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# Prenatal Depression and Breastfeeding Practices Healthy Start Participants, 2019-2022

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# PRENATAL DEPRESSION AND BREASTFEEDING PRACTICES HEALTHY START PARTICIPANTS, 2019-2022

by

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# ABSTRACT

Background: Breastfeeding has health benefits for both mother and child, but breastfeeding practices among Black and lower-income women are the poorest in the United States. Few studies have examined the associations between maternal prenatal depression and breastfeeding duration, even fewer among a predominantly low-income Black population.

Objective: To explore the association between prenatal depression and breastfeeding practices among low-income Black women during the COVID-19 pandemic.

Methods: Prospective cohort data from Midlands Healthy Start (MHS) was analyzed to examine women's depression symptoms during pregnancy and their breastfeeding initiation and duration through two and six months. Perinatal depressive symptoms were identified using validated instruments: the Center for Epidemiologic Studies-Depression Scale (CES-D) or Edinburgh Postpartum Depression Scale (EPDS) over time. Standardized depressive symptoms scores were calculated. For categorical analysis of depression, we utilized cut-off scores of 10 or higher and 16 or higher for the EPDS and CES-D, respectively. Bivariate analyses and multiple logistic regression modeling were completed.

Results: Of MHS participants included in this study (initiation: n=400; two months: n=355; six months: n=326), 21% had prenatal depression, 72.5% initiated breastfeeding, 31.8% breastfed through two months, and 15.0% breastfed at least six months. The mean standardized prenatal depression scores were lower among women who initiated breastfeeding (p=0.827) and had longer breastfeeding duration (two months: p=0. 459; six

months: p=0. 226) than those who did not. Prenatal depression was associated with a lack of breastfeeding for six months (p = 0.047), as 17.2% of women without prenatal depression breastfed through six months, while 7.9% of women with depression breastfed for six months. The odds of each breastfeeding practice decreased (initiation: AOR 0.94, 95% CI 0.75-1.17; two months: AOR 0.90, 95% CI 0.71-1.13; six months: OR 0.83, 95% CI 0.61-1.12) for every one-point increase in standardized depression scores.

Conclusions: This study suggests that low-income Black women with prenatal depression have poorer breastfeeding practices than those who do not have depression. Future research with larger sample sizes is needed to determine if this association is significant.

# TABLE OF CONTENTS

# CHAPTER 1

# INTRODUCTION

Improving breastfeeding rates among women is an important public health goal as breastfeeding has significant benefits for both mother and child.(1) Yet just 44% of non-Hispanic Black children and 41.1% of children living under the federal poverty line are breastfed through six months postpartum.(2) Breastfeeding initiation and duration related rates are lowest among Black children in the United States compared to all other races and those who live below the federal poverty line have lower rates of breastfeeding than people who live above the federal income poverty line.(2) Women who are depressed during pregnancy are less likely to intend to breastfeed which is a strong predictor for breastfeeding initiation.(3-5) Also studies found that the duration of breastfeeding among White and Hispanic women with prenatal depression is less than that for women without depression during their pregnancy.(6, 7) There were higher rates of depression found among pregnant women during the COVID-19 pandemic compared to rates of depression before the pandemic.(8, 9) Few studies have examined the associations between maternal prenatal depression and breastfeeding duration. To our best knowledge, there are no existing studies which have explored if there is an association between prenatal depression and breastfeeding through six months in a majority low-income Black population. As Black women and low-income families have the lowest rates of breastfeeding in the United States, it is important to identify factors which are associated to the breastfeeding practices among them. Thus, we will use data from the Midlands Healthy Start program to assess if

prenatal depression is associated with breastfeeding practices among low-income Black women population during the COVID-19 pandemic. We hypothesize that women who experience prenatal depression are less likely to initiate breastfeeding and continue to breastfeed through six months compared to women who do not have prenatal depression after adjusting for potential confounders. We believe that our findings will contribute to the limited existing literature on the association between prenatal depression and breastfeeding practices and stress the importance of mental health intervention during prenatal care.

# CHAPTER 2

# BACKGROUND

## Importance of Breastfeeding

Breastfeeding has been firmly established as being beneficial for maternal and infant health that the American Academic of Pediatrics recommends new mothers to exclusively breastfeed their infants for six months.(1) Breastfeeding through six months is critically important as infants who were breastfed exclusively through four months compared to at least six months are at increased risk of respiratory tract infection which includes pneumonia and reoccurring otitis media.(10, 11) Breastfeeding is also associated with a reduced risk of sudden infant death syndrome along with several other infant health outcomes.(11) Less-than-optimal breastfeeding among the non-Hispanic Black population is associated with 1.7 times the excess number of acute otitis media, 3.3 times the excess cases of necrotizing enterocolitis, and 2.2 times the excess number child deaths when compared to a non-Hispanic White population.(12) Black infants who were ever breastfed had 33% lower risk of postneonatal death compared to Black infants which were never breastfed.(13) Furthermore, breastfeeding is also beneficial for women's health. Women who ever breastfed or breastfeed for longer durations had lower rates of breast and epithelial ovarian cancer, hypertension, and developing type 2 diabetes in maternal health outcomes compared to mothers who did not initiate breastfeeding or stopped breastfeeding earlier.(14)

**Breastfeeding in Low-income Black Populations**

Despite the short-term and long-term benefits of breastfeeding for mothers and infants, the rates of any breastfeeding and exclusive breastfeeding at six months are less than optimal. Non-Hispanic Black children had the lowest rates of breastfeeding with 74.1% initiating breastfeeding, 44.0% receiving any breast milk at six months, and 19.1% with exclusive breastfeeding at six months in 2019.(2) For those whose poverty income ratio (ratio of income to the federal poverty threshold value) was less than 100, 74.0% ever breastfed, 41.1% breastfed at six months, and just 19.3% exclusively breastfed through 6 months in 2019.(2) Whereas the rate of children in higher-income families with a poverty income ratio of 600 or greater in 2019 who were breastfed at all at six months is 70.4% and 91.6% ever breastfed.(2) The breastfeeding practices among Black women and lower-income women are the poorest in the United States and this population should be a priority in order to improve the breastfeeding practices of mothers overall in the United States. There is a need to understand the predictors of breastfeeding so that programs can be designed to improve breastfeeding practices more effectively.

**Depression in Low-income Black Populations**

Despite depression being a treatable mental health condition, it remains all too common in the United States especially among women. In fact, women are more likely to experience mild, moderate, and severe depression symptoms than men.(15) Up to one in seven pregnant women develop a depressive disorder which can be due to a lack of social support, financial difficulties, health problems and more.(16) The prevalence of depression in the United States was reported highest (9.2%) among non-Hispanic Black adults than any other race/ethnicity reported by the Centers for Disease Control and Prevention in a

National Center for Health Statistics data brief in 2018.(17) In this same data brief, as family income levels increased the prevalence of depression decreased with 15.8% of adults who live below the federal poverty level having depression.(17)

**Consequences of Depression**

Depression is a serious public health concern with the economic burden of major depressive disorder among adults increasing from 2010 to 2018 by 37.9%, $236.6 billion to $326.2 billion.(18) In fact, almost one in five adults experienced symptoms of depression within the last two weeks in 2019.(15) Depression, either mild or major, in individuals aged 20-39 years is associated with a significantly increased lifetime cardiovascular disease risk.(19) Depression also increases the odds of developing obesity which has a multitude of negative health implications.(20) Studies have shown that an average of 39% of women with prenatal depression experience postpartum depression.(21) Depression not only negatively impacts health outcomes but also has been found to have a relationship with the breastfeeding practices of women.(22)

