53% of the observed racial difference in mean birth weight [8]. African Americans also have lower rates of macrosomia [17]. We found that although the incidence of macrosomia increased with increasing BMI in all women, obese African-American women were significantly less likely than obese Caucasian women to have macrosomic infants. This is particularly intriguing in light of the finding that African-American women have consistently higher rates of maternal obesity [1], which is a risk factor for macrosomia. Despite these associations, no clear etiology for the persistent birth weight differences has been identified yet, leading us to speculate on possible placental differences or impact of maternal diet on fetal growth as possible contributing factors. Future studies are clearly indicated.

Although obesity was a risk factor for birth trauma and low Apgar scores for infants of Caucasian women, infants of obese African-American women were not at increased risk for these outcomes compared to their normal weight peers. However, regardless of maternal BMI and despite controlling for maternal demographic factors, African-American infants were at increased risk of composite neonatal morbidity compared to Caucasian infants. The greatest difference among the composite neonatal morbidity factors between African-American and Caucasian infants were length of stay >5 d and low Apgar scores (<7 at 5 min). We speculate that the increased incidence of low birth weight may have contributed to both of these outcomes, but additional studies would be needed. Additional confounders are also possible, such as other maternal medical conditions, postpartum/postoperative complications or substance abuse which may have contributed to increased composite neonatal morbidity.

Racial disparity was also evident in the incidence of obesity with significantly more African-American women meeting BMI criteria in all obesity categories compared to Caucasian women [2,4,28]. According to the National Health and Nutrition Examination Survey, as of 2007–2008, among African-American reproductive aged women 20–39 years old, 78.0% were overweight or obese (BMI ≥25 kg/m^2), 47.2% were obese (BMI ≥30 kg/m^2) and 15.0% were morbidly obese (BMI ≥40 kg/m^2) [29]. Compared to Caucasian women, African-American women had twice the risk of obesity (OR 2.01, 95% CI 1.76, 2.29) [30]. Salihu et al. [31] reported that the risk for neonatal mortality based on maternal obesity was significantly increased among African-American infants compared to no impact for Caucasian infants, and our results suggest that maternal obesity may contribute to some of the other disparities in neonatal morbidity. In order to improve perinatal outcomes, it is essential to address the weight inequities within the African-American community and focus on healthy preconception weight.

Limitations of this study include the use of birth certificate data, which are dependent upon the original quality of the data entered and the opportunity for misclassification. Such misclassification would generally bias any comparisons toward the null hypothesis and so any positive findings may underestimate the actual associations. Additionally, in such data the potential for undercoding remains a concern for diagnoses such as birth trauma or preeclampsia, as severe undercoding of birth trauma (5%) and minimal undercoding of preeclampsia (85%) was found in an audit of Missouri birth certificate with hospital discharge data [32]. However, there is no reason to expect that undercoding would be biased by maternal BMI or maternal race. However, patients who were not coded properly would lead to an underrepresentation of the true incidence of these conditions and thus suggesting that our estimates serve as lower rather than upper thresholds of the population risks.

These findings highlight the racial differences in perinatal outcomes in obese women despite controlling for socioeconomic factors. In order to improve maternal and neonatal outcomes, it is essential to address the impact of obesity on pregnancy with all patients, and especially those within the African-American community. In future, prospective studies are needed to further examine these findings and search for potentially modifiable factors in addition to maternal BMI that may help improve perinatal outcomes for the next generation.

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Table 1

Population characteristics.

	African American (*N* = 43 523)		Caucasian (*N* = 258 934)	
	N	**%**	***N***	**%**
Maternal age*				
<18	3573	8.2	7081	2.7
18–34	37380	85.9	223770	86.4
≥35	2569	5.9	28082	10.9
Education*				
High	14693	34.2	141541	54.9
Average	20417	47.5	84314	32.7
Low	7858	18.3	32140	12.5
Married*	9814	22.6	186461	72.0
Parity*				
0	16342	37.9	101455	39.4
1	11943	27.7	88026	34.2
2	7827	18.2	44685	17.3
≥3	6969	16.2	23571	9.2
Smoking status*				
Yes	5236	12.0	50416	19.5
No	37912	87.1	207269	80.1
Unknown	375	0.9	1249	0.5
Medicaid*	30607	70.7	99835	38.7
Prenatal care utilization*				
Missing	1558	3.8	3012	1.2
None	583	1.4	834	0.3
Inadequate	4067	9.9	8431	3.3
Adequate	16881	40.9	144024	56.4
Intermediate	14539	35.3	83134	32.5
Intensive	3612	8.8	16000	6.3
Male infant†	22050	50.7	132630	51.2
BMI(kg/m^2)*				
Underweight (<18.5)	1878	4.3	14219	5.5
Normal (18.5–24.9)	18711	43.0	137079	52.9
Overweight (25–29.9)	11158	25.6	58221	22.5
Obese (30–39.9)	9222	21.2	41143	15.9
Obese (40–49.9)	2178	5.0	7512	2.9
Obese (≥50)	376	0.9	760	0.3

*$p<0.0001$;

†$p<0.05$.

