Antenatal Depression and Cesarean Delivery Among Recently-Delivered Nulliparous Women in Rhode Island

NINA K. AYALA, MD; ADAM K. LEWKOWITZ, MD; ANNIE GJELSVIK, PhD; KARINE MONTEIRO, MPH; SIRAJ AMANULLAH, MD, MPH

ABSTRACT

OBJECTIVE: Antenatal depression (AD) is frequently cited as a risk factor for cesarean delivery (CD) with limited supporting data.

STUDY DESIGN: We utilized 2016–2018 data from the Pregnancy Risk Assessment Monitoring System (PRAMS) survey for the state of Rhode Island. Nulliparous women who reported AD (n=242) were compared to women who did not (n=1,081). Maternal demographics, pregnancy and delivery characteristics were compared by AD status using population-weighted bivariable analyses and multivariable logistic regression.

RESULTS: 17.7% reported AD, and 34% underwent CD. There was no difference in CD based on reported AD status (aOR 1.04; 95% CI 0.69, 1.56). However, there were significant differences between those reporting AD compared to those who did not: less education, more public insurance, use of Women, Infants and Children (WIC) benefits, tobacco use, and pre-gestational hypertension/diabetes.

CONCLUSION: In this large, population-based, state representative sample, we found no difference in CD among recently delivered nulliparous women with and without AD.

KEYWORDS: antenatal depression, cesarean delivery

INTRODUCTION

The rate of cesarean delivery (CD) across the US has risen precipitously over the last few decades, now with one in three women delivering by cesarean section.[1] CD is associated with increased maternal morbidity including hemorrhage, infection, adhesive disease, and abnormal placentation in subsequent pregnancies.[2] Recognition that prior mode of delivery is the most important determinant of subsequent mode has led to a push within the obstetric community to identify risk factors and actionable opportunities to safely prevent the primary cesarean section.[3,4]

Depression is twice as common in women than men with the peak occurring in the reproductive years[5] and has been progressively increasing over the last two decades.[6] Perinatal depression, defined as depression that occurs during pregnancy or within 1 year postpartum, is one of the most common pregnancy-associated complications, affecting one in seven women.[7] Perinatal depression is associated with adverse maternal and neonatal outcomes, including increased rates of preterm birth and small for gestational age[8], and ultimately has significant impacts on infant bonding and attachment.[9] Likewise, severe and untreated perinatal depression can have devastating effects on women, infants, and families; maternal suicide now exceeds hemorrhage and hypertensive disorders as a cause of maternal mortality.[10] Thus, there has been increasing appreciation for the importance of screening for and treating cases of perinatal depression.[7]

While many of the maternal and neonatal risks of perinatal depression have been well-characterized, much of the focus has been on the postpartum period. There is less information about antenatal depression (AD), or depression occurring during the periconceptual period or during pregnancy, and its impact on outcomes. Prior studies looking at the association between AD and mode of delivery have yielded mixed results, with some reporting increased risk for CD[11–15] and others showing no difference.[16,17] These studies have been limited by small sample size of depressed patients[14,17], inclusion of a population with mixed parity, where small differences in CD are unlikely to be detected[11,12,14,16–18] and reliance on medical claims databases.[13,15] Thus, we sought to investigate the association between AD and CD among nulliparous women within a large, population representative, modern obstetric cohort. We hypothesized that AD would be associated with an elevated risk of CD.

METHODS

The Phase 8 (2016–2018) Pregnancy Risk Assessment Monitoring System (PRAMS) database for the state of Rhode Island was utilized. PRAMS is an ongoing, state-based surveillance project of the Centers for Disease Control and Prevention (CDC) which focuses on maternal behaviors, attitudes, and experiences before, during, and shortly after pregnancy.[19,20] PRAMS consists of a questionnaire with 2 components: core questions administered by all participating states/regions and a set of state-specific questions either chosen from a list of standard items developed by the CDC

or developed by the sites themselves. The core questionnaire addresses major issues related to pregnancy, such as content and source of prenatal care, pregnancy-related morbidity, contraceptive use, and mother's health complications. Participating states use birth certificates to select a stratified random sample, which ranges annually from 1,000 to more than 3,400 women. The first study invitation and survey are mailed in the initial 2–4 months after delivery; non-respondents are followed up with additional mailings and then by telephone. Completed surveys are linked to data extracted from the birth certificate and state vital statistics records.