**Mechanistic Association Between Depression and Breastfeeding**

There are a few pathways biologically and psychologically in which maternal depression could influence the breastfeeding practices of women. One avenue in which depression can impact the breastfeeding outcomes for women is that depressed women during pregnancy have an increased risk of having depression in the postpartum period.(23) Women with postpartum depressive symptoms produce a significantly smaller milk volume and their weaning (time to cease giving milk) is significantly earlier compared to women without depressive symptoms.(24) There is not just a biological association, but a psychological association as well between depression and breastfeeding. The intention to

exclusively breastfeed is a predictor of both the initiation of breastfeeding and breastfeeding duration.(5) Women with depressive symptoms during pregnancy are almost two times more likely to not intend to breastfeed than women without depressive symptoms thus leading to poor breastfeeding practices among mothers with prenatal depression.(3, 4) Mothers with depression also have a greater lack of confidence in breastfeeding than non-depressed mothers.(6) Maternal breastfeeding confidence is also a significant predictor of both breastfeeding duration and exclusivity of breastfeeding.(25)

**Association between Prenatal Depression and Breastfeeding**

Few studies to date have explored how prenatal depression impacts the breastfeeding practices of women. Most existing literature on maternal depression and breastfeeding outcomes focuses on the association between postpartum depression and breastfeeding which seem to have a bidirectional relationship due to studies finding that postpartum depression both predicts and is predicted by early breastfeeding cessation.(7, 22, 26-28) Hahn-Holbrook et al. concluded in 2013 that there was a bidirectional relationship between depression and breastfeeding as their results showed that maternal prenatal depression predicts less breastfeeding shortly after delivery and breastfeeding predicted a decrease in maternal depression postpartum.(7) It is crucial to study prenatal depression to further explore the directionality of the relationship between maternal depression and breastfeeding outcomes.

One study in 2002 which explores this relationship, found that their group of depressed mothers whose Center for Epidemiologic Studies-Depression Scale (CES-D) score being greater than 16 had a lower breastfeeding initiation rates than the nondepressed group (50% vs. 80%, $\chi^2 = 5.35$, $p < 0.05$).(6) The duration of breastfeeding in this

depressed group was significantly less than the group of nondepressed mothers (2.6 months vs. 4.2 months, $t = 2.14$, $p < 0.05$).(6) However, this study only included 40 women initially and had a 20% attrition rate at the eight month follow-up interview(6). Hahn-Holbrook et al. conducted a larger prospective study with 254 participants which agrees with the findings of Field et al. as prenatally depressed women (CES-D bivariate scores total of at least 4 out of 9) stopped breastfeeding 2.3 (SE = 1.04 months) months earlier than women who did not report depressive symptoms.(6, 7) Prenatal depression in this study also predicted lower rates of breastfeeding exclusively and any breastfeeding at three months postpartum.(7) The women in both of these studies were majority Hispanic or Caucasian/White and primarily upper-middle or middle socioeconomic status.(6, 7) Because breastfeeding practices are worse among low-income and Black women, the results by Field et al. and Hahn-Holbrook et al. may not be generalizable to low-income and Black women.(6, 7)

There is one existing study which explores prenatal depression and breastfeeding among majority African American women with a low mean income by Chung et al. in 2004.(29) However, Chung et al. examines depression at time points both during pregnancy and postpartum and does not differentiate the two.(29) Instead, this study uses depressive symptoms which is a CES-D score of at least 16 at no time points (never having depressive symptoms), one or two time points (ever having depressive symptoms), and at all three time points (persistent depressive symptoms).(29) Neither of the independent variables of ever having depressive symptoms (OR 1.10, 95% CI 0.77-1.57) or persistent depressive symptoms (OR .84, 95% CI 0.47-1.52) were associated with breastfeeding at one month postpartum.(29) Exploring the association of prenatal depression and breastfeeding

duration through six months postpartum, which this study lacked, is crucial due to the additional health benefits gained by breastfeeding through the full six month postpartum period.

Several existing studies also failed to find significant associations between maternal prenatal depression and certain limited breastfeeding outcomes.(3, 30-32) Pippins et al. is one of these studies which failed to find enough evidence of an association between maternal depressive symptoms, a CES-D score greater than 10, at one time point (OR 0.79, 95% CI 0.44-1.41) or symptoms at two or more time points (OR 0.93, 95% CI 0.42-2.06) and breastfeeding initiation.(30) Yet, Pippins et al. did find that prenatal depressive symptoms at two or more time points was significantly associated with breastfeeding for less than a month (OR 1.77, 95% CI 1.10-2.86).(30) One of these studies with insignificant findings used data from a program which provides home visitation to explore the relationship between severity of prenatal depression and breastfeeding at three months.(32) This insignificant finding could be due to the study participants having higher rates of breastfeeding than the national average (56% vs. 51%) and that around half of the participants with higher Edinburgh Postpartum Depression Scale (EPDS) scores had been connected to mental health resources.(32) The study for this paper will differ by adjusting for postpartum depression scores on the EPDS to explore if prenatal mental health interventions are able to positively impact breastfeeding outcomes. The other studies which did not find significant associations between prenatal depression and breastfeeding did not assess breastfeeding duration at all or through six months postpartum period.(3, 31)

Bogen et al. also failed to find an association between maternal major depressive disorder or depressive symptoms (Hamilton Depression Rating Scale score of at least 9)

and breastfeeding initiation and breastfeeding duration at two and twelve weeks postpartum.(5) However, this study identified and used depression indices at delivery, two weeks postpartum and twelve weeks postpartum for each outcome of initiation of breastfeeding and duration thus these results are not fully representative of possible associations between prenatal depression and breastfeeding practices.(5)

There are a few studies which have been completed outside the United States which examined prenatal depression and breastfeeding practices.(33-36) One of these studies found conflicting results with women living in Portugal as higher depression scores on the EPDS in the first trimester predicted increased exclusive breastfeeding at three months postpartum but higher depression scores at the third trimester is associated with decreased breastfeeding duration.(33) Among Canadian and Norwegian women, depression during pregnancy is significantly associated with breastfeeding less than six months.(34, 36) Less women in Sweden who had high prenatal scores on the EPDS (at least a score of 10) breastfed than women with low EPDS scores.(35)

No existing study has explored if there is an association between prenatal depression and breastfeeding through six months in a majority Black population. This study will fill this gap in literature by exploring the relationship between prenatal depression and breastfeeding practices in a predominantly low-income Black population.

**Healthy Start impacts on Breastfeeding Outcomes**

The Midlands Healthy Start program is a member of the national Healthy Start initiative that has programs across the United States. Healthy Start programs provide breastfeeding classes to work towards two of the benchmark goals of the national initiative that relate to breastfeeding practices. Rosenbach et al. examined the breastfeeding

outcomes of participants from eight Healthy Start sites in 2010 and found that 72% of participants ever breastfed meanwhile a nationwide estimate of low-income mothers was just 60% ever initiating breastfeeding.(37) The Westside Healthy Start program in Chicago, Illinois, who have a predominantly low-income Black population that they serve, had 67% of participants initiating breastfeeding after implementing a new multilevel approach to breastfeeding which is improved from the breastfeeding initiation rate of participants just a few prior from 58.5%.(38) The improved rate of breastfeeding just surpasses the initiation rate (65%) of women who delivered at the program's partner hospital but were not enrolled in the program in 2015.(38) Healthy Start programs can improve the breastfeeding practices of the people that they serve. The magnitude of these improvements, however, can change with the differing populations of participants.