Table 2

Outcomes in obese and morbidly obese women by race.

	African-American *n* (%)	Caucasian *n* (%)	AA vs. C aOR* (95% CI)	*p*-Value
Cesarean delivery				
Obese	3 626 (30.8)	17 933 (36.3)	1.1 (1.0, 1.1)	0.216
Morbidly obese	976 (38.2)	3 747 (45.3)	1.0 (0.9, 1.2)	0.676
Operative vaginal delivery				
Obese	625 (5.3)	2 942 (6.0)	1.0 (0.9, 1.1)	0.825
Morbidly obese	139 (5.4)	451 (5.5)	1.1 (0.9, 1.4)	0.437
Preeclampsia				
Obese	859 (7.3)	3 949 (8.0)	1.0 (0.9, 1.1)	0.665
Morbidly Obese	259 (10.1)	821 (9.9)	1.0 (0.8, 1.2)	0.826
Macrosomia				
Obese	109 (0.9)	1,105 (2.2)	0.5 (0.4, 0.6)	<0.0001
Morbidly obese	42 (1.6)	250 (3.0)	0.6 (0.4, 0.8)	0.002
Low birth weight				
Obese	404 (3.4)	883 (1.8)	1.9 (1.7, 2.2)	<0.0001
Morbidly obese	82 (3.2)	169 (2.0)	1.8 (1.3, 2.4)	0.001
Birth trauma				
Obese	366 (3.1)	1 628 (3.3)	0.9 (0.8, 1.1)	0.333
Morbidly obese	83 (3.3)	291 (3.5)	1.0 (0.7, 1.3)	0.844
Length of stay >5 d				
Obese	536 (4.6)	1 423 (2.9)	1.6 (1.5, 1.8)	<0.0001
Morbidly obese	131 (5.1)	292 (3.5)	1.5 (1.1, 1.9)	0.003
Low Apgar				
Obese	111 (0.9)	298 (0.6)	1.5 (1.2, 1.9)	0.002
Morbidly obese	27 (1.1)	52 (0.6)	1.7 (1.0, 3.0)	0.047
Composite morbidity				
Obese	1 232 (10.5)	4 642 (9.4)	1.1 (1.1, 1.2)	0.001
Morbidly obese	311 (12.2)	896 (10.8)	1.2 (1.0, 1.4)	0.048

*Adjusted for maternal age, education, nulliparous versus multiparous, Medicaid status, adequate prenatal care, smoking status, married versus single, prior cesarean, primary elective cesarean and infant gender, Obese = BMI 30–39.9 kg/m^2, Morbidly Obese = BMI ≥40 kg/m^2.

Table 3

Risks of perinatal outcomes in obese women compared with normal weight women by race.

	African-American aOR* (95% CI)	Caucasian aOR* (95% CI)
Cesarean delivery	2.1 (1.9, 2.2)†	2.1 (2.1, 2.2)†
Operative vaginal delivery	0.9 (0.8, 1.0)	0.8 (0.8, 0.9)†
Preeclampsia	2.1 (1.9, 2.4)†	3.1 (2.9, 3.2)†
Macrosomia	2.5 (1.8, 3.6)†	2.6 (2.4, 2.8)†
Low birth weight	0.7 (0.6, 0.8)†	0.8 (0.8, 0.9)†
Birth trauma	1.0 (0.9, 1.2)	1.2 (1.1, 1.2)†
Length of stay >5d	1.3 (1.1, 1.4)†	1.4 (1.3, 1.5)†
Low Apgar	1.1 (0.8, 1.4)	1.2 (1.1, 1.4)
Composite morbidity	1.3 (1.2, 1.4)†	1.4 (1.3, 1.4)†

*Adjusted for maternal age, education, nulliparous versus multiparous, Medicaid status, adequate prenatal care, smoking status, married versus single, prior cesarean, primary elective cesarean and infant gender;

†*p*-value<0.0001.