# THE EFFECT OF THE BIRTH EXPERIENCE ON BREASTFEEDING OUTCOMES AMONG NON-HISPANIC BLACK WOMEN IN NORTH CAROLINA

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A thesis submitted to the faculty at the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the Department of Anthropology.

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## ABSTRACT

Julia A. Mackessy: The Effect of the Birth Experience on Breastfeeding Outcomes Among non-Hispanic Black Women in North Carolina
(Under the direction of Amanda L. Thompson)

The influence of cesarean section on breastfeeding initiation and duration has been well-documented. However, few studies have looked at how the psychological impact of the birth experience may affect breastfeeding outcomes in the United States. The present study predicted that among a population of non-Hispanic Black (NHB) women in North Carolina, a mismatch between a participant's birth intent and birth outcome (labor mismatch) would affect their breastfeeding outcome. This study used data from Mothers & Others, a two-group randomized control trial. 128 of the 265 participants (48.30%) had a mismatch between their delivery intent and delivery outcome (labor mismatch). In bivariate analysis, maternal BMI and low-income status was associated with labor mismatch. Though no association was found between labor mismatch and breastfeeding outcomes, adjusted multinomial regression analysis found that BMI, education, and low-income status were associated with breastfeeding for a shorter duration than participants intended.

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| | |
|---|---|
| BMI | Body Mass Index |
| c-section | Cesarean section |
| NHB | non-Hispanic Black |
| NHW | non-Hispanic White |
| WIC | Women, Infants, and Children |

## INTRODUCTION

Breastfeeding rates are low in the United States compared to our social and economic counterparts. Only 24.9% of women[1] in the United States achieve the WHO recommendation of 6 months of exclusive breastfeeding. This rate is even lower among different racialized groups, with only 19.1% of non-Hispanic Black (NHB) women exclusively breastfeeding through 6 months (CDC 2019). The benefits of breastfeeding for both moms and infants are well established. Moms who breastfeed their babies are at reduced risk for hypertension (Binns et al. 2016), type 2 diabetes (Schwarz et al. 2010), cardiovascular disease (Binns et al. 2016), postpartum depression (Sibolboro Mezzacappa and Endicott 2007), and breast cancer (Collaborative Group on Hormonal Factors in Breast Cancer 2002). Infants who are breastfed are less likely to develop respiratory tract infections (Chantry et al. 2006), infectious diseases (Duijts et al. 2010), or to be overweight or obese as adolescents (Binns et al. 2016), and also demonstrate improved cognitive development (Kramer et al. 2008). With rising rates of maternal mortality and high rates of overweight and obesity in the United States (Hoyert 2023, Hales et al. 2020), improving breastfeeding rates, especially among non-Hispanic Black (NHB) women, could be a protective intervention. Understanding the decisions made and the factors contributing to breastfeeding initiation and continuation are essential to improving breastfeeding rates.

Moreover, there is evidence to suggest that mode of delivery has an effect on

[1] Because the individuals in this study all identified as women, I will be using the term woman to refer to the study participants throughout this paper. When referring to other studies, I will use the convention of the paper. However, when writing about the population more broadly, I will be using gender inclusive terms such as birthing person, pregnant person, etc.

breastfeeding duration. Emergency cesarean sections (c-sections) are negatively associated with important breastfeeding outcomes like breastfeeding initiation within the first 24 hours, successful breastfeeding initiation, and overall duration of breastfeeding (Benton et al. 2019, Hobbs et al. 2016, Zanardo et al. 2010). Further, medical interventions such as labor induction with Pitocin and the use of opioid pain medication have been shown to shorten the duration of breastfeeding (Ahluwalia et al. 2012, Bai et al. 2013). Because NHB women are more likely to have emergency c-sections (Osterman et al. 2023, Edmonds et al. 2013), mode of delivery could be one factor underlying the lower rates of breastfeeding among Black women.

An overlooked part of the literature in the US is how the psychological impact of the birth experience, beyond just mode of delivery, affects breastfeeding duration. Literature from other countries indicates that the psychological impact of the birth experience may have an effect on breastfeeding outcomes (Davis and Sclafani 2022, Ahluwalia et al. 2012, Brown and Jordan 2013, Türkmen et al. 2020, Zanardo et al. 2017). Mode of delivery is often categorized as either vaginal or c-section, with little attention paid to the individual experience of a vaginal birth over a cesarean birth. Having a birth that does not meet an individual's expectations, whether that is having a vaginal birth when you were expecting a c-section or having a c-section when you were expecting a vaginal birth, has been shown to negatively impact an individual's perceptions of their birth experience (Hodnett 2002). Moreover, some evidence suggests that even achieving a vaginal birth might have a negative effect on breastfeeding duration if artificial oxytocin is used to augment labor (Olza et al. 2012).

The present study predicted that women who have a mismatch between their birth intention and their birth outcome (labor mismatch) would breastfeed for a shorter amount of time than they planned compared to women whose birth intention matched their birth outcome.

Specifically, this study aimed to answer the following questions: (1) What makes a woman more likely to have a labor mismatch and (2) does a labor mismatch affect if a woman achieves her breastfeeding goals?

