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ABSTRACT

EXAMINING THE ASSOCIATION BETWEEN SELF-REPORTED POSTPARTUM DEPRESSION AND BREASTFEEDING HABITS OF WOMEN IN GEORGIA

By

HELINA WONDWOSSEN KETEMA

DATE : JULY 29 2019

INTRODUCTION: Breastfeeding provides several health benefits for both mother and child. Breastfed infants have a lowered risk of sudden infant death syndrome (SIDS), asthma, type 2 diabetes mellitus, respiratory tract infections and obesity. Mothers who have breastfed also have a lower risk of breast and ovarian cancer, cardiovascular diseases, hypertension and have faster pregnancy weight loss after delivery. For decades, researchers have hypothesized a link between breastfeeding and self-reported postpartum depression (PPD). However, the association remains unclear due to inconsistent findings in prior studies.

AIM: The purpose of this study is to determine whether breastfeeding initiation and breastfeeding continuation up to 8 weeks are associated with a decreased risk of self-reported postpartum depression among Georgia mothers.

METHODS: Cross-sectional data from the 2017 Georgia Pregnancy Risk Assessment Monitoring System (PRAMS) was used. All data analysis was performed in SAS 9.4 and SAS-callable SUDAAN version 11.0.1 with sampling weights to account for sampling methodology and bias. Bivariate and multivariate logistic regression models were used to examine the association between breastfeeding initiation, continuation and postpartum depression.

RESULTS: Among the 955 women who were included in this analysis, 129 (12%) of mothers reported experiencing PPD. A total of 749 (82 %) mothers initiated breastfeeding while 314 (38%) of Georgia mothers reported breastfeeding their baby for at least eight weeks; 435(43%) of mothers discontinued breastfeeding before eight weeks. Two multivariate logistic regression were performed. In Model 1 breastfeeding initiation was included as the primary independent variable and Model 2 included breastfeeding continuation as the primary independent variable. In Model 1, the only significant relationship found was between history of depression during pregnancy and PPD (OR=5.81 95% CI 2.01,16.41). In model 2, history of depression during pregnancy (OR=6.62; 95% CI 2.28,19.2) and maternal NH-Asian race (OR=5.35; 95% CI 1.15,24.9; p=0.03) was significantly associated with a increased odds of having PPD after adjusting for potential confounders.

DISCUSSION: The evidence suggests that breastfeeding initiation and continuation are not associated with postpartum depression in this sample. However, the increasing trend of PPD rate is a cause for concern. Future studies should consider data form multiple years to get a better understanding of the overall trend of PPD and understand its association with breastfeeding initiation and continuation.

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DEPRESSION AND BREASTFEEDING HABITS OF WOMEN IN GEORGIA

by

HELINA WONDWOSSEN KETEMA

B.S., GEORGIA STATE UNIVERSITY

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of Georgia State University in Partial Fulfillment

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APPROVAL PAGE

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by

HELINA WONDWOSSEN KETEMA

Approved:

Dr. ASHLI A. OWEN-SMITH
Committee Chair

Dr. DORA II'YASOVA
Committee Member

July 29th, 2019
Date

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Author's Statement Page

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Helina Wondwossen Ketema
Signature of Author

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1. INTRODUCTION

1.1 Postpartum depression (PPD)

Postpartum depression (PPD) is a clinical complication that can occur within the first year of childbirth. PPD differs from postpartum blues (“baby blues”) in that postpartum blues is a milder condition characterized by symptoms such as sadness, difficulty sleeping and crying for no reason. Approximately 70-80% of all women have experienced postpartum blues, but the symptoms are less severe and resolve within fourteen days after delivery (Anderson, 2017). Unlike PPD, postpartum blues do not interfere with daily activities or require medical attention. However, if symptoms persist for more than two weeks, it can progress to a serious case of postpartum depression. A recent report by the Center for Disease Control and Prevention (CDC) showed that 11.5% of all mother’s experience postpartum depression in the United States (Ko et al., 2017). Some of the symptoms associated with PPD are extreme sadness, hopelessness, insomnia, lack of appetite, difficulty concentrating, crying, lack of interest in the baby or lack of bonding, feeling of being a bad mother and fear of harming the baby or oneself.

Postpartum depression can interfere with the mother-child relationship. Prior studies suggest that mothers who experience PPD can have difficulties establishing a bond with their child (Dubber et al., 2015; Reck et al., 2016; S. Hairston et al., 2018). Most mothers report having trouble soothing, showing affection, talking, or singing to their child (Rosie et al., 2018; Surkan et al., 2016). Insufficient mother-child bonding can significantly impede the development of the child. Researchers recognized that infants of mothers with PPD were less responsive to faces and voices (Field et al., 2009), socially withdrawn (Burtchen et al., 2013) and had a significantly low expressive language development (Sona-Sanae et al., 2019). PPD triggered

maternal distress can also affect the well-being of the father. Several studies have identified maternal PPD as one of the strongest predictors of paternal PPD (Goodman, 2008; Paulson et al., 2010). Fathers who had a partner with PPD were 2.5 times more likely to be depressed at six weeks postpartum (Matthey et al., 2000).