**Objectives**

The main objective of this study is to fill the gap in literature that exists on assessing the association between prenatal depression and breastfeeding practices in a predominantly low-income and Black population. Black and low-income women are at high-risk of poor breastfeeding practices, and we hypothesize that we will highlight prenatal depression as a significant predictor of breastfeeding initiation and duration. This study can also add context to the relationship of maternal prenatal and postpartum depression with breastfeeding by including maternal depression at both time points in the analysis.

# CHAPTER 3

# DATA AND METHODS

We utilized prospective cohort data from the Midlands Healthy Start (MHS) program to complete this study. MHS is an ongoing program that support moms-to-be through their pregnancy journey and until their child is eighteen months old. The program is free to women in the Richland and Sumter counties in South Carolina. The MHS program has been a member of the national Healthy Start initiative that is funded by the Health Resources and Services Administration. The purpose of the Healthy Start initiative is to improve the health outcomes of pregnancy and diminish the racial and ethnic differences that are found in rates of infant mortality and poor perinatal outcomes. One of the critical benchmarks that Healthy Start strives towards is to improve breastfeeding initiation and any breastfeeding at six months postpartum.(39) MHS provides breastfeeding classes to improve the breastfeeding practices of the women they serve. Other services provided by the program include childbirth education classes, pregnancy classes, case management, social workers, assistance finding emergency services, support groups, and a fatherhood initiative.

**Study Sample**

In this analysis, women who were enrolled from January 1, 2019, to December 31, 2022, were only included if they had a singleton pregnancy and completed either the CES-D or EPDS form in the prenatal period. During this period, 588 women were served by MHS. Women were excluded if they were under the age of 16 years old at delivery, their

child had died, or had not completed a follow-up visit. Women were also excluded from the subsequent breastfeeding duration analysis if they were not yet two months or six months postpartum as of December 31, 2022. After applying exclusion criteria, 400 women were included in the breastfeeding initiation analysis, 355 included in breastfeeding at two months analysis, and 326 included in breastfeeding at six months analysis. If a woman had multiple pregnancies with MHS during the study period, then the first pregnancy was used for this study and the following pregnancies were removed from the sample.

**Outcome: Breastfeeding Practices**

Staff members of MHS interviewed mothers at a home visit shortly after delivery and again when their child turned six months to inquire about their feeding practices. Staff asked if mothers ever breastfed this child and the total number of months they breastfed or fed pumped milk thus far. If a mother was still breastfeeding when first interviewed, MHS staff followed-up with the mother to update the relevant questions on her forms to indicate how many months in total a mother breastfed. Using the data, we assessed breastfeeding practices in three ways: the initiation of breastfeeding (yes or no), breastfeeding at two months postpartum (yes or no), and breastfeeding at six months postpartum (yes or no). Two months breastfeeding duration was chosen due to the sample size and the majority of women in MHS ending their breastfeeding journey early in the postnatal period.

**Exposure: Maternal Depression**

To assess for prenatal depression, MHS has participants complete the validated instrument that is the EPDS upon enrollment into the program or at the first home visit starting January 1st, 2020.(40, 41) A follow-up EPDS is completed by mothers after delivery. There are ten items on this scale for a range in score of 0-30 with higher scores

indicating increased depressive symptoms. The items inquire as to how the women felt over the previous week with four possible responses from zero for no, not at all to three for most of the time. If a single item response was missing, the EPDS score was recorded as missing. There were four women with one item missing on their EPDS and one woman with six items missing which were subsequently recorded as missing an EPDS score. Prior to January 1st, 2020, MHS had participants complete a CES-D, another validated instrument, upon enrollment into the program and an EPDS in the postpartum period. (42) The CES-D is similar to the EPDS as it has the same four possible responses for the 20 items but with a range in score of 0-60. If there were less than five missing items on the CES-D, the mean of every non-missing item from the person was imputed as the response to the missing items. There were fourteen women with one item missing and three with two items missing on the CES-D. This technique for imputing mean scores has been shown to not significantly change the mean CES-D score from completed CES-D scores.(43) The average CES-D score changed from 13.4 to 13.5 after imputing the person-mean for the missing items. To harmonize depressive symptom data from two different instruments, we used standardized scores for the EPDS or CES-D so that they were comparable. For categorical analysis, we used commonly used cut-off points to determine if a woman was likely to have depression at each time point. The cutoff scores of 10 or higher and 16 or higher for the EPDS and CES-D, respectively, were utilized to assess for depression as dichotomous exposure. A cutoff score of 10 or higher on the EPDS has a 85% sensitivity and 84% specificity while the CES-D cutoff of 16 or higher can have 87% sensitivity and 70% specificity.(44, 45) If a woman had multiple prenatal EPDS forms completed, the highest EPDS total score was used. While if a women had at least one EPDS and one CES-

D, the EPDS score was utilized. For those with multiple postnatal EPDS completed, their EPDS which was closest to their delivery date was included for analysis so that temporality could potentially be established. The median prenatal CES-D or EPDS was taken 12 weeks before delivery and the median postnatal EPDS was assessed 40 days after delivery for women included in this study.

**Covariates**

After reviewing previous literature on factors that can impact breastfeeding and maternal depression, we assessed the following potential confounders: maternal age (<20, 20-29, 30+), maternal education status (less than high school, high school or GED, some college, college or more), marital status (married, divorced, never married, widowed), parity (nulliparous or primiparous), housing status (owns/rents/live with family or homeless/public housing), Body Mass Index (BMI) (<24.9, 25-29.9, 30+), prenatal maternal smoking status at enrollment (yes or no), total services received from MHS staff members during pregnancy, and the COVID-19 pandemic. The cutoff point to determine the pre-pandemic group and the pandemic group of women, is a delivery date before or after March 1, 2020. All information was identified from the Healthy Start Participants Risk Assessment Form at enrollment into the program except preterm delivery and total encounters with MHS staff which were gathered or calculated postpartum.

**Statistical Analysis**

To begin the analysis in this study, chi-square tests and a Fisher's exact test were completed to compare the prevalence of breastfeeding initiation and breastfeeding at two and six months by maternal depression status, the pandemic period, sociodemographic variables, and other potential confounders. One-Way Analysis of Variance (ANOVA) tests

were completed to assess the mean standardized depression scores between women who did the breastfeeding practices of interest or not. Multiple logistic regression models were also used to examine the association between maternal prenatal depression status and breastfeeding practices. First, we started with a crude model to assess the association between maternal depression and breastfeeding practices. Next, we adjusted the crude model by considering all the covariates that were below 0.25 p-value in the chi-square test or Fisher's exact test for either breastfeeding initiation or breastfeeding at two months in the model analysis. The following model explored if there is any interaction between maternal depression and the pandemic since there were higher rates of depression reported among pregnant women during the pandemic.(8, 9) The last model for analysis in this study assessed maternal prenatal and postpartum depression simultaneously. Goodness of fit diagnostics were completed for all logistic regression models by assessing the Receiver Operating Characteristics (ROC) curve. All of this analysis has been conducted using SAS statistical software survey procedures. The alpha level will be set at .05 to conclude all statistical significance.