**Figure 1**

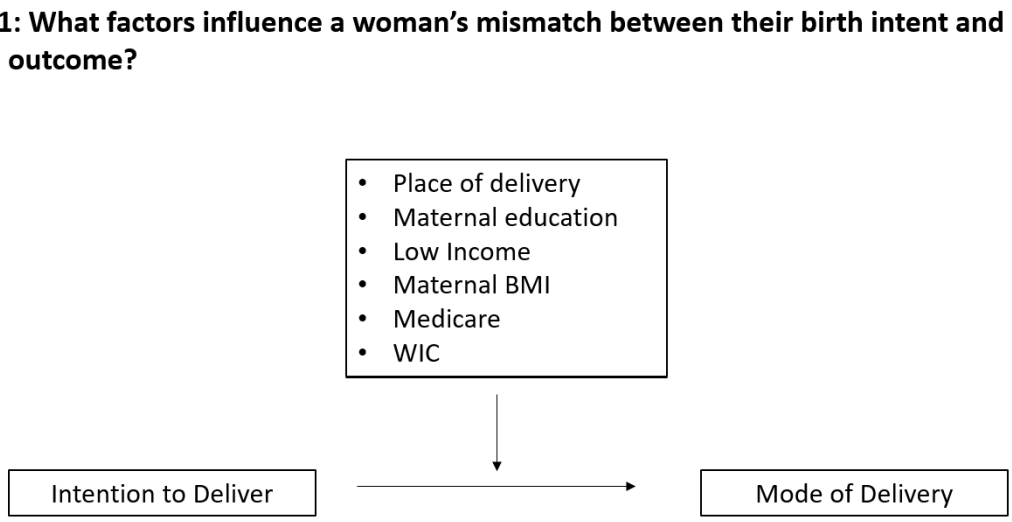
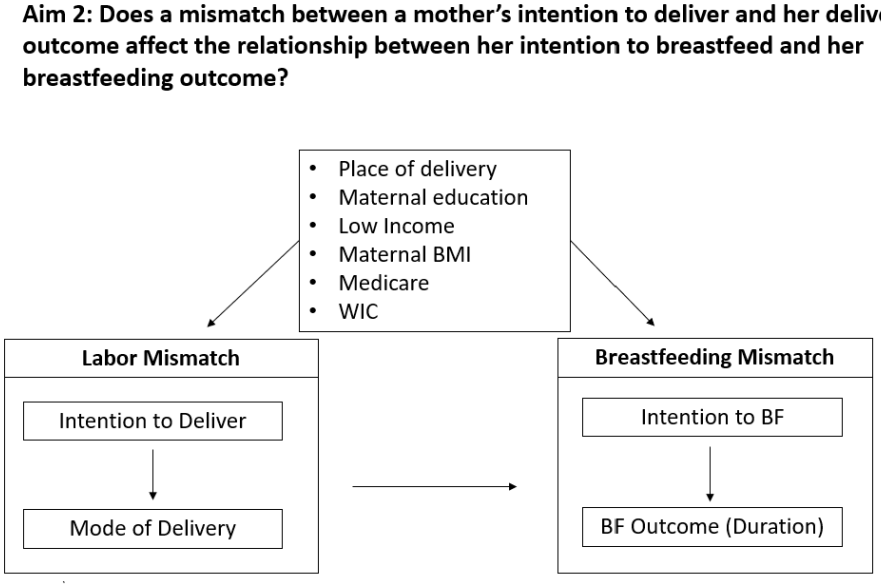



**Figure 2**



## BACKGROUND

### The Medicalized Birth Process & Breastfeeding

Medical anthropologists have argued that birth and breastfeeding in the United States are fundamentally different than birth and breastfeeding in other countries, primarily because birth and breastfeeding in the United States has been medicalized (Jordan 1993, Davis-Floyd 2022, Torres 2014). Medicalization is the process through which normal, physiologic human conditions are deemed pathological (Lock & Nguyen 2018). Often biomedicine then treats the now medicalized condition with medication, surgery, or another biomedical treatment in order to return the body back to "normal". In the past, this definition of "normal" was defined by statistical averages of primarily white, primarily male, and primarily Western populations (Wiley & Cullen 2020). Therefore, processes such as pregnancy and birth, which are not experienced by white males, were deemed deviant conditions. As a result, biomedical perceptions of these processes indicate that professional, medical intervention is needed to return the body back to a non-pregnant, or normal, state (Davis-Floyd 2022).

Birth in the United States differs from other countries of similar social and economic standing in that there was a sharp decline in midwifery and rise in obstetrics (Goode and Rothman 2017). Particularly in the South, Black midwives were intentionally driven out of practice by obstetricians who believed their practices to be dangerous (Fraser 1998 & Luke 2018). Modern obstetrics inherits this bias against the midwifery model of care.

In the United States today, there are two main models of care utilized for reproductive health: the midwifery model of care and the medical model of care. The midwifery model of care

supports pregnancy and birth as a normal, physiologic process in the life cycle of a woman. Midwives monitor the physical, psychological, and social well-being of the mother throughout the childbearing cycle, provide the mother with individualized education, counseling, and prenatal care, provide the mother with continuous hands-on assistance during labor and delivery as well as postpartum support, minimize technological interventions, and identify and refer women who require obstetrical attention to OBGYNs (Midwifery Task Force 2014). The woman's body determines how long the process will take and the mother is seen as the main decision maker.

Under the medical model of care, birth is seen as a dangerous process that needs to be managed by medical interventions (Davis-Floyd 2022). As a result, most births in the United States take place in the hospital (98.6%) and are attended to by OBGYNs (89.3%). Additionally, a third of births end in c-sections (32.1%), and around 32.1% use artificial induction of labor (Osterman et al. 2023). Arguably, the high rates of c-sections can be attributed to the medical model of birth, with an increase seen after the rise in obstetrics and decline in midwifery in the 1920s and 1930s (Fraser 1998). As a result, today OBGYNs are the default caregiver for pregnant people in the United States even for low-risk births. In other countries, like Iceland, Norway, and New Zealand, midwives are the primary caregiver for pregnant people, unless someone is deemed a high-risk pregnancy, in which case they are referred to an OBGYN.

Rarely in their training do American OBGYNs see a natural, physiologic birth (Davis-Floyd 2022). For this reason, OBGYNs most likely see birth as inherently dangerous, and are taught that medical interventions are often necessary to manage the birth process. A woman who wishes to have a natural birth, or a birth without medical intervention, is seen as deviant, as evidenced by the negative perceptions of birthing plans of nurses and doctors (Lothian 2006).

However, hospitals are working towards improving the birth experience for their patients as demonstrated by the increase in hospital doula programs (Beets 2014) and the rise of the Baby-Friendly Hospital Initiative (Baby-Friendly USA 2023). Unfortunately, resources such as doulas and certified lactation consultants are often not equitably distributed, so disadvantaged populations are unlikely to receive the benefits of these efforts (Hartmann et al. 2012, Kozhimannil et al. 2017).

Also evident in the medical model of care is the inheritance of Cartesian dualism. Cartesian dualism is the theory presented by Rene Descartes in the 1600s that the mind and body operate separately from each other. Medical birth practices in the United States like the ones mentioned above indicate that birth is seen as a physical act, rather than an interaction between a person's emotions, hormones, and physiology. Conversely, doulas and midwives are trained under the midwifery model of care to support a birthing person emotionally as well as physically. This emotional care could look like simply asking the mother how she is feeling if labor has stalled or directly asking about her fears in a prenatal meeting. This acknowledgment of the importance of the emotional and psychological aspect of birth is missing under the current medical model of care. Because only 7.9% of births in the United States are attended to by midwives (Declercq 2015), this separation between the psychological aspect of giving birth and the physical act of giving birth could explain why medical practitioners may not see the importance of supporting natural, physiologic birth. Some have argued that this gap may be a factor in the poor birth and breastfeeding outcomes we see in the United States today, especially compared to other countries of similar economic and social standing (Goode and Rothman 2017, Smith 2007).