For the study purpose, we included nulliparous women (no prior live births) (n=1,349) who had valid data for antenatal depression and mode of delivery. The analytic sample (n=1,323) therefore excluded 1.9% of the eligible population. We opted to limit our analysis to nulliparous patients as prior mode of delivery is highly predictive of subsequent mode of delivery, and we hoped to capture differences associated with AD.

Antenatal depression (AD) was defined by the affirmative answers ('yes') to either of the following questions: "During the 3 months before you got pregnant with your new baby, did you have any of the following health conditions? – Depression" (pre-conception depression) and "During your most recent pregnancy, did you have any of the following health conditions? – Depression"(depression during pregnancy).[21] Mode of delivery was obtained from the birth certificate and was dichotomized into CD or vaginal delivery (spontaneous deliveries, forceps-assisted and vacuum-assisted deliveries).

Demographic variables analyzed included maternal age, race/ethnicity, education, health insurance status at time of delivery, marriage status and tobacco exposure during pregnancy. Age was stratified into three categories: <20 years, 20–34 years and ≥35 years. Race/ethnicity categories included Hispanic, non-Hispanic white, non-Hispanic Black, and non-Hispanic Other [American Indian/Alaskan Native, Native Hawaiian or Pacific Islander, Asian, Multiracial, Other], consistent with prior publications from PRAMS.[22] Maternal education was organized into four categories: less than high school diploma, high school diploma, some college (1-3 years) and college diploma or greater. Insurance status at delivery was stratified into private and public/governmental (Medicaid, military, Indian health service and no insurance).

Pregnancy characteristics obtained from the birth record included gestational age at delivery by best obstetric estimate[23], preterm birth (<37 weeks), neonatal birth weight, and maternal body mass index (BMI), which we categorized into 3 categories: normal weight (BMI <25), overweight (BMI 25-29) and obese (BMI ≥30). Variables obtained from the core survey included Women, Infants and Children (WIC) benefit use during pregnancy, pre-gestational and gestational hypertension and diabetes mellitus.

Statistical analyses

Analysis was performed using STATA software version 16.[24] Analysis accounted for complex survey design through application of survey weights as recommended by PRAMS to obtain population level estimates.[19,20] Outcomes were compared based on self-reported AD status. We first completed bivariable analyses comparing maternal demographic characteristics and potential confounders by AD status. All categorical variables were reported as numbers and weighted population proportions, while all continuous variables were reported as weighted population mean and standard deviation. Population weighted multivariable regression analysis was performed to assess for odds of CD based on AD status, adjusting for variables that were statistically significant in bivariable analyses and confounders that are known to be independently associated with risk for CD from prior literature. These included maternal age, race/ethnicity, education, insurance, pre-gestational hypertension or diabetes and BMI. This study was determined to be exempt by our institutional review board due to use of publicly available de-identified data.

RESULTS

During 2016–2018, an estimated 17.7% of nulliparous new mothers from RI self-reported AD. There were no differences in maternal age or race between women with and without AD (**Table 1**). However, women with AD had lower levels of maternal education (for college degree 30.6% vs 45.2%; for high school diploma 24.4% vs. 17.1%, p<0.01), were more likely to have public insurance (52.3 vs 41.6%, p<0.01), use WIC during pregnancy (50.6 vs. 36.3%, p<0.01), use tobacco during pregnancy (5.5 vs. 4.2%, p<0.01) and were less likely to be married (40.1 vs 57.0%, p<0.01).

In terms of pregnancy and delivery characteristics, women with AD were more likely to have pre-gestational hypertension (13.9 vs 1.6%, p<0.01) and pre-gestational diabetes mellitus (11.6 vs 1.0%, p<0.01), but there was no difference in rates of hypertensive disease of pregnancy or gestational diabetes (**Table 2**). There was also no difference in maternal BMI between those with AD and those without. Gestational age at delivery and birthweight was similar between groups, and there was no difference in rates of preterm birth among those with AD compared to those without.