# CHAPTER 4

# RESULTS

## Sample Characteristics

Of the 588 pregnant individuals which were served by MHS from 2019 to 2022 and assessed for eligibility, 400 met all the inclusion criteria to assess for breastfeeding initiation. There were three different samples of women utilized to maximize the sample size: breastfeeding initiation sample (N=400), two-month breastfeeding duration sample (N=355), and a six-month breastfeeding duration sample (N=326) (Figure 4.1). The women included in this study were predominantly Black (88.0%), between the ages of 20 and 29 (57.3%), with a high school degree or less in education (56.0%) (Table 4.1). Nearly all women utilize Medicaid for health insurance (93.8%) and either own their home, rent, or live with family (79.5%) but some women were homeless or living in public housing (12%) or were missing this information (9%). Almost half the women were obese before pregnancy (47.8%) while just 16.3% were overweight (Table 4.2). A small minority of women delivered preterm (13.3%) or reported smoking prior to their pregnancy upon enrollment into MHS (5.5%). More women reported having symptoms of depression above the cutoff points of 10 and 16 or higher on the EPDS and CES-D, respectively, in the prenatal period (84/400; 21.0%) than the postnatal period (27/316; 8.5%). Part of this reduction in prevalence of severe depression symptoms reported by women may be due to 19.3% of women included in this study being referred to mental health services but just 35.7% of women with scores above the cutoff points were referred. Within this group of

women who were referred to mental health services, 61.0% were women with depression scores below the chosen cutoff points during the prenatal period.

**Prenatal Depressive Symptoms and Breastfeeding Initiation**

The overall prevalence of women initiating breastfeeding was 72.5%. Non-Black women initiated breastfeeding significantly more than Black women (85.4% vs. 70.7%, p = 0.033). The largest prevalence of breastfeeding initiation was found among women who had at least a college degree for education which is significantly different from the women who had the equivalent of a high school education or less initiated breastfeeding (89.7% vs. 66.1%, p = 0.002). Legally married women had a higher prevalence of breastfeeding initiation compared to those who were not legally married (84.9% vs. 69.3%, p = 0.014). The number of prenatal services received from MHS was significantly associated with breastfeeding initiation (p = 0.011) as just 64.2% of those who received two or less services initiated breastfeeding while 78.3% of those who received at least six services initiated breastfeeding. There were no other significant differences found in our bivariate analysis of breastfeeding initiation.

Those who initiated breastfeeding had slightly lower mean standardized depression scores in the prenatal period (0.1324) than women who did not initiate breastfeeding (0.1592), however this difference was not significant (p=0.827) (Table 4.3). For every one-point increase in the prenatal standardized depression score, the odds of initiating breastfeeding decreased by 6% after adjusting for confounders (OR: 0.94, 95% CI: 0.75-1.17). A one-point increase in the standardized scale is equivalent to almost 4.5 points on the EPDS and just over 9 points on the CES-D. The Area Under the Curve (AUC) from the ROC curve for this specific model was 0.683.

**Prenatal Depressive Symptoms and Breastfeeding at Two Months**

The prevalence of breastfeeding for at least two months in this study was 31.8%. Education was significantly associated with breastfeeding duration of two months ($p < 0.001$) with 58.8% of women who had at least a college degree breastfeeding at least two months while just 20.7% of women who had a high school education or less breastfed through two months. Breastfeeding at least two months was also positively associated with marriage ($p = 0.042$), non-Medicaid insurance ($p = 0.030$), owning/renting a home or living with family ($p = 0.035$), preterm delivery ($p = 0.011$), and higher total MHS services ($p = 0.040$).

Women who breastfed for at least two months had marginally lower mean standardized depression scores in the prenatal period than women who did not breastfeed for at least two months (0.0992 vs. 0.1927, $p=0.459$). The odds of breastfeeding for two months decreased by 10% for every one-point increase in the standardized prenatal depression score after adjusting for confounders (OR: 0.90, 95% CI: 0.71-1.13). The AUC from the ROC curve for this model was 0.709. When adjusting for confounders and for postnatal depression scores, the odds of breastfeeding for at least two months decreased by 15% for every one-point increase in the standardized prenatal depression score (OR: 0.85, 95% CI: 0.64-1.11). The AUC from the ROC curve for second model was 0.726.

**Prenatal Depressive Symptoms and Breastfeeding at Six Months**

Just 15% of overall women in this study breastfed for at least six months (Appendix A.1). College or higher education ($p = 0.008$), being married ($p = 0.026$), and no prenatal smoking ($p = 0.049$) were all found to be positively associated with breastfeeding through six months (Appendix A.2). Prenatal depression was negatively associated with

breastfeeding for six months when dichotomized using the CES-D and EPDS cut off points of 16 and 10, respectively. 17.2% of women without prenatal depression breastfed through six months while just 7.9% of those with higher depression symptoms breastfeeding for the same length of time ($p = 0.047$).

Women who breastfed for at least six months had lower mean standardized depression scores in the prenatal period than women who stopped breastfeeding earlier (-0.0201 vs. 0.1923, $p=0.226$) (Appendix A.3). The odds of breastfeeding through six months decreases 17% for every one-point increase in the standardized prenatal depression scores (OR: 0.83, 95% CI: 0.62-1.12). Due to the small sample size, no adjusted odds ratios could be reported.

**Postnatal Depressive Symptoms and Breastfeeding at Two and Six Months**

There were 27 women out of 316 who took the EPDS in the postnatal period who reported severe depressive symptoms above the cutoff points used in this study. Postnatal depression was significantly associated with breastfeeding through two months in our bivariate analysis ($p = 0.017$) as 36.2% of women without higher depression scores breastfed through two months and just 25% of women with higher depression scores breastfed that long. Women who breastfed through two months had slightly higher mean standardized depression scores (-0.0919 vs. -0.1322) in the postnatal period but this was not a significant difference ($p=0.738$). When simultaneously adjusting for confounders and both prenatal and postnatal depression, the odds of breastfeeding for two months increased by 16% for every one-point increase in the postnatal score (OR: 1.16, 95% CI: 0.84-1.61). For every one-point increase in the postnatal standardized depression score the odds of breastfeeding for two months increased by 7% when adjusting for only confounders (OR:

1.07, 95% CI: 0.79-1.44). In relation to breastfeeding through six months, women did so had faintly lower mean standardized depression scores in the postnatal period than women who did not initiate breastfeeding (-0.2550 vs. 0. -0.0520, p=0.225) (Appendix A.3). The odds of breastfeeding through six months decreases 22% for every one-point increase in the standardized postnatal depression scores (OR: 0.78, 95% CI: 0.52-1.17).

**COVID-19 Pandemic and Breastfeeding Practices**

The COVID-19 pandemic was not found to be significantly associated with breastfeeding initiation (p = 0.134) or breastfeeding duration of two months (p = 0.450). However, pandemic delivery was found to be significantly associated with a six-month breastfeeding duration as 18.2% of women who delivered during or after March 2020 breastfed for six months while just 9.8% of women who delivered before the pandemic breastfed for the same duration (p = 0.038). There were no significant associations found in the logistic regression analysis when adjusting for prenatal or postnatal depression and other confounders between the COVID-19 pandemic and breastfeeding practices.