In addition to the medicalization of birth, Jennifer Torres (2014) argues that breastfeeding

itself has been medicalized under the medical model of care. Torres discusses the shift from breastmilk to formula and argues that this shift resulted in the medicalization of breastfeeding. Mothers now talk about their breastmilk in terms of ounces and component parts and get frustrated or worried about the amount of milk they produce. The lactation consultants Torres interviewed stated that this frustration affects the mothers' ability to produce milk, and so they often take scales out of the mothers' postnatal recovery rooms. It is well known in breastfeeding literature that a mother must be relaxed enough for the letdown response, or for breastmilk to fill the milk ducts sufficiently to feed the infant (Stuebe et al. 2012). This connection indicates the importance of the emotional state to the physical state of new mothers, especially when it comes to breastfeeding.

Research conducted on both birth and breastfeeding in the United States should consider the highly medicalized system in which most pregnant people are birthing and breastfeeding their infants. Though most research outside of medical anthropology does not acknowledge this highly medicalized context, understanding how the United States differs from other countries in terms of birth and breastfeeding practices could provide insights into why our birth and breastfeeding outcomes are poorer than other countries.

## Factors Affecting Breastfeeding Outcomes

Studies conducted in the United States and elsewhere have found breastfeeding outcomes such as initiation and duration rely on a multitude of factors. Previous research looking at prohibitive factors to breastfeeding initiation and duration found that smoking, mode of delivery, parity, dyad separation, maternal education, and maternal breastfeeding education are all significant to breastfeeding initiation and continuation (Cohen et al. 2018, Huang et al. 2019).

Mode of delivery has been found to be particularly impactful on some breastfeeding outcomes. For example, emergency cesarean sections are associated with unsuccessful first latch, lower likelihood of breastfeeding with the first 24 hours, and shorter breastfeeding duration over time (Benton et al. 2019, Hobbs et al. 2016, Zanardo et al. 2010). A meta-analysis of 31 countries suggests that having a cesarean delivery before starting labor is negatively associated with early breastfeeding, but not associated with breastfeeding at 6 months (Prior et al. 2012). Moreover, some studies suggest that beyond mode of delivery, interventions during the labor process could affect breastfeeding outcomes. One study conducted on 1280 mother-infant pairs found that induction of labor, opioid pain medication, and having an emergency cesarean birth were all associated with a shorter duration of any breastfeeding; however, this association went away when controlling for confounders such as maternal age, education, monthly family income, previous breastfeeding experience, intention to exclusively breastfeed, and returning to work postpartum (Bai et al. 2013). In a study that used data from the longitudinal Infant Feeding Practices Study II, though no significant association was found between delivery method and breastfeeding initiation, individuals with induced vaginal and emergency cesarean deliveries were significantly less likely to breastfeed at 6 months (Ahluwalia et al. 2012).

Pre-pregnancy BMI also affects birth and breastfeeding outcomes. One study found that healthy and overweight women have similar prenatal intentions for breastfeeding, but overweight women were less likely to exclusively breastfeed after they were discharged from the hospital (Jersey et al. 2017). Another study conducted in the US found that overweight/obese women with medical or labor and delivery complications were less likely to initiate breastfeeding compared to women of normal weight (Kitsantas and Pawloski 2010). This same study found that though there was not an independent effect of pre-pregnancy overweight/obesity on

breastfeeding initiation among women with no medical problems, they did have an 11% increased risk of stopping breastfeeding with each additional month of breastfeeding duration compared to women of normal weight. Though the study does not offer an explanation for why this was the case, a possible explanation could be that women with an obese BMI are less likely to seek breastfeeding support in the first three months postpartum (Mok et al. 2008).

These factors indicate that the birth process as well as a person's BMI can impact breastfeeding outcomes. However, this literature does little to examine the pathways through which mode of delivery and BMI impacts breastfeeding initiation and duration. Some evidence suggests that the emotional and psychological experience of the birth process may have something to do with the poor breastfeeding outcomes we see in the United States.

The Psychological Impact of the Birth Experience on Breastfeeding Outcomes

Studies conducted in other countries indicate that the birth experience, including the birthing person's perception of the birth experience, their perception of clinical care, and medical interventions used during the labor process, impact whether a birthing person is breastfeeding at 6 weeks and 6 months postpartum. In the United States, the lack of literature around how the psychological impact of a traumatic birth impacts breastfeeding outcomes in the United States is indicative of our dominant medicalized birth model. For example, literature on breastfeeding after cesarean sections focuses mainly on the physical aspects of recovery rather than the mental aspects of recovery (Hobbs et al. 2016).

However, some research outside of the US has looked at the effect of the emotional and psychological impact of the birth process on breastfeeding outcomes. Davis and Sclafani (2022) found that among a large sample (N = 3,080) of mothers in Canada, mothers who reported more

positive birth experiences were more likely to report breastfeeding their child for a longer period (over 9 months) than those who had more negative birth experiences. Similarly, a UK study found that mothers who experienced birth complications breastfed for a significantly shorter duration than those who did not and reported discontinuing breastfeeding for reasons of pain and difficulty (Brown 2013). Moreover, c-section, fetal distress, failure to progress, and postpartum hemorrhage were all associated with a shorter breastfeeding duration.

Another study conducted in the UK found that mothers who had received artificial oxytocin were significantly more likely to report stopping breastfeeding for physical reasons such as pain or difficulty (Brown and Jordan 2014). Moreover, Zanardo et al. (2017) found that elective induction of labor was associated with lower exclusive breastfeeding rates at 1 and 3 months postpartum among a group of women in Italy. An integrative review of the literature on oxytocin use and breastfeeding outcomes found that half of the measures reviewed indicated "less optimal breastfeeding outcomes", with the remaining measures having mixed findings or no association between artificial oxytocin use and breastfeeding outcomes (Erickson and Emeis 2017). This literature indicates that the psychological impact of birth and birth practices may affect breastfeeding outcomes. However, especially in the United States, some groups may face even more challenges with birth and breastfeeding.