New mothers with AD, when compared to those without, had similar proportions of CD (30.5 vs 29.6%) (**Table 3**). This translated into unadjusted odds of 1.05 (95% CI 0.74-1.47) for CD in those with AD compared to those without. When adjusted for maternal age, race/ethnicity, maternal education, insurance status, pre-gestational hypertension, pre-gestational diabetes and BMI, these odds still remained insignificant (aOR 1.04 95% CI 0.68, 1.56).

Table 1. Baseline characteristics among recently-delivered nulliparous mothers with and without antenatal depression, RI PRAMS 2016–2018.

Demographic characteristic	Antenatal depression	No antenatal depression	P-Value
Maternal age (years)			0.20
<20	28 (13.1)	86 (8.7)	
20-34	183 (75.5)	853 (79.1)	
≥35	31 (12.0)	142 (12.1)	
Maternal race/ethnicity			0.09
Hispanic	23 (10.1)	78 (6.8)	
Non-Hispanic white	162 (65.6)	622 (60.0)	
Non-Hispanic Black	11 (2.6)	66 (4.7)	
Other	44 (21.0)	309 (28.1)	
Maternal education			<0.01
Less than high school	28 (10.5)	77 (7.2)	
High school diploma	47 (24.4)	175 (17.1)	
Some college	71 (28.1)	266 (24.8)	
College degree	79 (30.6)	509 (45.2)	
Insurance			<0.01
Public	125 (52.3)	426 (41.6)	
Private	116 (47.1)	655 (58.4)	
Women Infants and Children (WIC) Benefits in Pregnancy	112 (50.6)	386 (36.3)	<0.01
Married	107 (40.1)	650 (57.0)	<0.01
Tobacco use in pregnancy	32 (5.5)	45 (4.2)	<0.01

* Columns are unweighted N and weighted %

Table 2. Pregnancy and delivery characteristics among recently-delivered nulliparous mothers with and without antenatal depression, RI PRAMS 2016–2018.

Pregnancy and delivery characteristic	Antenatal depression	No antenatal depression	P-Value
Hypertension			
Pre-gestational	36 (13.9)	26 (1.6)	**<0.01**
Gestational	30 (8.2)	157 (10.1)	0.32
Diabetes			
Pre-gestational	29 (11.6)	14(1.0)	**<0.01**
Gestational	9 (3.2)	74 (6.5)	0.23
Body Mass Index			0.06
<25	119 (51.3)	610 (57.5)	
25-29	40 (19.4)	149 (13.8)	
≥30	78 (27.0)	271 (23.7)	
Gestational age at delivery (mean, SD)	38.80 (0.1)	38.92 (0.04)	0.29
Preterm birth	62 (8.0)	268 (7.2)	0.62
Birthweight, g (mean, SD)	3255.3 (34.4)	3276.5 (14.7)	0.57

* Columns are unweighted N and weighted % unless otherwise noted

Table 3. Prevalence, unadjusted and adjusted odds ratio of cesarean delivery among recently-delivered nulliparous mothers with and without antenatal depression, RI PRAMS 2016–2018.

	Prevalence (n, weighted %)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Antenatal depression	87 (30.5)	1.05 (0.74, 1.47)	1.04 (0.68, 1.56)
No antenatal depression	363 (29.6)	1.00	1.00

** Adjusted for: maternal age, race/ethnicity, education, insurance, pre-gestational HTN or DM, body mass index

DISCUSSION

In this study, we found no association between AD and CD among recently-delivered nulliparous women in Rhode Island. These findings are supported by smaller, prospective studies out of the United Kingdom[18], United States[16] and Sweden[16] that also found no difference in adverse perinatal outcomes, including CD, among women who exhibited depressive symptoms during pregnancy. While all these studies included populations of mixed parity, authors Wu et al[17] and Larsson et al[16] still found no association between AD and CD when stratified by parity. However, the sample sizes of depressed patients in both of these studies were small (approximately 250), and thus underpowered to detect subtle differences in outcomes.