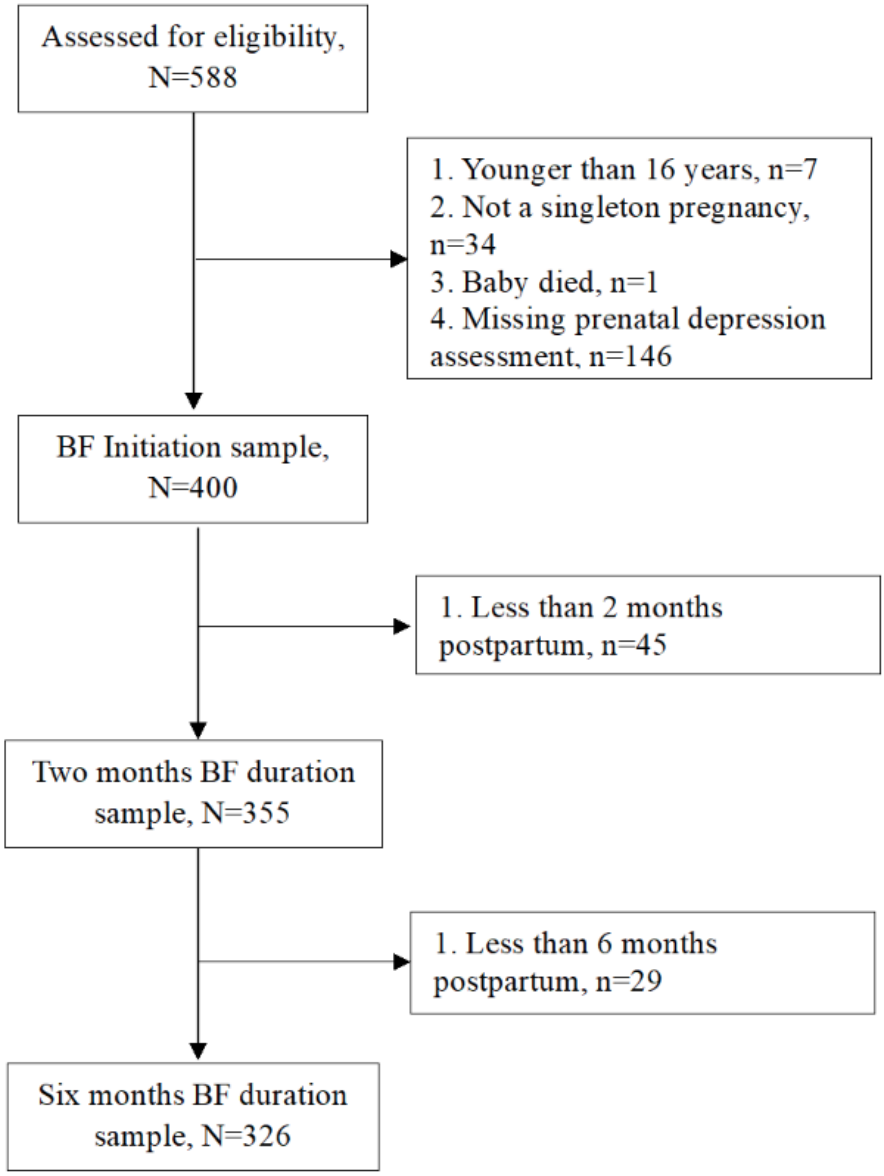


Figure 4.1 Study participant eligibility flow chart

Table 4.1 Characteristics of study participants and the prevalence of breastfeeding initiation and breastfeeding at two months

| Maternal Characteristics | All women n (%) | Initiated breastfeeding (N=400) yes, % | p | Breastfeeding ≥ 2 months (N=355)[a] yes, % | p |
|---|---|---|---|---|---|
| Total | 400 (100.0) | 72.5 | | 31.8 | |
| Age | | | | | |
| 16-19 | 46 (11.5) | 67.4 | 0.661 | 28.9 | 0.259 |
| 20-29 | 229 (57.3) | 72.5 | | 29.3 | |
| 30+ | 125 (31.3) | 74.4 | | 38.1 | |
| Race | | | | | |
| Black | 352 (88.0) | 70.7 | 0.033 | 30.7 | 0.200 |
| Non-Black | 48 (12.0) | 85.4 | | 40.5 | |
| Education | | | | | |
| Less than HS & HS or GED | 224 (56.0) | 66.1 | 0.002 | 20.7 | <0.001 |
| Some college | 137 (34.3) | 78.1 | | 42.3 | |
| College or more | 39 (9.8) | 89.7 | | 58.8 | |
| Marital Status | | | | | |
| Married: married & separated | 86 (21.5) | 84.9 | 0.014 | 40.9 | 0.042 |
| Not married: divorced, widowed & never married | 287 (71.8) | 69.3 | | 31.1 | |
| Missing | 27 (6.8) | 66.7 | | 14.8 | |
| Nulliparous | | | | | |
| Yes | 141 (35.3) | 74.5 | 0.543 | 35.9 | 0.067 |
| No | 239 (59.8) | 70.7 | | 31.4 | |
| Missing | 20 (5.0) | 80.0 | | 10.0 | |
| Medicaid Insurance[b] | | | | | |
| Yes, Medicaid | 375 (93.8) | 71.5 | 0.073 | 30.4 | 0.030 |
| Non-Medicaid[c] | 25 (6.3) | 88.0 | | 52.2 | |
| Housing Status | | | | | |
| Owns, rents, or living with family | 318 (79.5) | 73.3 | 0.628 | 35.1 | 0.035 |
| Homeless or public housing | 48 (12.0) | 66.7 | | 21.4 | |
| Missing | 34 (8.5) | 73.5 | | 17.7 | |

High School, HS; General Educational Development, GED

a: Reduced sample size due to 45 women not yet being 2 months postpartum.

b: Fisher's Exact Test due to small sample size. Chi-square test was used for all other p-values.

c: Non-Medicaid includes private and other insurance.

Table 4.2 Characteristics of study participants and the prevalence of breastfeeding initiation and breastfeeding at two months

| Maternal Characteristics | All women n (%) | Initiated breastfeeding (N=400) yes, % | p | Breastfeeding ≥ 2 months (N=355)[a] yes, % | p |
|---|---|---|---|---|---|
| Pre-Pregnancy BMI | | | | | |
| Normal and Underweight (>25) | 94 (23.5) | 77.7 | 0.452 | 34.2 | 0.601 |
| Overweight (25-29.99) | 65 (16.3) | 67.7 | | 29.3 | |
| Obese (30+) | 191 (47.8) | 70.7 | | 33.7 | |
| Missing | 50 (12.5) | 76.0 | | 24.5 | |
| Prenatal Smoking at Enrollment | | | | | |
| Yes | 22 (5.5) | 72.7 | 0.782 | 23.8 | 0.085 |
| No | 364 (91.0) | 72.8 | | 33.4 | |
| Missing | 14 (3.5) | 64.3 | | 7.1 | |
| Preterm Delivery (<37 weeks) | | | | | |
| Yes | 53 (13.3) | 79.3 | 0.238 | 48.8 | 0.011 |
| No | 347 (86.8) | 71.5 | | 29.5 | |
| Pandemic Delivery | | | | | |
| Prepandemic (before March 2020) | 123 (30.8) | 67.5 | 0.134 | 29.3 | 0.450 |
| Postpandemic (March 2020 or after) | 277 (69.3) | 74.7 | | 33.2 | |
| Prenatal Services Received from MHS | | | | | |
| 0-2 | 81 (20.3) | 64.2 | 0.011 | 27.5 | 0.040 |
| 3-5 | 89 (22.3) | 65.2 | | 22.4 | |
| 6+ | 230 (57.5) | 78.3 | | 37.2 | |
| Mental Health Services Referral | | | | | |
| Yes | 77 (19.3) | 74.0 | 0.739 | 38.4 | 0.179 |
| No | 323 (80.8) | 72.1 | | 30.1 | |
| Prenatal Depression[d] | | | | | |
| Yes | 84 (21.0) | 72.6 | 0.978 | 27.9 | 0.389 |
| No | 316 (79.0) | 72.5 | | 33.0 | |
| Postnatal Depression[d] | | | | | |
| Yes | 27 (6.8) | 74.1 | 0.930 | 25.0 | 0.017 |
| No | 289 (72.3) | 72.0 | | 36.2 | |
| Missing | 84 (21.0) | 73.8 | | 19.5 | |

Body Mass Index, BMI; Midlands Healthy Start, MHS

a: Reduced sample size due to 45 women not yet being 2 months postpartum.

d: Score of 16 or higher on CES-D and score of 10 or higher on EPDS for depression to be recorded as present.