Disparities in Birth Practices

Particularly among NHB pregnant people, birth practices and the birth experience may differ from the studies referenced above. NHB women are at greater risk for not receiving prenatal care and receiving a c-section compared to white women in the United States (Osterman et al. 2023). However, induction of labor is significantly less common among Black women than

non-Hispanic White women (Wood et al. 2023), except during 34-36 weeks gestation (Falciglia 2015). Moreover, another study found that Black women are more likely to have a c-section due to fetal distress and for "failure to progress" in the first stage as compared to the second stage of labor compared to white women, even in a low-risk nulliparous population (Edmonds et al. 2013).

It is unclear whether this disparity is a result of medically necessary interventions, or a result of cultural factors such as hospital practices and pregnant people's preferences. However, qualitative data surrounding racism in healthcare suggests that this disparity relates largely to obstetric racism (Davis 2019, Goode & Rothman 2017). Dána-Ain Davis defines obstetric racism as "the intersection of obstetric violence and medical racism […] It includes, but is not limited to, critical lapses in diagnosis; being neglectful, dismissive, or disrespectful; causing pain; and engaging in medical abuse through coercion to perform procedures or performing procedures without consent" (Davis 2019, 2-3). For example, Davis shares the story of a woman who wanted "a peaceful birth" at a birthing center, but instead had a hospital birth with Pitocin, an epidural, and a c-section (Davis 2019, 7). The mother's birth plan was rejected by hospital staff, and the baby was sent to the NICU immediately after birth. When the mother inquired why her son was still in the NICU despite looking like a healthy baby, the staff dismissed her saying, "Because we have to monitor him" (Davis 2019, 7). The mom attributed this largely to the fact that she looked young and was subjected to the stereotypical ideas around single Black pregnant teenagers. Obstetric racism very likely contributes to the fact that NHB women are more likely to receive medical interventions during the birth process than non-Hispanic White (NHW) women.

Breastfeeding among NHB Women in the United States

Data further indicates that NHB women may also have different experiences and more pronounced challenges with breastfeeding than the studies referenced above. Though exclusive breastfeeding rates at 6 months are improving in the United States, NHB women continue to experience lower rates of breastfeeding initiation and exclusive breastfeeding at six-months than their NHW counterparts (Anstey et al. 2017). The gap between breastfeeding initiation between NHB women and NHW women from 2010-2013 was 17.2 percentage points (Anstey et al. 2017). In North Carolina, 14% fewer NHB women initiate breastfeeding than NHW women and 6% fewer NHB women breastfeed exclusively through 6 months compared to NHW women (Anstey et al. 2017). One study found that NHB women are the least likely to initiate breastfeeding compared to NHW women and Hispanic women (Masho et al. 2015). Another study similarly found that NHB women were less likely to initiate breastfeeding but had similar odds of continuing to breastfeed at 6 months (Haas et al. 2022).

Some studies indicate that factors such as needing to return to work early, lack of access to professional breastfeeding support, and cultural differences such as formula as the expected way to feed a baby, taboos against public breastfeeding, and the mother's perceptions of her weight and attractiveness may play a role in the lower rates of breastfeeding among NHB women (Masho et al. 2015, Anstey et al. 2017, Louis-Jacques et al. 2022).

Moreover, Ahluwalia et al. (2012b) found that maternity care practices associated with breastfeeding in the US varied across three racial/ethnic groups. Their study found that breastfeeding within the first hour, baby given a pacifier, and assistance from hospital staff were significantly associated with breastfeeding duration among Black and White women and not Hispanic women (Ahluwalia et al. 2012b). Additionally, breastfeeding on demand was significantly associated with breastfeeding to 10 weeks for Black and Hispanic women and not

for White women (Ahluwalia et al. 2012b).

These disparities in breastfeeding outcomes for NHB women could be associated with the disparities in birth practices mentioned in the previous section, given the studies in other countries that have found associations between birth practices and breastfeeding outcomes. However, few studies in the United States—especially among NHB women—have looked at this relationship despite the stark health disparities that exist. Moreover, these health disparities in early life may have impacts on health later in life.

Birth, Breastfeeding, and Health Outcomes: Developmental Origins of Health and Disease

Studies have shown that the labor process and breastfeeding have important implications both for the immediate and future health of infants. Studies using Developmental Origins of Health and Disease (DOHaD) framework indicate that both the labor process and the breastfeeding period are critical events in the lifespan of an individual. Drawing on experimental, clinical, epidemiological, and public health research, this framework looks at how early environments shape morbidity through organisms' plasticity, or the ability of organisms to adapt their phenotype from environmental cues such as nutrition or hormones (Gluckman et al. 2009). A component of this framework is the impact that critical periods, or stages of development that are particularly sensitive to changes in the environment, have on development. Pregnancy, birth, and the breastfeeding period are all considered critical periods under the DOHaD framework, suggesting that cues from the birth and breastfeeding environment have implications for the health of individuals later in life.

There are a few suggested pathways through which the birth and breastfeeding environments impact health later in life. Some evidence suggests that the stress of the labor

process activates critical systems in the offspring's body, like stimulating the lungs to expand. A meta-analysis found an association between cesarean section and childhood asthma, suggesting that the labor process may be important to development of the lungs (Thavagnanam et al. 2008). Moreover, evidence suggests that whether an infant is delivered preterm or at term, fed breastmilk or formula, delivered via the vaginal canal or via c-section, spends time in the NICU, and/or is given medications such as antibiotics affects the programming of their intestinal microbiota (Goulet 2015). This programming, if disrupted, can lead to asthma, irritable bowel syndrome, diabetes, and obesity (Goulet 2015, Thompson 2019). Additionally, animal models indicate that the macronutrients, micronutrients, antibodies, growth factors, and hormones found in breastmilk can help prevent metabolic dysfunctions, cardiovascular diseases and neurobehavioral disorders later in life (Lisboa et al. 2021).

Studying the impact of the birth experience on breastfeeding outcomes has implications for the future health of individuals, particularly those who identify as NHB. Both the birth and breastfeeding process are important to the immediate health of infants and lay the groundwork for optimal adult health. Especially for groups of people who are at greater risk for developing adverse health outcomes as adults, optimizing early life conditions is particularly important to ensure that good health is achievable later in life.