According to the 2016 America's Health Ranking report, 8.4% of Georgia mothers experienced PPD (n.d.). What causes postpartum depression is still unclear; however, several studies have identified some predictor variables. History of depression during pregnancy was found to be the most important predictive factor by multiple studies (Underwood et al., 2017). Other predictors reported, including pregnancy intention, social support, and stressful life events were shown to be associated with PPD as well (Dagher & Shenassa, 2012; Howard et al., 2014). In general, the literature showed mothers with PPD were most likely to be younger, non-Hispanic black, high school education or less, low-income, and unmarried (Beck, 2001; Hein et al., 2014; Lancaster et al., 2010; O'Hara & McCabe, 2013).

1.2. Breastfeeding

Breastfeeding provides newborn babies with the necessary nutrients needed for healthy growth and development. Studies have shown that infants who were breastfed had a lower risk of sudden infant death syndrome (SIDS), asthma, type 2 diabetes mellitus, respiratory tract infections, and obesity (Dieterich et al., 2013). Additionally, breastfeeding has several health benefits for mothers, including a lower risk of breast and ovarian cancer, cardiovascular diseases, hypertension, and provided faster pregnancy weight loss after delivery (Eidelman & Schanler, 2012).

According to the American Academy of Pediatrics, mothers are recommended to exclusively breastfeed for the first 6 months with continued feeding for at least a year (Faucher, 2012). In 2015, CDC's breastfeeding report card showed 4 out of 5 (83.2%) mothers in the US reported ever breastfeeding while slightly over half (57.6%) continued breastfeeding through 6 months period. Even though the Healthy People 2020 goal of breastfeeding initiation (81.9%) has been successfully achieved, the rate of breastfeeding continuation (60.6%) has still fallen short of the goal(CDC, 2019). Some of the factors that affect breastfeeding initiation and continuation rates include maternal age, race/ethnicity, educational level, access to health care or WIC, previous live birth, type of delivery, stressful life events, and social support(Wouk, Stuebe, & Meltzer-Brody, 2017).

1.3 Study Aim and Research Question

For decades, researchers have hypothesized a link between breastfeeding and postpartum depression. But, because of the inconsistent results of previous studies, the association remains unclear. The thesis aims to determine the association between breastfeeding initiation, breastfeeding continuation, and self-reported postpartum depression among Georgia mothers. Specifically, the research question are as follows:

- 1) What are the rates of breastfeeding initiation, breastfeeding continuation, and postpartum depression among Georgia mothers?
- 2) What is the association between breastfeeding indicators and postpartum depression after adjusting for potential confounding variables?

2. LITERATURE REVIEW

2.1 Factors Associated with PPD

The differences in PPD rates among racial/ethnic groups were examined using the 2007-2008 Massachusetts PRAMS data (Faucher, 2012). This study included mothers of White (N=1043), Black (N=1027), Asian/Pacific Islander (N=425), and Hispanic (N=1253) racial backgrounds. The rate of PPD was measured using the question that asked “*Since your new baby was born, how often have you felt down, depressed, or hopeless?*” and “*Since your new baby was born, how often have you had little interest or little pleasure in doing things?*”. The responses were indicated by “always,” “often,” “sometimes,” “rarely,” or “never,” The result showed that mothers who were Asian pacific islander or Hispanic had significantly higher rates of PPD symptoms after adjusting for maternal age, education, household income, pregnancy intention, gestational diabetes, and infant NICU stay. This study also identified other predictive factors that contribute to the increased prevalence of PPD. The study showed that African American and Hispanic mothers who reported high financial stress were significantly associated with a higher risk of PPD.

A cross-sectional study by Salm et al. (2017) explored the association between stressful life events and postpartum depression among Georgia mothers (N=10293) using 2004-2011 GA-PRAMS. Stressful live events were measured using thirteen yes/no questions regarding events that may have happened during the 12 months before delivery. These events include emotional stress, partner or relational stress, and financial stress. This study concluded that mothers who reported a high number of stressful life events had higher odds of postpartum depression. Mothers who experienced six or more stressful life events have 5.77 times higher odds of

experiencing PPD (95 % CI 3.89, 8.55) compared to those who have not experienced any stressful events during pregnancy. This study also found a significant association between lower educational level and increased odds of PPD (OR=1.70; 95% CI 1.13,2.54) when compared to mothers who had a college education or higher.

Suh et al. (2016) examined the association between pregnancy intention and PPD symptoms among 5,549 parents that participated in the 2000-2003 Louisiana PRAMS. Pregnancy intention of mothers was measured using the survey question that asked “Thinking back to just before you got pregnant, how did you feel about becoming pregnant?” Responses were categorized into intended, unintended, mistimed, and unwanted pregnancies. Mothers who had a mistimed or unwanted pregnancy were significantly associated with higher odds of experiencing PPD (OR= 1.76, 95 % CI 1.23, 2.53).

Vaezi et al. (2019) investigated the role of social support on the development of PPD in a clinical setting. This cross-sectional study enrolled 200 women from 3 large teaching gynecology and children hospitals in Tehran, Iran. In this study, PPD was measured using the Edinburgh Postnatal Depression Scale (EPDS>12), and social support was measured by the social support questionnaire (SSQ) tool. The general prevalence of mothers enrolled in the study was 43.5%, which was significantly higher than the global average of 10-15%. However, the authors attribute the high incidence rate to the variations in EPDS cut-off points, or PPD assessment tools used when compared to previous literature findings. This paper concluded that mothers who had sufficient social support had a lower risk of PPD after adjusting for history of depression, illness of baby and medication consumption during pregnancy (OR = 0.47, 95% CI = 0.33,0.67).