Table 4.3 Standardized maternal depression scores and breastfeeding initiation and breastfeeding at two months

| | Mean (std) | | P-value[a] | Model 1: Adjusted OR (95% CI)[b] | Model 2: Adjusted OR (95% CI)[c] |
|---|---|---|---|---|---|
| **Initiated breastfeeding** | Yes (n=290) | No (n=110) | | | |
| Prenatal depression standardized score | 0.1324 (1.100) | 0.1592 (1.060) | 0.827 | 0.94 (0.75-1.17) | |
| **Breastfeeding ≥ 2 months** | Yes (n=113) | No (n=242) | | | |
| Prenatal depression standardized score | 0.0992 (1.088) | 0.1927 (1.118) | 0.459 | 0.90 (0.71-1.13) | 0.85 (0.64-1.11) |
| Postnatal depression standardized score[d] | -0.0919 (0.882) | -0.1322 (0.996) | 0.738 | | 1.16 (0.84-1.61) |

a: P-value from ANOVA test.
b: Adjusted for pandemic delivery, race, education, insurance, marital status, parity, prenatal smoking, housing status, and prenatal services count.
c: Adjusted for pandemic delivery, race, education, insurance, marital status, parity, prenatal smoking, housing status, prenatal services count, and postnatal depression.
d: Sample size is 278. There are 98 women who breastfed at least two months and 180 women who did not.

# CHAPTER 5

# DISCUSSION

To the best of our knowledge, this study is one of the first to explore the relationship between prenatal depression and breastfeeding through six months in a predominantly Black and low-income population in the United States. The main aims were to assess any potential association between prenatal depression and breastfeeding practices in a low-income Black population. The results of this study suggest that prenatal depression is negatively associated with breastfeeding initiation and duration. Low-income Black women with higher depressive symptoms had poorer breastfeeding practices than those who do not have depression. In one bivariate analysis there was a significant negative association found between prenatal depression and a breastfeeding duration of six months. The mean standardized prenatal depression scores were lower among women who initiated breastfeeding and had longer breastfeeding duration. While there were no significant associations found in the logistic regression models, the odds of every breastfeeding practice decreased for every one-point increase in the standardized depression score. A one-point increase in the standardized scale is equivalent to almost 4.5 points on the EPDS and just over 9 points on the CES-D. Education and marital status were significantly associated with every breastfeeding practice assessed in this study.

The COVID-19 pandemic was also not found to be associated with breastfeeding initiation or breastfeeding duration of two months. However, more women who delivered during or after March 2020 breastfed through six months than women who delivered prior

to the pandemic beginning. In fact, the prevalence of each breastfeeding outcome was higher after the pandemic than before in this population. This contrasts findings from other studies which have found a decrease in the rates of breastfeeding during the pandemic.(46, 47) The COVID-19 pandemic was also the only covariate that was significantly associated with prenatal depression besides the number of prenatal services received, however, delivering during the pandemic decreased the odds of prenatal depression by 65% compared to delivering prior to the beginning of the pandemic. Which also conflicts with findings from other studies which have shown higher rates of depression during the pandemic.(8, 9) These contrasting findings may be due to the fact that our study included predominantly low-income black women. Another study which explored the racial and ethnic differences in exclusive breastfeeding rate changes due to the pandemic found that breasting rates improved in Black women, but this change was not statistically significant.(48)

The lack of statistical significance found between prenatal depression and breastfeeding could be due to the smaller sample size of this study but is consistent with previous literature as other studies have failed to find significant associations, including Chung et al. who had a majority African American population.(29) Another study previously discussed which also used data from a similar program failed to find any significant association between prenatal depression and breastfeeding at three months.(32) The authors explained that this lack of a significant finding may be due to the fact that women with higher EPDS scores were referred to mental health resources.(32) Our study included mental health services referral in analysis but we did not find a significant association between a referral and breastfeeding practices alone as there was less than a

2% difference in the prevalence of breastfeeding initiation and 8.3% in breastfeeding through two months. We did not include this referral to mental health resources in any model as we believed it is on the causal pathway and not a confounder for prenatal depression and breastfeeding practices.

The lack of significant associations between depression and breastfeeding could also be due to breastfeeding being determined by more than socioeconomic and biological factors. There are social, behavioral, and cultural factors, which all play into a person's decision or ability to breastfeed their child. A study published in 2021 on African American women and breastfeeding perceptions found that participants believed breastfeeding is not common or socially accepted.(49) Another explanation is that it is difficult to differentiate breastfeeding practices based on prenatal depression when there are overall poor breastfeeding practices being reported. Within this study, the prevalence of initiation (72.5%) is just slightly lower than the national rate of initiation for Black women (74.1%) and lower than the South Carolina rate of initiation (80.6%).(2) There is a larger difference between the prevalence of breastfeeding at least six months in this study (15.0%) and the rate women in South Carolina (46.6%) or Black women in the United States (44.0%) breastfeeding for six months.(2)

Our significant finding of prenatal depression and breastfeeding duration of six months is consistent with previous literature that assessed breastfeeding duration of at least six months.(6, 7) Very few studies have assessed breastfeeding duration through six months and more studies are needed with larger sample sizes to explore the association between prenatal depression and it's impacts on the duration of breastfeeding.

**Strengths**

A strength of this study is that few prior studies have focused on Black women, especially low-income Black women, who have lower breastfeeding rates than White women and women with a higher socioeconomic status. One previous study which did have a majority African American study participants and similar results only examined breastfeeding through one month and missed the significant association between prenatal depression and a longer breastfeeding duration in this population.(29) Another strength of this study is the prospective cohort study design. The MHS program makes multiple attempts throughout the prenatal and postnatal period to contact and update breastfeeding information. This minimizes the loss to follow-up and missing information in a higher risk population.

**Limitations**

Despite the efforts made by MHS to enhance participation in the program and minimize loss to follow up, the missing information and loss to follow up are limitation of this study. Due to the smaller sample size, we decided to include missing responses of covariates as separate categories to maximize our sample size instead of excluding them from analysis. Excluding the women with missing responses of covariates would have greatly reduced our overall sample size. 21% of women were missing a postnatal EPDS, and they were not included in any model with postnatal depression included. Also due to sample size, adjusted logistic regression models were not able to be completed for breastfeeding duration of six months. Another limitation is the two different depression symptom scales utilized in this study as the two validated instruments are slightly different and standardization may not be appropriate. The one-point increase of the odds ratio is 4.5

points on the EPDS and 9 points on the CES-D which is 15% of the overall range in score possible for the instruments.

Another limitation is that there were 146 women who were excluded due to missing a prenatal depression assessment. MHS protocol changed in June 2020 to screen women for prenatal depression with two questions as a part of their background form instead of automatically administering the EPDS at enrollment. Depending on the severity of their response, women would subsequently complete an EPDS right at enrollment or at their first home visit. However, this led to confusion among staff and some staff did not complete the EPDS at the first home visit before delivery. Women may have also not been available for that subsequent home visit and been unresponsive, leading to a missing prenatal depression assessment. This missing assessment in a subset of the participants and subsequent exclusion from analysis can lead to some selection bias. Some sociodemographic and maternal characteristics were significantly different among the women missing a prenatal depression assessment and the prevalence of the breastfeeding outcomes was higher among women that had a missing prenatal depression assessment (Appendix A.5). However, these differences in breastfeeding practices did not differ significantly (Appendix A.6).