### Context of Mothers & Others Study

This analysis uses a dataset from the Mothers & Others study, a randomized controlled trial (Wasser et al. 2017). Its main intervention was a family-based obesity prevention program aimed at targeting the rapid infant weight gain that NHB infants are twice as likely to experience over NHW infants. The research team recruited self-identified NHB pregnant women in the

North Carolina Triangle area at 28 weeks' gestation, at which time team members conducted a baseline survey to determine eligibility. Data were collected between November 2013 and December 2017 via online surveys and home visits by a peer educator at 3-, 6-, 9-, 12-, and 15-months postpartum. At these home visits, the obesity prevention group received anticipatory guidance on responsive feeding and care practices, while the injury prevention group received anticipatory guidance on child safety. In the obesity prevention group, study partners were encouraged to attend the home visits. In the injury prevention group, study partners only completed the study assessments.

Participants from this dataset gave birth at one of three hospitals in the Triangle area in North Carolina. Two of these hospitals, UNC Women's Hospital and Duke Regional, are large research institutions connected to universities. Both UNC Women's Hospital and Duke Regional were certified baby-friendly at the time of data collection. Being certified baby-friendly ensures that the hospitals facilitate immediate and uninterrupted skin-to-skin contact, support mothers in initiating breastfeeding as soon as possible after giving birth, help support mothers to maintain breastfeeding and manage common difficulties, enable mothers and infants to remain together and to practice rooming-in 24 hours a day, help mothers recognize and respond to their infants' cues for feeding, counsel mothers on the use and risks of bottles and pacifiers, and coordinate so parents have access to ongoing support and care (Baby-Friendly USA 2023). This designation is associated with positive breastfeeding outcomes such as early breastfeeding initiation, exclusive breastfeeding at hospital discharge, and any breastfeeding and early breastfeeding duration (Pérez-Escamilla et al. 2016). The other hospital, WakeMed, was a large regional hospital and not certified as baby-friendly.

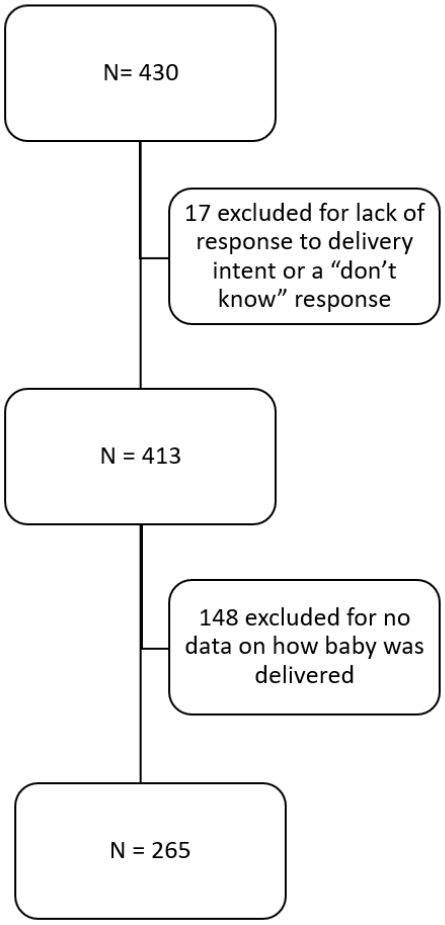
## METHODS

Dataset

430 mother-infant pairs were enrolled in this study. However, one participant did not complete the baseline assessment and was therefore not randomized. Due to multiple factors such as loss to follow up, extended hospital stays, preterm deliveries, low birthweights, multiple births, and medical conditions, 299 mothers remained eligible after the birth of their baby and were followed through the duration of the study.

Data collected on mother's intent to deliver, intentions for breastfeeding, delivery outcome, and breastfeeding duration, in addition to other demographic data, were used for the current analysis. Intent to deliver, intentions for breastfeeding, and demographic data were all collected at the 28-week baseline survey. Delivery outcome was collected via survey 1 month after participants delivered their baby, and breastfeeding duration was collected at the in-home visits at 3-, 6-, 9-, 12-, and 15-months postpartum. Participants who did not have data on how their infant was delivered were excluded from this study. The final analytic sample size was 265 mother-infant pairs (N = 265). Because this dataset collected detailed information on delivery and breastfeeding outcomes, it is appropriate for examining the effect of labor mismatch on breastfeeding outcomes.

**Figure 3. Consort Flow Diagram**




Variables

*Labor Mismatch Variable* The labor mismatch variable was coded using participant's responses for how they planned to deliver their baby (vaginally and not induced, vaginally and induced, cesarean and not induced, cesarean and induced, don't know, refuse) and how they delivered their baby (vaginally and not induced, vaginally and induced, a planned cesarean, and an unplanned or emergency cesarean). Participants who intended to have a vaginal delivery and ended up with an induced vaginal delivery, a planned cesarean section, or an unplanned cesarean section were coded as "yes" for the labor mismatch variable. Participants who intended to have an induced vaginal delivery and delivered their baby via a vaginal uninduced delivery, a planned

cesarean section or an emergency cesarean section were also coded as "yes" for the labor mismatch variable. Similarly, for participants who intended to have a cesarean section and had either a vaginal delivery or an induced vaginal delivery were also coded as "yes" for the labor mismatch variable. Individuals who intended to have either an induced or un-induced cesarean section were coded "yes" for mismatch if they ended up with a vaginal delivery, induced or not induced, and "no" if they had either a planned or an unplanned or emergency c-section. Despite the implication of "unplanned" cesarean section, (i.e. that it was not intended and therefore should be a labor mismatch) this decision was made because there was a small number of individuals (N = 3) for whom this was the case. No respondents replied with "don't know" or "refuse" for their labor intention.

**Figure 4: Coding Labor Mismatch Variable**

| | | Delivery Outcome | | | | |
|---|---|---|---|---|---|---|
| | | Vaginally & Not Induced | Vaginally & Induced | Planned Cesarean | Unplanned or Emergency Cesarean | Total |
| Delivery Intent | Vaginally & Not Induced | No (N = 108) | **Yes (N = 86)** | **Yes (N = 3)** | **Yes (N = 30)** | 227 |
| | Vaginally & Induced | **Yes (N = 6)** | No (N = 5) | **Yes (N = 1)** | **Yes (N = 2)** | 14 |
| | Planned Cesarean | **Yes (N = 0)** | **Yes (N = 0)** | No (N = 8) | No (N = 1) | 9 |
| | Cesarean & Induced | **Yes (N = 1)** | **Yes (N = 0)** | No (N = 12) | No (N = 2) | 15 |
| | Total | 115 | 91 | 24 | 35 | 265 |

*Breastfeeding Mismatch Variable* The breastfeeding mismatch variable was created using participants' responses to their intent to breastfeed and their breastfeeding duration outcome.