A prospective longitudinal study by Mohamad et al. (2015) investigated the association between PPD and depression during the antenatal period. The study recruited mothers (N= 2072) from five health clinics in Kota Kinabalu and Penampang Districts of Sabah, Malaysia between 2009 to 2010. Postpartum depression was measured using the Edinburgh Postnatal Depression Scale (EPDS) with a cut-off score greater than 12. The study showed that women who experienced antenatal depression had 3.7 times the odds of PPD (95% CI 2.46, 5.60) compared to mothers who have not had any history of depression during the pregnancy period.

2.2 Breastfeeding and Postpartum Depression

Yonkers et al. (2001) examined 802 women who came for an initial postpartum appointment at four inner-city maternal-health clinics in Dallas. The prevalence of depressive symptoms during the postpartum period was found to be between 6.5% and 8.5%. Mothers who bottle-feed had higher odds of PPD compared to mothers who breastfed. Similarly, unmarried women showed had increased odds of reporting PPD symptoms compared to mothers who were married. Women who reported any breastfeeding up to three weeks after childbirth were significantly associated with reduced odds of depressive symptoms (OR: 0.60; 95% CI: 0.44,0.81; $p=0.008$). However, the association was not significant among mothers who breastfed their child up to 6 weeks.

Hatton et al. (2005) examined the relationship between breastfeeding and PPD at 6 weeks and 12 weeks after delivery. The study recruited 377 participants from a Calcium for Preeclampsia Prevention (CPEP) trial. The participants were asked to complete a brief survey and the Edinburgh Postnatal Depression Scale ($EPDS \geq 13$) 6 weeks postpartum. After controlling for age, income, education, race, and history of depression, PPD was significantly lower among

those who were breastfeeding at six weeks but not significantly associated with mothers who breastfed up to 12 weeks postpartum. Mothers who discontinued breastfeeding had more depressive symptoms (EPDS ≥ 15) compared to mothers who continued breastfeeding upto 12 weeks postpartum.

Watkins et al., (2011) examined the association between early breastfeeding experiences and postpartum depression using the Infant Feeding and Practices Study II longitudinal data. The study included 2,586 mothers who completed the 2-month Edinburgh Postnatal Depression Scale (EPDS >12) questionnaire. Mothers who reported having a negative experience while breastfeeding in the first week had increased odds of PPD at two months (OR=1.42; 95%: 1.04-1.93) after controlling for maternal age, parity, education, ethnicity, and WIC participation. The study also found that mothers who reported PPD symptoms were most likely to discontinue breastfeeding at two months postpartum (p=0.03).

Ystrom, (2012) conducted a longitudinal cohort study of 42,225 women using the Medical Birth Registry and questionnaires in Norway. They examined whether breastfeeding cessation was associated with a higher risk of postpartum depression at six months. After adjusting for anxiety and depressive symptoms during pregnancy, they found that any breastfeeding ($\beta=0.04$ CI: 0.02-0.07) and formula feeding ($\beta=0.11$ CI: 0.09-0.14) were associated with increased risk of both postpartum anxiety and depressive symptoms.

Borra et al., (2015) investigated the association between breastfeeding intention and postpartum depression among 14,000 parents that participated in the Avon Longitudinal Survey of Parents and Children (ALSPAC) survey in the early 1990's England. The EPDS tool was used to screen for PPD with a cut-off of EPDS >12 . During pregnancy, parents were asked about how they intended to feed their babies for the first month. The results from a multivariate regression

model showed a decreased risk of PPD if mothers intended to breastfeed whereas for mothers who did not plan or initiate breastfeeding in the first month there was an increased risk of PPD.

Woolhouse et al., (2016) recruited 1258 women from six metropolitan public hospitals in Melbourne Australia to determine the relationship between PPD at three months postpartum and breastfeeding up to 6 months. The study used the Edinburgh Postnatal Depression Scale (EPDS >13) tool at the baseline and 3 months. The women were asked three questions including “did you breastfeed your baby or give breastmilk?” if they answered yes were asked ‘are you still breastfeeding your baby?’ and if they answered no they were asked, “if you have stopped, how old was your baby when you stopped?”. The majority of the women (94%) reported initiating breastfeeding. However, 40% of all mothers who reported initiating breastfeeding reported no breastfeeding at six months postpartum. Mothers who reported having PPD symptoms had a significantly low breastfeeding rate at six months (OR = 0.55; 95% CI 0.34, 0.90) after adjusting for maternal age, maternal country of birth, education level, employment status and maternal smoking status in early pregnancy.

Some biological mechanisms were proposed to explain the association between postpartum depression and breastfeeding. Past studies have shown breastfeeding may have a role in stress reduction, which results in a protective effect on postpartum depression (Kendall-Tackett, 2007). A 2015 study by Ahn & Corwin (2015), explored the relationship between breastfeeding and postpartum depressive symptoms by looking at stress responses and levels of pro-inflammatory cytokines. This longitudinal study recruited 119 women from prenatal clinics and the community. Data collection occurred during the 3rd trimester, at seven days postpartum and months 1,2,3 and 6. Women were asked to complete stress and depression questionnaires. Blood and saliva samples collected were used to analyze levels of cortisol, pro, and anti-

inflammatory cytokines. The results show that women who exclusively breastfeed had decreased level of pro-inflammatory markers and increased level of salivary cortisol but showed no significant association with levels of depressive symptomatology 1,2,3 and 6 months postpartum.