**Public Health Implications**

While there were few significant findings between depression and breastfeeding practices in this study, there are important public health implications. Education is strongly associated with both breastfeeding initiation and breastfeeding duration and this finding can help programs like MHS and other community health programs stress the importance of continuing education beyond a high school degree. The prevalence of breastfeeding

duration through two months more than doubles between women who have a high school education or less and women who have some college education. Marital status being shown to be significantly associated with breastfeeding practices can help programs and care providers identify women who will be less likely to initiate breastfeeding or breastfeed through six months postpartum. This study also found that 64% of women with higher depression symptoms enrolled in the MHS program were not referred to mental health services. A closer monitorization of prenatal depression by MHS, as well as other similar public health programs and healthcare providers, is warranted to ensure all women with severe depression symptoms are connected to the proper services to improve breastfeeding practices and their overall health.

In addition to improving referrals to mental health services, this study results show that the total number of services a woman receives does impact her breastfeeding practices. MHS, and other similar programs which aim to improve the breastfeeding practices of the women they serve, can better understand that there is value in offering numerous services and that utilization of these services can improve and impact the breastfeeding initiation and duration of women. Another item that MHS should note as they continue serving women throughout pregnancy and early motherhood is that their prevalence of breastfeeding initiation is close to the national average for Black women, yet the breastfeeding duration among their participants is still poor. Over 61% of women that initiated breastfeeding had quit less than two months later. The breastfeeding support they provide to encourage and assist women with the initiation of breastfeeding needs to continue throughout the first few months postpartum to improve the breastfeeding duration in these women. Improving health education and awareness on why breastfeeding duration

is important and not just the initiation is crucial to improving the breastfeeding practices of women.

# CHAPTER 6

# CONCLUSION

This study contributes to the limited existing literature on the association between prenatal depression and breastfeeding practices among women in the United States by focusing on low-income Black women and their breastfeeding practices from initiation to six months. Overall, these findings suggest that low-income Black women with higher prenatal depression symptoms have worse breastfeeding practices than women who do not have prenatal depression. Although, the significance of this association needs further examination. Improving a woman's breastfeeding practices is very important as breastfeeding has many short and long-term health benefits for mother and child.(1) Thus, healthcare providers and public health programs, such as MHS, should take care to identify risk factors that lead to women not breastfeeding for very long, if at all. The significant risk factors for poor breastfeeding practices identified in this study were prenatal depression, no college education, and not being married. Prenatal depression was shown to be negatively associated with breastfeeding initiation and duration through two months, yet it was not significant in this study. There was, however, a significant negative association found between prenatal depression and a breastfeeding duration of six months. The COVID-19 pandemic also was only found to be significantly associated with breastfeeding through six months as more women breastfed for at least six months during the pandemic than women who delivered before the start of the COVID-19 pandemic. Higher education and marriage were associated with women initiating breastfeeding more and breastfeeding

for longer durations than women who only had a high school education or less and women who were not married. Future research with larger sample sizes that focuses on low-income Black women is needed to determine if the association between prenatal depression and breastfeeding practices is significant.

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# APPENDIX A

# SUPPLEMENTARY TABLES

Table A.1 Characteristics of study participants and the prevalence of breastfeeding at six months

| Maternal Characteristics | All women n (%) | Breastfeeding ≥ 6 months (N=326) yes, % | p |
|---|---|---|---|
| Total | 326 (100.0) | 15.0 | |
| Age | | | |
| 16-19 | 43 (13.2) | 11.6 | 0.263 |
| 20-29 | 188 (57.7) | 13.3 | |
| 30+ | 95 (29.1) | 20.0 | |
| Race | | | |
| Black | 288 (88.3) | 14.2 | 0.269 |
| Other | 38 (11.7) | 21.1 | |
| Education | | | |
| Less than HS & HS or GED | 180 (55.2) | 11.7 | 0.008 |
| Some college | 112 (34.4) | 15.2 | |
| College or more | 34 (10.4) | 32.4 | |
| Marital Status | | | |
| Married: married & separated | 61 (18.7) | 24.6 | 0.026 |
| Not married: divorced, widowed & never married | 238 (73.0) | 13.9 | |
| Missing | 27 (8.3) | 3.7 | |
| Nulliparous | | | |
| Yes | 115 (35.3) | 19.1 | 0.184 |
| No | 191 (58.6) | 13.6 | |
| Missing | 20 (6.1) | 5.0 | |
| Medicaid Insurance[a] | | | |
| Yes, Medicaid | 304 (93.3) | 14.5 | 0.349 |
| Non-Medicaid[b] | 22 (6.8) | 22.7 | |

High School, HS; General Educational Development, GED

a: Fisher's Exact Test due to small sample size. Chi-square test was used for all other p-values.

b: Non-Medicaid includes private and other insurance.

Table A.2 Characteristics of study participants and the prevalence of breastfeeding at six months

| Maternal Characteristics | All women n (%) | Breastfeeding ≥ 6 months (N=326) yes, % | p |
|---|---|---|---|
| Housing Status | | | |
| Owns, rents, or living with family | 254 (77.9) | 17.3 | 0.063 |
| Homeless or public housing | 38 (11.7) | 10.5 | |
| Missing | 34 (10.4) | 2.9 | |
| Pre-Pregnancy BMI | | | |
| Normal and Underweight (>25) | 76 (23.3) | 21.1 | 0.149 |
| Overweight (25-29.99) | 52 (16.0) | 11.5 | |
| Obese (30+) | 152 (46.6) | 15.8 | |
| Missing | 46 (14.1) | 6.5 | |
| Prenatal Smoking at Enrollment[a] | | | |
| Yes | 16 (4.9) | 0.0 | 0.049 |
| No | 296 (90.8) | 16.6 | |
| Missing | 14 (4.3) | 0.0 | |
| Preterm Delivery (<37 weeks) | | | |
| Yes | 40 (12.3) | 20.0 | 0.348 |
| No | 286 (87.7) | 14.3 | |
| Pandemic Delivery | | | |
| Prepandemic (before March 2020) | 123 (37.7) | 9.8 | 0.038 |
| Postpandemic (March 2020 or after) | 203 (62.3) | 18.2 | |
| Prenatal Services Received from MHS | | | |
| 0-2 | 78 (23.9) | 10.3 | 0.064 |
| 3-5 | 72 (22.1) | 9.7 | |
| 6+ | 176 (54.0) | 19.3 | |
| Mental Health Services Referral | | | |
| Yes | 66 (20.3) | 19.7 | 0.235 |
| No | 260 (79.8) | 13.9 | |
| Prenatal Depression[c] | | | |
| Yes | 76 (23.3) | 7.9 | 0.047 |
| No | 250 (76.7) | 17.2 | |
| Postnatal Depression[c] | | | |
| Yes | 23 (7.1) | 4.4 | 0.116 |
| No | 228 (69.9) | 17.5 | |
| Missing | 75 (23.0) | 10.7 | |

Body Mass Index, BMI; Midlands Healthy Start, MHS

a: Fisher's Exact Test due to small sample size. Chi-square test was used for other p-values.

c: Score of 16 or higher on CES-D and score of 10 or higher on EPDS for depression to be recorded as present.