Some prior studies have found increased risk for CD among patients with depression. Most notably, Sion et al found that a pre-gestational diagnosis of depression was associated with a more than twofold increase in CD.[14] However, their cohort of depressed patients was only 0.1% of the study population; they included patients of mixed parity and the baseline rates of prior CD differed among the depressed and non-depressed group. Similarly, other studies have found an association between third trimester depression and an increased rate for emergency cesarean section[11,12], yet both included a population of mixed parity and did not present data on the distribution of prior cesarean section among the groups, potentially confounding these findings.

Most recently, two large claims-data based studies have demonstrated increased rates of cesarean delivery among parturients with AD.[13,15] The first, an analysis of the National Inpatient Sample[13], demonstrated a 5% increase in CD among those with perinatal mood and anxiety disorders. However, their analysis was limited in multiple ways: they could only capture patients whose depression was directly addressed during the index delivery hospitalization; they were not able to determine whether CD were primary or repeat; and they could not adjust for common confounders for CD. To address some of these limitations, Zochowski et al[15] performed a follow-up analysis using a large, retrospective observational cohort of administrative claims data and found that across their study period, parturients with AD

had approximately 3.5% increased likelihood of CD. While they had more robust means of capturing cases of AD prior to the delivery admission and restricted their analysis to those undergoing primary CD, they were only able to include patients with commercial insurance, and thus likely did not capture the subset of the population at highest risk for both AD and CD. Our study, instead, focuses on patient-reported experience of AD and includes a racially and socioeconomically diverse population.

Our study has some important strengths: the PRAMS database provided a large, state-representative cohort of nulliparous patients, who are the most likely to demonstrate differences in rate of CD, and those in which a CD is most likely to trickle down over time to additional morbidity. We also utilized a patient-driven report of depression, which has been shown to have higher accuracy in terms of identifying AD when compared to data obtained from medical claims datasets.[25]

Nevertheless, our study also has some important limitations to consider. First, the PRAMS database is retrospective in nature and primarily survey-based; thus, our results may be limited by recall bias. The antenatal experience of depression, in particular, may have been incorrectly classified, with postpartum mood driving inaccuracies in reporting of antenatal mood. Likewise, multiple data points are derived from the birth record, which has some inherent limitations and relies on accurate documentation at the time of delivery. While mode of delivery is reliably coded on the birth certificate[26], other data points may be less reliably collected. Additionally, some maternal and neonatal complications were not captured in this database, limiting our ability to evaluate for other perinatal complications that may be associated with AD, CD or potential confounders (i.e. small for gestational age, fetal anomalies, etc). Lastly, there was no assessment of depression control available, nor was there information about when prior to or during pregnancy depressive symptoms may have occurred, so there was no way to stratify our analysis by these characteristics.

In conclusion, while depression is frequently cited as a risk factor for CD, our data did not support an association between AD and CD among first-time mothers in Rhode Island. This is very important for reassurance of our local patients with AD, many of whom are concerned about the potential implications of depression and its treatment on pregnancy-related health for them and their offspring. These findings should be confirmed with a larger study incorporating a national cohort, to ensure these findings also apply to non-local populations.

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Authors

Nina K. Ayala, MD, Division of Maternal Fetal Medicine, Women & Infants Hospital of Rhode Island.

Adam K. Lewkowitz, MD, Division of Maternal Fetal Medicine, Women & Infants Hospital of Rhode Island.

Annie Gjelsvik, PhD, Hassenfeld Child Health Innovation Institute, Brown University; Department of Epidemiology, Brown School of Public Health.

Karine Monteiro, MPH, Rhode Island Department of Health.

Siraj Amanullah, MD, MPH, Hassenfeld Child Health Innovation Institute, Brown University;Department of Pediatrics, Department of Emergency Medicine, Alpert Medical School of Brown University; Department of Health Services, Policy and Practice, Brown School of Public Health.

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Correspondence

Nina K. Ayala, MD
Division of Maternal Fetal Medicine
Women & Infants Hospital of Rhode Island
101 Dudley Street
Providence, RI 02905
401-274-1122, x43435
nayala@wihri.org