A recent study by Wouk et al., (2017) examined the link between postpartum depression and anxiety symptoms and breastfeeding. The study used the 2010-2011 Pregnancy Risk Assessment Monitoring System (PRAMS) data from New York City and the 29 states who had available data. Multivariate logistic regression was performed on a stratified random sample of 74,429 U.S. mothers where variables such as age, race/ethnicity, marital status, pregnancy intention, income, infant admission to NICU, type of delivery, prenatal care, stressful life event, and partner abuse was included in the model. About 13.4 % of participants reported having health care check-ups for anxiety and depression symptoms (OR=0.61;95 % CI 0.56, 0.67). Overall, the study showed that mothers who experienced PPD or anxiety symptoms had lower odds of any and exclusive breastfeeding up to 3 months postpartum (OR=0.79;95 % CI 0.70, 0.88) after adjusting for maternal race/ethnicity and marital status.

However, some studies report a null association between breastfeeding and postpartum depression. Triviño-Juárez et al., (2016) conducted a longitudinal prospective study of mothers (N=364) who gave birth at a public hospital in Madrid, Spain. The study examined the differences in quality of life among mothers by the type of infant feeding behaviors. The study found that at the sixth week postpartum, women in the breastfeeding group reported better mental health than those in the artificial milk feeding group, although this difference was no longer statistically significant after controlling for the other variables in the multivariate analysis. Similarly, Pope et al., (2016) Conducted a retrospective cross-sectional study of 6421 Canadian mothers who completed the survey Canadian Maternity Experiences Survey. The study

examined breastfeeding cessation and risk for postpartum depression. A correlational (Pearson product-moment) as used to test linear association between breastfeeding duration and high EPDS scores. The study result failed to support findings of previous literature that showed significant association between breastfeeding initiation and PPD. After controlling for confounders, the association between breastfeeding intention, initiation or duration and PPD was statistically insignificant.

2.3 Study Rationale

The purpose of the current study is to examine the overall prevalence of PPD amongst Georgia mothers as well as see how it relates to breastfeeding initiation and continuation rates. To our knowledge this is the first study that used the 2017 PRAMS data to examine this association. The results can inform public health policy to support existing programs or serve as a community needs assessment for new program in the state of Georgia

3. METHODS

3.1 Data sources.

This cross-sectional study was conducted using the 2017 Georgia Pregnancy Risk Assessment Monitoring System (PRAMS) data. PRAMS is a population-based surveillance system that was developed in 1987 by the Center for Disease Control and Prevention (CDC) in collaboration with state health departments. This surveillance system aims to collect state specific information on maternal health behaviors and experiences that happen before, during and shortly after pregnancy. Currently, forty-seven states participate including Puerto Rico, District of Columbia and the Great Plains Tribal Chairmen’s Health Board (GPTCHB). The data collected by the PRAMS surveillance is representative of 83% of all live births in the United States (CDC, 2018).

3.2 Data Collection.

PRAMS data is derived from combining birth certificate data, questionnaire data and operational data. The combination of the three data sources are used to create the final weighted PRAMS dataset. Every month, a stratified random sample of 100 to 200 Georgia mothers with live-born infants get selected from the birth certificate data (Georgia Department of Public Health, 2017). Participating mothers are asked to complete the Georgia PRAMS questionnaire through either mail or telephone interview or both 2-4 months after delivery. The 2017 Georgia PRAMS Phase-8 survey contains 79 “core” question (questions included on all states’ surveys) and 12 additional supplementary questions focused on Zika virus (Appendix). Phase-8 “core” questions addressed topics such as alcohol and cigarette use, physical abuse, contraception,

prenatal care, maternal stress, health insurance coverage, oral health, breastfeeding and maternal mental health. Georgia PRAM also provided both English and Spanish versions of the survey.

3.4 Measures

Dependent Variable. The outcome of interest of this study was self-reported postpartum depression (PPD) among Georgia mothers. Two questions were used from the Phase-8 PRAMS survey that were shown to be an adequate screening instruments for detecting PPD (Davis et al., 2013; Sidebottom et al., 2012). The first question used asked, “*Since your new baby was born, how often have you felt down, depressed, or hopeless?*”. The second question asked, “*Since your new baby was born, how often have you had little interest or little pleasure in doing things?*”. Both questions had 936 (98%) respondents. The answers available for both questions were: “Always”, “Often”, “Sometime”, “Rarely” and “Never”. The questions were recoded into dichotomous variables such that the participants who responded with “Always” or “Often” to either question were recoded as having PPD while participants who responded “Sometimes”, “Rarely” or “Never” to both questions were recoded as not having PPD.

Independent Variable. The primary independent variables were breastfeeding initiation and continuation of Georgia mothers. PRAMS survey data were collected at various time points (2-4 months postpartum). To allow every woman with equal chance of breastfeeding time, the cutoff for breastfeeding was assigned to be 8 weeks postpartum. Breastfeeding initiation was based on the survey question “*Did you ever breastfeed or pump breast milk to feed your new baby even for a short period of time?*” To assess breastfeeding continuation, we analyzed the question that asked, “*Are you still breastfeeding or feeding pumped milk to your new baby?*” The cutoff time for breastfeeding continuation was decided according to the PRAMS survey mailing

timeline of two to four month after delivery. Mothers who answered “Yes” to the breastfeeding continuation question were considered having breastfed 8 weeks or more, while those that answered “No” were considered to have breastfed for less than 8 weeks.