Participants' breastfeeding intent was coded using the infant feeding intentions scale. Participants either responded that they were planning to only feed their baby formula, to at least give breastfeeding a try, or be exclusively breastfeeding at 1, 3, or 6 months. Participants were coded as "No breastfeeding" if they strongly disagreed with the statement "I am planning to at least give breastfeeding a try". Participants were coded intending to attempt "Some breastfeeding" if they strongly agreed with the statements, "I am planning to at least give breastfeeding a try" and "When my baby is 1 month old, I will be breastfeeding without using any formula or other milk". Similarly, participants were coded as intending to breastfeed for 3 months or six months if they strongly agreed with the statements, "When my baby is [3 or 6] months old, I will be breastfeeding without using any formula or other milk." If participants answered "Unsure" for 1 month, 3 months, and 6 months, they were coded as Unsure for breastfeeding duration intention. There were 33 participants who did not fit into this coding. Generally, the response for the "I am planning to at least give breastfeeding a try" was used if the response to the 1 month intention was "Unsure", "Somewhat disagree", or "Strongly disagree". If the 1 month intention response was "Somewhat agree", the last month that had "Somewhat agree" was used as the intention duration.

To ascertain breastfeeding duration, participants were asked at study visits, "at what age did you stop breastfeeding [infant]?". This question was only asked if the mothers responded "no" to "Are you still breastfeeding [infant]?". At every visit after mothers responded "no" to "Are you still breastfeeding [infant]?", participants were again asked "at what age did you stop breastfeeding [infant]?". In most cases (N = 207), participants responded differently at different visits. For example, one participant answered the question 7 months at the third in-home visit, but at the fourth and fifth visit they reported stopping breastfeeding at 8 months and 9 months,

respectively. For these participants, the answer given closest to the reported cessation of breastfeeding was used. So, in the example, this participant's breastfeeding duration was coded as 7 months, because that is the answer reported closest to the participant's reported cessation. Mothers responded to "at what age did you stop breastfeeding [infant]?" with either 0-7 days, 8-14 days, more than 14 days but less than 1 month; 1 month; 2 months; 3 months; 4 months; 5 months; 6 months; 7 months; 8 months; 9 months; 10 months; 11 months; or 12 months or older. If respondents answered 0-7 days, it was recoded to 3.5 days for the purpose of analysis. Similarly, 8-14 days was recoded as 11 days, and more than 14 days but less than 1 month was recoded as 22 days. This ensured that the units could remain in months. Participants were coded as having a breastfeeding mismatch if their breastfeeding duration intent was either shorter or longer than their actual breastfeeding duration.

*Other Confounding Variables* Income was reported as a household measure. Participants were asked which level of income (weekly, monthly or yearly) was easiest for them to recall and the peer educator recorded the amount. Individuals were classified into low-income based on the same measures as WIC, or less than 185% of the poverty line. Participant's BMI was calculated using self-reported pre-pregnancy weight and the height recorded by the peer educator. For this analysis, BMI was separated into three categories: underweight/normal due to the small number of underweight individuals (N = 8), overweight, and obese. The Women, Infants, and Children (WIC) variable used for this analysis included whether participants, or any member of their household, received benefits from the WIC program in the last 12 months. This variable was recoded as a yes/no variable. Similarly, whether or not individuals were enrolled in Medicaid was recorded as yes or no. For participant's education level, they were asked to report the highest grade or year of school they completed. Participant's responses were recorded as less than high

school, high school or GED, and some college. For place of delivery, study participants delivered their babies at one of three hospitals in central North Carolina: UNC Women's Hospital, Duke Regional, or WakeMed. Only one participant delivered their baby at Duke Regional, so Duke Regional and UNC Women's Hospital, which were both baby-friendly, were combined for the purpose of this analysis.

## Data Analysis

To test for associations between demographic variables and a labor mismatch outcome, chi-squared analysis was conducted for categorical variables and t-tests were conducted for continuous variables. Logistic bivariate regression was also used to test for associations between the labor mismatch variable and BMI, place of delivery, education, low-income status, Medicaid enrollment, and WIC enrollment. To test for whether a labor mismatch resulted in a mismatch between an individual's breastfeeding intent and breastfeeding outcome, multinomial logistic regression with relative risk ratio was used for both adjusted and unadjusted models. All analyses were conducted using STATA 17.0.

## IRB Approval

This project was approved by the IRB board at UNC-Chapel Hill.

# RESULTS

## Sample Characteristics

Most participants in this sample were enrolled in Medicaid (74.18%), enrolled in WIC (81.78%), had a pre-pregnancy BMI of more than 30 (56.05%), were low-income (72.77%), had some college (47.43%), gave birth at WakeMed hospital (76.74%), and intended to attempt at least some breastfeeding (32.17%) or breastfeed for 6 months (20.51%). Results can be seen in Table 1. Of the 430 mothers admitted to this study, 215 were assigned to the obesity prevention group (intervention group) and 214 were assigned to the injury prevention group (non-intervention group). One participant was not assigned to a group because they had incomplete baseline data.

Of the analytic sample, 265 participants had data on their birth intention and birth outcome. Sample characteristics of this subsample were similar to the overall sample characteristics: most participants were enrolled in WIC (80.75%), enrolled in Medicaid (73.96%), were low income (73.31%), had some college education (51.70%), gave birth at WakeMed (76.60%), and either intended to try at least some breastfeeding (29.43%) or breastfeed for 6 months (20.00%). Most individuals in this sample breastfed for longer than they intended to (72.12%). However, the analytic sample differed from the overall sample in that there was about an equal number of participants with an underweight or normal pre-pregnancy BMI (38.34%) as participants with an obese pre-pregnancy BMI (39.92%). Results can be seen in Table 2.