Table A.3 Standardized maternal depression scores and breastfeeding at six months

| | Mean (std) | | P-value[a] | Model 3: Crude OR (95% CI) | Model 4: Crude OR (95% CI) |
|---|---|---|---|---|---|
| **Breastfeeding ≥ 6 months** | Yes (n=49) | No (n=277) | | | |
| Prenatal depression standardized score | -0.0201 (0.930) | 0.1923 (1.162) | 0.226 | 0.83 (0.62-1.12) | |
| Postnatal depression standardized score[b] | -0.2550 (0.678) | -0.0520 (1.025) | 0.225 | | 0.78 (0.52-1.17) |

a: P-value from ANOVA test.

b: Sample size is 251. There are 41 women who breastfed at least six months and 210 women who did not.

Table A.4 Covariates in the adjusted logistic regression model and breastfeeding initiation and breastfeeding at two months

| Maternal Characteristics | Breastfeeding initiation OR (95% CI) | Breastfeeding ≥ 2 months OR (95% CI) |
|---|---|---|
| Race | | |
| Black vs Non-Black | 0.50 (0.20-1.27) | 0.49 (0.22-1.11) |
| Education | | |
| Less than HS & HS or GED vs College or more | **0.29 (0.09-0.92)** | **0.18 (0.07-0.44)** |
| Some college vs College or more | 0.48 (0.14-1.59) | 0.41 (0.17-1.01) |
| Marital Status | | |
| Not married: divorced, widowed & never married vs Married | 0.54 (0.27-1.06) | 1.09 (0.58-2.04) |
| Missing vs Married | 0.29 (0.06-1.34) | 0.73 (0.12-4.39) |
| Nulliparous | | |
| No vs Yes | 0.84 (0.50-1.39) | 0.85 (0.51-1.42) |
| Missing vs Yes | 1.23 (0.34-4.41) | 0.22 (0.04-1.11) |
| Medicaid Insurance[a] | | |
| Yes, Medicaid vs Non-Medicaid | 0.71 (0.18-2.80) | 0.99 (0.35-2.77) |
| Housing Status | | |
| Homeless or public housing vs Owns, rents, or living with family | 0.98 (0.48-2.00) | 0.71 (0.30-1.68) |
| Missing vs Owns, rents, or living with family | 3.08 (0.63-14.95) | 1.03 (0.23-4.68) |
| Prenatal Smoking at Enrollment | | |
| Yes vs No | 0.87 (0.31-2.48) | 0.62 (0.20-1.92) |
| Missing vs No | 0.55 (0.10-2.87) | 0.22 (0.02-2.49) |
| Pandemic Delivery | | |
| Postpandemic vs Prepandemic | 1.20 (0.67-2.15) | 0.85 (0.47-1.54) |
| Prenatal Services Received from MHS | | |
| 0-2 vs 6+ | 0.51 (0.26-1.02) | 0.73 (0.36-1.49) |
| 3-5 vs 6+ | **0.52 (0.29-0.93)** | **0.47 (0.24-0.92)** |

High School, HS; General Educational Development, GED; Midlands Healthy Start, MHS

Table A.5 Comparison of the characteristics of study participants and the women missing a prenatal depression assessment score

| Maternal Characteristics | Non-Missing Prenatal Depression Assessment, n (%) | Women Missing Prenatal Depression Assessment, n (%) | p[a] |
|---|---|---|---|
| Total | 400 (100.0) | 146 (100.0) | |
| Age | | | |
| 16-19 | 46 (11.5) | 12 (8.2) | 0.181 |
| 20-29 | 229 (57.3) | 77 (52.7) | |
| 30+ | 125 (31.3) | 57 (39.0) | |
| Race | | | |
| Black | 352 (88.0) | 120 (82.2) | 0.079 |
| Non-Black | 48 (12.0) | 26 (17.8) | |
| Education | | | |
| Less than HS & HS or GED | 224 (56.0) | 81 (55.5) | 0.177 |
| Some college | 137 (34.3) | 43 (29.5) | |
| College or more | 39 (9.8) | 22 (15.1) | |
| Marital Status | | | |
| Married: married & separated | 86 (21.5) | 27 (18.5) | <0.001 |
| Not married: divorced, widowed & never married | 287 (71.8) | 86 (58.9) | |
| Missing | 27 (6.8) | 33 (22.6) | |
| Nulliparous | | | |
| Yes | 141 (35.3) | 36 (24.7) | 0.001 |
| No | 239 (59.8) | 110 (75.3) | |
| Missing | 20 (5.0) | 0 (0.0) | |
| Medicaid Insurance | | | |
| Yes, Medicaid | 375 (93.8) | 140 (95.9) | 0.339 |
| Non-Medicaid[b] | 25 (6.3) | 6 (4.1) | |
| Housing Status | | | |
| Owns, rents, or living with family | 318 (79.5) | 99 (67.8) | <0.001 |
| Homeless or public housing | 48 (12.0) | 14 (9.6) | |
| Missing | 34 (8.5) | 33 (22.6) | |
| Pre-Pregnancy BMI | | | |
| Normal and Underweight (>25) | 94 (23.5) | 23 (15.8) | 0.001 |
| Overweight (25-29.99) | 65 (16.3) | 23 (15.8) | |
| Obese (30+) | 191 (47.8) | 61 (41.8) | |
| Missing | 50 (12.5) | 39 (26.7) | |

High School, HS; General Educational Development, GED
a: Chi-square test was used for all p-values.
b: Non-Medicaid includes private and other insurance.

Table A.6 Comparison of the characteristics of study participants and the women missing a prenatal depression assessment score

| Maternal Characteristics | Non-Missing Prenatal Depression Assessment, n (%) | Women Missing Prenatal Depression Assessment, n (%) | p[a] |
|---|---|---|---|
| Prenatal Smoking at Enrollment | | | |
| Yes | 22 (5.5) | 5 (3.4) | <0.001 |
| No | 364 (91.0) | 108 (74.0) | |
| Missing | 14 (3.5) | 33 (22.6) | |
| Preterm Delivery (<37 weeks) | | | |
| Yes | 53 (13.3) | 29 (19.9) | 0.052 |
| No | 347 (86.8) | 117 (79.5) | |
| Pandemic Delivery | | | |
| Prepandemic (before March 2020) | 123 (30.8) | 10 (6.9) | <0.001 |
| Postpandemic (March 2020 or after) | 277 (69.3) | 136 (93.2) | |
| Prenatal Services Received from MHS | | | |
| 0-2 | 81 (20.3) | 65 (44.5) | <0.001 |
| 3-5 | 89 (22.3) | 23 (15.8) | |
| 6+ | 230 (57.5) | 58 (39.7) | |
| Mental Health Services Referral | | | |
| Yes | 77 (19.3) | 18 (12.3) | 0.059 |
| No | 323 (80.8) | 128 (87.7) | |
| Postnatal Depression[c] | | | |
| Yes | 27 (6.8) | 7 (4.8) | 0.528 |
| No | 289 (72.3) | 112 (76.7) | |
| Missing | 84 (21.0) | 27 (18.5) | |
| Breastfeeding Initiation | | | |
| Yes | 290 (72.5) | 115 (78.8) | 0.139 |
| No | 110 (27.5) | 31 (21.2) | |
| Breastfeeding $\geq$ 2 Months[d] | | | |
| Yes | 113 (31.8) | 56 (40.3) | 0.075 |
| No | 242 (68.2) | 83 (59.7) | |
| Breastfeeding $\geq$ 6 Months[d] | | | |
| Yes | 49 (15.0) | 28 (22.8) | 0.053 |
| No | 277 (85.0) | 95 (77.2) | |

a: Chi-square test was used for all p-values.
c: Score of 16 or higher on CES-D and score of 10 or higher on EPDS for depression to be recorded as present.
d: a: Reduced sample size due to women not yet being 2 months or 6 months postpartum.