Covariates. The following covariates were included based on what previous literature suggests are potential confounders in the relationship between breastfeeding and postpartum depressive symptoms. Variables from birth certificate data included:

- *Maternal age:* used in the analysis as continuous variable. The age of participants was normally distributed where the youngest mother being 15 and the oldest 46.
- *Maternal race/Ethnicity:* variables were coded in four groups: NH white, NH black, NH Asian, NH others and Hispanic.
- *Maternal Education:* Educational attainment was categorized into three groups. Mothers who had high school education or less, some college education and bachelor’s degree or higher.
- *Marital Status:* Based on the birth certificate data, marital status was dichotomized into married or other.
- *Health Insurance:* Access to health insurance was categorized into three: private, public and others.
- *Previous Live Birth:* Mothers were asked “*Before you got pregnant with your baby. Did you ever have any other babies who were born alive?*”. The responses were dichotomized into a “Yes/No” categories in the analysis.
- *Pregnancy Intention:* Pregnancy intention was coded based on the GA- PRAMS question “*Thinking back to just before you got pregnant with your new baby, how did you feel about becoming pregnant?*”. The available responses were “I wanted to be pregnant sooner”, “I

wanted to be pregnant then”, “I didn’t want to be pregnant then or anytime in the future” or “I wasn’t sure what I wanted”. Based on the literature review, pregnancy intention was recoded into four categories (Chisolm et al., 2014; Terplan et al., 2014). The pregnancy was considered “Intended” if participants responded that they wanted to be pregnant “Sooner” or “Then”; the pregnancy was considered “Mistimed” if the participants responded that they were not what they wanted; and the pregnancy was considered “Unwanted” if participants responded that they didn’t want to be pregnant then or anytime in the future.

- *Stressful Life Events:* Stressful events in the PRAMS Survey included four major categories including emotional, financial, partner associated and traumatic events. Some of the options listed in the survey were stress associated with sick family member, death in the family, arguments with husband, divorce, homelessness, loss of income and partner getting incarcerated. These were then recoded to indicate how many of these stressors’ mothers experienced during the perinatal period. Based on the participants response, the four categories created were “No stressful events”, “1-2 stressful life events”, “3-5 stressful life events” and “6 or more stressful life events”.
- *History of Depression:* Previous history of depression was measured using two questions. To assess history of depression before pregnancy, the question that asked, “*During the 3 months before you got pregnant with your new baby, did you have any of the following health conditions?*” was used in the analysis. To examine experiences of depression during pregnancy, the question that asked, “*During your most recent pregnancy, did you have any of the following health conditions?*” was used in the analysis. Specifically, participants

were given response options which included gestational diabetes, high blood pressure and depression.

3.3 Statistical Analysis.

This study used SAS version 9.4 (SAS Institute Inc., Cary, NC) and SAS-callable SUDAAN version 11.0.1 (RTI International, Research Triangle Park, NC) to manage the complex weighted PRAMS data. Descriptive statistics were calculated on the study population to evaluate differences and identify potential confounders. A weighted bivariate analysis of was performed with a Chi-squared test (χ^2) and a 95% CI to test for significance. A step-wise regression was conducted during the model building process to determine which variables to include in the final models. Two separate multivariate logistic regression model were constructed to determine the independent relationship between PPD and breastfeeding habits (initiation/continuation) of Georgia mothers. Both crude and adjusted odds ratio were calculated after controlling for potential confounding variables that were identified in the literature review. A collinearity procedure was also performed to ensure that there was no correlation (correlation <0.90) amongst each the covariates in the model.

Human Subject Research. This data used was provided by Georgia Department of Public Health without any personal identifiers. This research project was conducted in accordance with ethical principles and was revied by the Georgia Department of Public Health and Georgia State university Institutional Review Boards.

4. RESULTS

4.1 Descriptive statistics

Demographics and other predictors: The 2017 GA-PRAMS data was summarized by running a descriptive statistic (See Table 1). The overall sample size of this study was 955 mothers with mean age of 29 (SD= 68.5). About 355(50%) of participants were NH-White, 414(40%) NH-Black, 25(3.7%) NH-Asian and 130(16%) were Hispanic descent. Majority of the mothers had a high school education or less 42%, 23% had some college education and 35% reported having a bachelor's degree or higher. More than half (60%) reported being married, had previous live birth (60%) and had vaginal delivery (69%). About 42% of Georgia mothers had access to private health insurance, 48% had public insurance and 10% had others. Among the births in 2017, 56% of the pregnancies in were intended, 20% were mistimed, 8% were unintended while 15% of mothers were not sure if they wanted to be pregnant. During the perinatal period, 41% mothers experienced one or two stressful life events, 36% reported not experiencing any stressful event, 18% reported experiencing three to five stressful life events while only 4% of mothers experiencing more than six stressful life events. *Breastfeeding Indicators:* 82 % of mothers initiated breastfeeding while 14% reported never initiating breastfeeding. Two fifths (38%) of Georgia mothers breastfed their baby for at least eight weeks while 43% of mothers discontinued breastfeeding before eight weeks. *Depression Indicators:* 8% of mothers reported having depressive symptoms three months before pregnancy while 92% have not experienced any depressive symptoms before pregnancy. The same was number for mothers reported feeling depressive symptoms during the pregnancy period (8%). Overall, 12% of mother's reported experiencing PPD while 85 % had no signs of PPD after the birth of their

child. PRAMS survey also asked if any of the mothers who experienced depressive symptoms sought counseling services after childbirth and only 11% have utilized such services.