Predictors of Labor Mismatch

Of the included participants, 128 (48.3%) had a mismatch between their birth intent and their birth outcome. In chi-squared analyses, place of delivery, maternal education, BMI, Medicaid enrollment, and WIC status were not significantly associated with a labor mismatch. However, being low-income was significantly associated with labor mismatch in chi-squared analyses (p-value $< 0.05$). In unadjusted regression results, having an obese pre-pregnancy BMI was associated with a 1.69 increase in odds for a labor mismatch compared to having a normal or underweight pre-pregnancy BMI. Additionally, women who were low-income were half as likely to have a labor mismatch compared to women who were not low-income. Unadjusted regression models did not show significant results between having a labor mismatch and place of delivery, education, Medicaid enrollment, or WIC enrollment.

In the adjusted regression model, participants who had an obese pre-pregnancy BMI were associated with 1.98 increase in odds for a labor mismatch compared to participants who had an underweight or normal pre-pregnancy BMI when controlling for place of delivery, education, low-income status, Medicaid enrollment, and WIC enrollment. In addition, having a high-school education or a GED was associated with 1.82 increased odds of having a labor mismatch compared to participants with some college in the adjusted logistic regression model, and being low-income was associated with a 0.5 decrease in odds for a labor mismatch compared to participants who were not low-income, controlling for covariates. Adjusted regression models did not show significant associations between having a labor mismatch, place of delivery, Medicaid enrollment, or WIC enrollment.

Relationship Between Labor Mismatch and Breastfeeding Mismatch

There were no significant differences seen across breastfeeding duration intent between the mismatch and non-mismatch groups. Most of the respondents indicated that they intended to attempt at least some breastfeeding with their infant (30.23% for the mismatch group and 28.68% for the non-mismatch group).

There was not a significant relationship between a labor mismatch and breastfeeding mismatch in both unadjusted and adjusted multinomial analyses. However, breastfeeding duration and having an obese pre-pregnancy BMI were both significant for participants who breastfed shorter than they intended to. Unsurprisingly, breastfeeding shorter than intended was reduced by a factor of 0.6 for participants who breastfed for a longer duration than those who breastfed for a shorter duration. Additionally, participants with an obese pre-pregnancy BMI were 8.6 times more likely to breastfeed for a shorter period than they intended to compared to participants with a normal or underweight pre-pregnancy BMI. Breastfeeding duration, BMI, place of delivery, education, low-income status, Medicaid enrollment, and WIC enrollment were not significantly associated with breastfeeding longer than participants intended to.

## DISCUSSION

### Key Findings

Contrary to expectations, this study did not find that a labor mismatch was associated with whether women met their intended breastfeeding duration. Instead, we found that breastfeeding duration and having an obese pre-pregnancy BMI was associated with an increased risk for breastfeeding shorter than a participant intended. This study also found that being low-income and having an obese pre-pregnancy BMI was associated with an increased odds for labor mismatch when controlling for covariates.

BMI's significance to labor mismatch is consistent with the literature. Other studies have found that obese mothers are more likely to receive induction of labor than women of normal weight (Graves et al. 2006, Sebire et al. 2001), and are more likely to have emergency c-sections (Arrowsmith et al. 2011). Given that most of the women with an obese pre-pregnancy BMI in this study intended to have a vaginal and not induced delivery (85.71%, N = 138), it follows that these women, who are more likely to receive induction of labor and have an emergency cesarean section, would have a labor mismatch. These results are even less surprising given that this study included only NHB women, who are also at greater risk for c-sections (Edmonds et al. 2013).

Similarly, increased odds of having a labor mismatch for participants with a high school education or a GED as compared to participants with some college is consistent with the literature. Previous research indicates that women with less education are at greater risk for poor birth outcomes like cesarean section and induction of labor (Boerma et al. 2018, Coonrod et al. 2000). However, low-income participants being half as likely for a labor mismatch compared to

individuals who are not low-income was a surprising finding. Research on low-income mothers has mostly focused on birth outcomes like premature birth and low-birth weight, but Milcent and Zbiri (2018) found that low-income women in France were more likely to have cesarean sections. However, more research is needed on how being low-income affects individuals' risk for birth interventions such as labor induction and cesarean section.

An encouraging finding of this study is that most participants (76.80%) breastfed longer than they intended. The community support provided by identifying a study partner and having a peer educator visit regularly may have had a positive effect on participant's breastfeeding goals. That being said, most participants (54.30%) breastfed until 1 month, which is lower than the national average of 83.2% of infants receiving any breastmilk at 1 month (CDC 2019), and 11.29% breastfeeding until 6 months, which is lower than both the national average and statewide average for NHB women (14.0% and 16.2%, respectively).

Strengths & Limitations

A limitation of this study was that the only data on the birth experience was mode of delivery. Therefore, we made the assumption that a mismatch between a person's labor intention and their labor outcome constituted a negative experience. However, it could be the case that individuals did not have a negative experience. Qualitative interviews from the mothers on whether they had a positive birth experience or negative birth experience could have strengthened this analysis. Moreover, most of this data was self-report, which is subject to inaccuracies due to error in recalling information. However, because the study was longitudinal, error due to recall bias is less likely; there was high consistency among this data in reporting, for example, how long mothers breastfed. When mothers were asked at each study visit how long

they breastfed, a high percentage answered within the same range at each study visit. Another limitation of this study is that the dataset included only NHB women, which means the results are not generalizable beyond this population. However, this sample is important because NHB women are more likely to have poor birth and breastfeeding outcomes over other racialized groups (Osterman et al. 2023, Anstey et al. 2017).

Strengths of this study include sample size (N = 265) and detail of breastfeeding data. Furthermore, this study specifically looked at NHB mothers, which are an understudied population. Understanding the factors around NHB mothers' breastfeeding decisions is especially important because this population is at greater risk for poor breastfeeding outcomes (Anstey et al. 2017). The findings from this study indicate that more support is necessary for low-income, NHB mothers with an obese pre-pregnancy BMI for achieving their birth and breastfeeding goals.