4.2. Bivariate Logistic Regression

Bivariate analysis of maternal characteristics by postpartum depression is detailed in Table 2. Breastfeeding initiation rates were higher among those who had PPD symptoms (87%) compared to those who did not have PPD symptoms (85%) however, the chi-square test was statistically insignificant ($p=0.7$). Mothers who report having PPD symptoms were more likely to have discontinued breastfeeding before eight weeks postpartum (61.8%) when compared to those who continued breastfeeding up to 8 weeks (38%). In general, those who reported having PPD symptoms were between the ages of 15 to 46 (mean: 29; SD= 69), 47(33%) NH-White, 63(47%) NH-Black, 4(7%) NH-Asian, 5(6.1%) NH- other and 8(5.9%) Hispanic. Race/ethnicity was shown to be a statistically significant predictor of PPD ($\chi^2 = 23.55$; $p=0.02$). About half of the mothers who reported having PPD symptoms had a high school education or less 63(50.2%), were married 66(55.8%), used public health insurance 78(46.7%) and had an intended pregnancy 58(48.9%). Among all PPD cases, 34% reported having one to two stressful life events during pregnancy, while only 8% of cases reported experiencing more than six stressful life events. Among mother who had depressive episodes before pregnancy, 12% reported symptoms of PPD compared to those who did not have any depression before pregnancy (88%). Having PPD symptoms was significantly associated ($p=0.001$) with those who had a history of depression during pregnancy (21%) when compared to those who did not have depression during pregnancy (6.1%). Mothers who did not experience PPD symptoms were most likely NH-White (43%),

married (60%), had an intended pregnancy (58%), experienced 1-2 stressful life events (43%) and (93%) had no previous history of depression before or during the pregnancy.

4.3. Multivariate Logistic Regression of PPD by Predictors

Two adjusted multivariate logistic models were fit as show in Table 3. Model 1 included breastfeeding initiation measure as the primary independent variable whereas in Model 2 included breastfeeding continuation as the primary independent variable. Both models were adjusted for maternal age, race/ethnicity, education, marital status, health insurance pregnancy intention, stress, history of depression before and during pregnancy.

The association between breastfeeding initiation and PPD: In multivariate model, breastfeeding initiation was not significantly associated with PPD (OR=1.54; 95% CI 0.64,3.74; p=0.34). However, the odds of experiencing PPD was 5.8 times higher among those mothers who had history of depression during pregnancy (95% CI 2.01,16.41; p=0.001) when compared to those who did not have any depression during pregnancy. After controlling for all other predictor variables, race/ethnicity did not have a significant association with PPD in the multivariate analysis. Similar to the unadjusted bivariate model, predictors including maternal age, education, marital status, type of health insurance, pregnancy intention, stress and history of depression before pregnancy were not significantly association between PPD.

The association between breastfeeding continuation and PPD: In this multivariate model, breastfeeding continuation was not significantly associated with self-reported PPD (OR=0.59; 95% CI 0.26,1.38; p=0.22). Having a history of depression during pregnancy was associated with increased odds of having PPD (OR=6.62; 95% CI 2.28,19. 2; p<0.001).

Multivariate model the odds of having PPD was 5.4 times higher among mothers who were NH-

Asian (95% CI 1.15,24.9; p=0.03) when compared to mothers who were NH-White. Similar to model one and unadjusted bivariate model, the predictor variables maternal age, education, marital status, health insurance, pregnancy intention, stress, history of depression before pregnancy were not significantly associated with PPD.

5. DISCUSSION

5.1 Overview of Findings

One of the aims of this study was to find the prevalence of PPD using the 2017 GA-PRAMS data. We found out that 12.1% of Georgia mothers reported experiencing PPD symptoms. This finding is consistent with the national prevalence estimate of 12.8% however there is a significantly increased since 2013 9.2% (CDC, 2018b). The second aim of this study was to identify the rates of breastfeeding initiation and continuation in Georgia. Breastfeeding initiation rate among Georgia mothers was found to be 82% which meets the Healthy People 2020 goal of 81.9% (CDC,2019). This finding encouraging for public health agencies and policy makers to continue supporting breastfeeding initiatives in the state of Georgia. Our study found that about 43% of mothers discontinue to breastfeed before reaching 8 weeks. Understanding the current prevalence will be beneficial in assessing the needs and creating programs that promote continued breastfeeding in Georgia.

The current study also examined the association between breastfeeding and PPD prevalence in Georgia. We found no significant association between breastfeeding initiation or continuation and PPD even after controlling for maternal age, race/ethnicity, education, marital status, health insurance pregnancy intention, stress and history of depression. This finding was consistent with prior studies by Yonkers et al.,(2001) which showed insignificant association between PPD and breastfeeding continuation at 8 weeks postpartum. Additionally, Chaudron et al., (2001) also showed that the risk of postpartum depression was the same regardless of the breastfeeding status of the mother. In the both regression model analysis, history of depression was shown to be the strongest predictive factor associated with PPD even after controlling for confounding variables. In the model that measures breastfeeding initiation, PPD was 5.8 times

higher among those mothers who had history of depression during pregnancy. Whereas in the model that measured breastfeeding continuation rate at 8 weeks, the odds of PPD was 6.6 times higher among those mothers who had history of depression during pregnancy compared to mothers who had no depression before. This finding is supported by previous studies that's showed strong association between history of depression and increased risk of PPD (Hatton et al., 2005; Mohamad Yusuff et al., 2015; Wouk et al., 2017). In the multivariate model we also found out that mothers who were NH- Asian had significantly higher odds of having PPD symptoms compared to NH-White mothers. This finding is also supported by previous study conducted by Liu & Tronick, (2013) who reported higher percentage of PPD among Asian, pacific Islander and Hispanic mothers. This finding suggests that Georgia needs to focus on supporting mothers in minority communities as they are vulnerable for PPD. Finally, showed no association between maternal age, education level, marital status, health insurance, pregnancy intention, stressful life event and history of depression before pregnancy and postpartum depression.

5.2 Strengths and Limitations

The strengths of using PRAMS data is that minority populations are oversampled and weighted to provide a good sample size for extensive analysis. For this reason, PRAMS data can be generalizable and accurately represents the characteristic of Georgia mothers. Despite the strength of using PRAMS data, there are some limitation that need to be considered. Firstly, this study is a cross-sectional study making it impossible to draw causal inference. Secondly this study is subject to systematic bias. PRAMS survey measures breastfeeding behaviors as well as feelings associated with postpartum depression by asking mothers to recall as far as a year back. Asking mothers about their breastfeeding habits or their mental health status since child birth can

result in mothers not being forthcoming and just giving answers that may be socially acceptable. Especially if mothers are having a difficult time breastfeeding or having depressive symptoms, they might not be willing to disclose their true experience out of the fear of social stigma. Since our study is relying on self-reported data, we have to consider potential impact on the study validity. For this reason, it is important to recognize that the finding should not be generalized outside of this our study population. In addition to response bias, there is a potential for selection bias in this study. We should not ignore the possibility that mothers who chose to complete the PRAMS survey could have fundamental differences from mothers who were willing to complete the survey. Misclassification is also a potential limitation to consider as we have recategorized some of the predictive variables such as pregnancy intention, stressful life events, type of health insurance. Lastly, the measure used to define the outcome of interest only used two questions which is shown to be less sensitive tool when compared to the Edinburgh Postnatal Depression Scale (EPDS) or the Patient Health Questionnaire (PHQ-9) (Davis et al., 2013; Sidebottom et al., 2012).

5.3 Future Studies

Future studies should consider doing a needs assessment to examine factors contributing to the increased prevalence of PPD in GA since 2013. There are several factors that contribute to breastfeeding and postpartum depression that are not explored by GA-PRAMS survey questions. For example, Watkins et al., (2011) found negative experiences while breastfeeding to be associated with increased risk of PPD. Exploring these factors including breastfeeding support, cultural practice and beliefs and anti-depressant utilization can give us a better understanding of the association between PPD and breastfeeding. Sample size was one of the limitations of this

study so future researchers can further expand this study to include data from multiple year aswell as consider PRAMS data from other states can increase the generalizability of the findings. While expanding this study, researchers could consider using the Edinburgh Postnatal Depression Scale (EPDS) in addition to the two-question offered in PRAMS questionnaire.

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8. APPENDEX A

Table 1. Maternal sociodemographic characteristics and health behaviors of study sample, Georgia PRAMS 2017 (N= 955)

Characteristics	N (%) / Means (SD)
<i>Socio-Demographics</i>	
Maternal Age (years)	(28.7, 68.5)
Race/Ethnicity	
NH-White	335(49.9%)
NH-Black	414(40.4%)
NH-Asian	25(3.7%)
NH-Other	25(3.7%)
Hispanic	130(16.3%)
Missing	6(1.0%)
Education	
Highschool or Less	414(41.5%)
Some College	250(22.8%)
Bachelor's or Higher	285(35.1%)
Missing	6(0.5%)
Marital Status	
Married	549(60.1%)
Other	406(39.9%)
Health Insurance	
Private	381(42.4%)
Public	506(47.6%)
Other	68(10%)
<i>Pregnancy and Birth Outcomes</i>	
Previous Live Birth	
Yes	595(60.0%)
No	358(39.8%)
Missing	2(0.1%)
Pregnancy Intention	
Unwanted	88(8.3%)
Mistimed	174(20.1%)
Intended	497(56.2%)
Not Sure	182(14.6%)
Missing	14(0.8%)
Type of Delivery	
Vaginal	540(69.0%)
Cesarean	414(31.0%)
Missing	1(0.01%)
Stress	

No Stressful events	319(35.9%)
1-2 Stressful events	391(41.0%)
3-5 Stressful events	189(18.1%)
6 or more Stressful events	44(3.9%)
Missing	12(1.2%)
<i>Breastfeeding Indicators</i>	
<u>Ever Breastfed</u>	
Yes	749(81.7%)
No	170(14.2%)
Missing	36(4.1%)
<u>Still Breastfeeding</u>	
Yes	314(38.3%)
No	435(43.4%)
Missing	206(18.3%)
<i>Depression Indicators</i>	
<u>Depression Before Pregnancy</u>	
Yes	102(7.8%)
No	850(91.9%)
Missing	17(1.6%)
<u>Depression During Pregnancy</u>	
Yes	106(8.3%)
No	832(90.1%)
Missing	17(1.6%)
<u>Postpartum Depression</u>	
Yes	129(12.1%)
No	806(85.1%)
Missing	20(2.8%)

Table 2. Bivariate evaluation of Postpartum Depressive Outcomes by Maternal Characteristics.

Variables	Mothers with PPD (N=129) ^A N (%) /Means (SD)	Mothers W/o PPD (N=806) ^A N (%) /Means (SD)	Test Statistics	P-value
Maternal Age	29(69)	29(66)	t= 0.46	0.64
Race/Ethnicity				
NH White	47(33.4%)	302(43.2%)	$\chi^2 = 23.55$	0.02*
NH Black	63(47.4%)	341(31.8%)		
NH Asian	4(7.2%)	20(3.8%)		
NH Other	5(6.1%)	19(3.3%)		
Hispanic	8(5.9%)	120(18.0%)		
Education				
< Highschool	63(50.2%)	342(40.2%)	$\chi^2=4.20$	0.37
Some College	32(19.4%)	209(1.9%)		
> Bachelor's	34(30.4%)	249(36.7%)		
Marital Status				
Married	66(55.8%)	470(60.2%)	$\chi^2=0.85$	0.39
Other	63(44.2%)	336(39.8%)		
Health Insurance				
Private	41(40.0%)	335(43.8%)	$\chi^2=3.20$	0.47
Public	78(50.9%)	414(46.7%)		
Other	10(13.1%)	57(9.5%)		
Pregnancy Intention				
Unwanted	17(7.8%)	70(8.7%)	$\chi^2=12.42$	0.11
Mistimed	23(18.9%)	148(20.6%)		
Intended	58(48.9%)	432(58.3%)		
Not Sure	30(24.4%)	143(12.4%)		
Stress				
No Stressful Event	33(32.6%)	281(36.3%)	$\chi^2=11.2$	0.15
1-2 Stressful Event	44(33.7%)	344(42.9%)		
3-5 Stressful Event	36(26.1%)	150(17.3%)		
6 + Stressful Event	15(7.6%)	29(3.5%)		
History of Depression (Before pregnancy)				
Yes	29(12.1%)	68(6.7%)	$\chi^2=4.28$	0.14
No	99(87.9%)	736(93.3%)		
History of Depression (During pregnancy)				
Yes	35(20.8%)	66(6.1%)	$\chi^2=30.1$.0001*
No	93(79.2%)	729(93.9%)		
Breastfeeding Initiation (ever breastfed)				
Yes	101(87.0%)	640(85.0%)	$\chi^2=0.32$	0.70
No	23(13.0%)	146(15.0%)		
Breastfeeding Continuation (still Breastfeeding)				
Yes	31(38.2%)	281(48.4%)	$\chi^2=3.4$	0.19
No	70(61.8%)	359(51.6%)		

^A Total excludes missing or unknown values; column percentage reported * Significantly associated with PPD (p-value <0.05)

Table 3. Logistic Regression of PPD by Breastfeeding Initiation and Continuation

Variables	Model 1 ^c		Model 2 ^d	
	Adjusted OR (95% CI) ^B	P-value	Adjusted OR (95% CI) ^B	P-value
Maternal Age				
In years	1.01 (0.95-1.07)	0.744	1.03 (0.92-1.09)	0.339
Race/Ethnicity				
NH White	Referent		Referent	
NH Black	2.16(0.98-4.74)	0.055	2.36(-.98-5.73)	0.056
NH Asian	3.8(0.92-16.03)	0.065	5.35(1.15-24.94)	0.033*
NH Other	2.67(0.73-9.78)	0.136	3.51(0.90-12.69)	0.070
Hispanic	0.33(0.08-1.35)	0.123	0.39(0.089-1.74)	0.218
Education				
< Highschool	Referent		Referent	
Some College	0.71(0.30-1.66)	0.425	1.03(0.40-2.66)	0.951
> Bachelor's	0.61(0.27-1.37)	0.229	1.27(0.51-3.15)	0.613
Marital Status				
Married	1.25(0.61-2.56)	0.539	1.0(0.46-2.19)	0.994
Other	Referent		Referent	
Health Insurance				
Private	Referent		Referent	
Public	0.94(0.45-1.96)	0.875	0.73(0.60-3.11)	0.461
Other	2.51(0.83-7.64)	0.105	2.15(0.66-7.01)	0.202
Pregnancy Intention				
Unwanted	0.66(0.17-2.60)	0.558	1.34(0.32-5.66)	0.686
Mistimed	1.04(0.43-2.52)	0.939	0.90(0.34-2.38)	0.833
Intended	Referent		Referent	
Not Sure	1.74(0.63-4.79)	0.286	0.85(0.23-3.18)	0.807
Stress				
No Stressful Event	Referent		Referent	
1-2 Stressful Event	0.83(0.37-1.85)	0.644	0.83(0.30-2.02)	0.684
3-5 Stressful Event	1.47(0.62-3.48)	0.379	1.41(0.52 -3.8)	0.496
6 + Stressful Event	1.47(0.34-6.32)	0.601	1.86(0.44-7.87)	0.397
History of Depression (Before pregnancy)				
Yes	0.82(0.24-2.80)	0.746	1.06(0.29-3.82)	0.921
No	Referent		Referent	
History of Depression (During pregnancy)				
Yes	5.75(2.01-16.41)	0.001*	6.62(2.28-19.2)	0.0005*
No	Referent		Referent	
Breastfeeding Initiation (ever breastfed)				
Yes	1.54(0.64-3.74)	0.337		
No	Referent			
Breastfeeding Continuation (still Breastfeeding)				
Yes			0.59(0.26-1.38)	0.223
No			Referent	

^B Adjusted for age, race/ethnicity, education, marital status, health insurance pregnancy intention, stress, history of depression, OR, Odds ratio; CI, Confidence Interval * Significantly associated with PPD (p-value <0.05) ^c Model includes measure of breastfeeding initiation ^d Model includes measure of breastfeeding continuation