## APPENDIX A: TABLES

### Table 1. Sample Characteristics

| | Total (N = 430) | Included (N = 265) | Excluded (N = 165) | P-Value |
|---|---|---|---|---|
| Breastfeeding Duration Intent (N = 429) | | | | 0.079 |
| No BF | 24 (5.59) | 18 (6.79) | 6 (3.66) | |
| Some BF | 138 (32.17) | 78 (29.43) | 60 (36.59) | |
| 1 month | 58 (13.52) | 43 (16.23) | 15 (9.15) | |
| 3 months | 43 (10.02) | 30 (11.32) | 13 (7.93) | |
| 6 months | 88 (20.51) | 53 (20.00) | 35 (21.34) | |
| Unsure | 78 (18.18) | 43 (16.23) | 35 (21.34) | |
| Place of Delivery | | | | 0.930 |
| UNC or Duke Regional | 100 (23.26) | 62 (23.40) | 38 (23.03) | |
| WakeMed | 330 (76.74) | 203 (76.60) | 127 (76.97) | |
| Maternal Education | | | | 0.078 |
| Less than HS | 71 (16.59) | 40 (15.09) | 31 (19.02) | |
| HS/GED | 154 (35.98) | 88 (33.21) | 66 (40.49) | |
| Some College | 203 (47.43) | 137 (51.70) | 66 (40.49) | |
| Low Income (N = 393) | | | | 0.752 |
| Yes | 286 (72.77) | 184 (73.31) | 102 (71.83) | |
| No | 107 (27.23) | 67 (26.69) | 40 (28.17) | |
| Maternal BMI (N = 426) | | | | 0.024 |
| Underweight/Normal | 72 (16.74) | 36 (13.58) | 36 (21.82) | |
| Overweight | 117 (27.21) | 68 (25.66) | 49 (29.70) | |
| Obese | 241 (56.05) | 161 (60.75) | 80 (48.48) | |
| Medicaid (N = 426) | | | | 0.896 |
| Enrolled | 316 (74.18) | 196 (73.96) | 120 (74.53) | |
| Not Enrolled | 110 (25.82) | 69 (26.04) | 41 (25.47) | |
| WIC (N = 428) | | | | 0.485 |
| Enrolled | 350 (81.78) | 214 (80.75) | 136 (83.44) | |
| Not Enrolled | 78 (18.22) | 51 (19.25) | 27 (16.56) | |

**Table 2. Analytic Sample Characteristics of Mismatch Variable***

| | **Total (N = 265)** | **Mismatch "Yes" (N = 128)** | **Mismatch "No" (N = 137)** | **P-Value** |
|---|---|---|---|---|
| | Mean (Std Dev.) | | | |
| Breastfeeding Duration (in months), mean, std. dev. (N = 186) | 2.62 (3.10) | 2.51 (3.08) | 2.73 (3.14) | 0.625 |
| | N (%) | | | |
| Breastfeeding Duration Intent | | | | 0.796 |
| No BF | 18 (6.79) | 7 (5.43) | 11 (8.09) | |
| Some BF | 78 (29.43) | 39 (30.23) | 39 (28.68) | |
| 1 month | 43 (16.23) | 22 (17.05) | 21 (15.44) | |
| 3 months | 30 (11.32) | 14 (10.85) | 16 (11.76) | |
| 6 months | 53 (20.00) | 23 (17.83) | 30 (22.06) | |
| Unsure | 43 (16.23) | 24 (18.60) | 19 (13.97) | |
| | | | | |
| Breastfeeding Mismatch (N = 208) | | | | 0.415 |
| Planned | 12 (4.80) | 8 (6.61) | 4 (3.64) | |
| Longer than | 192 (76.80) | 92 (76.03) | 100 (77.52) | |
| Less than | 46 (18.40) | 21 (17.36) | 25 (19.38) | |
| Place of Delivery | | | | 0.585 |
| UNC & Duke Regional | 62 (23.40) | 31 (24.03) | 31 (22.79) | |
| WakeMed | 203 (76.60) | 98 (75.97) | 105 (77.21) | |
| Maternal Education | | | | 0.260 |
| Less than HS | 40 (15.09) | 19 (14.73) | 21 (15.44) | |
| HS/GED | 88 (33.21) | 49 (37.98) | 39 (28.68) | |
| Some College | 137 (51.70) | 61 (47.29) | 76 (55.88) | |
| Low-Income | | | | 0.049 |
| Yes | 184 (73.31) | 84 (67.74) | 100 (78.74) | |
| No | 67 (26.69) | 40 (32.26) | 27 (21.26) | |
| Maternal BMI | | | | 0.064 |
| Underweight/Normal | 97 (38.34) | 43 (34.96) | 54 (41.54) | |
| Overweight | 55 (21.74) | 22 (17.89) | 33 (25.38) | |
| Obese | 101 (39.92) | 58 (47.15) | 43 (33.08) | |
| Medicaid | | | | 0.199 |
| Enrolled | 196 (73.96) | 100 (77.52) | 96 (70.59) | |
| Not Enrolled | 69 (26.04) | 29 (22.48) | 40 (29.41) | |
| WIC | | | | 0.797 |
| Enrolled | 214 (80.75) | 105 (81.40) | 109 (80.15) | |
| Not Enrolled | 51 (19.25) | 24 (18.60) | 27 (19.85) | |

*Chi-square analysis used for categorical variables and t-test used for continuous variables

**Table 3. Results of Logistic Regression Analysis of Labor Mismatch**

| | Unadjusted | | | Adjusted | | |
|---|---|---|---|---|---|---|
| | OR | (95% CI) | p-value | OR | (95% CI) | p-value |
| BMI | | | | | | |
| Underweight/normal | 1.00 | ----- | ----- | 1.00 | ----- | ----- |
| Overweight | 0.84 | (0.43, 1.64) | 0.60 | 0.83 | (0.41, 1.69) | 0.61 |
| Obese | 1.69 | (0.97, 2.97) | 0.07* | 1.98 | (1.08, 3.62) | 0.03* |
| Place of Delivery | | | | | | |
| UNC or Duke Regional | 1.00 | ----- | ----- | 1.00 | ----- | ----- |
| WakeMed | 0.93 | (0.53, 1.65) | 0.81 | 0.94 | (0.49, 1.81) | 0.85 |
| Education | | | | | | |
| Less than HS | 1.13 | (0.56, 2.28) | 0.74 | 1.57 | (0.68, 3.62) | 0.29 |
| HS/GED | 1.57 | (0.91, 2.68) | 0.10 | 1.82 | (1.00, 3.32) | 0.05* |
| Some college | 1.00 | ----- | ----- | 1.00 | ----- | ----- |
| Low Income | | | | | | |
| Yes | 0.57 | (0.32, 1.00) | 0.05* | 0.50 | (0.27, 0.92) | 0.03* |
| No | 1.00 | ----- | ----- | 1.00 | ----- | ----- |
| Medicaid | | | | | | |
| Enrolled | 1.44 | (0.83, 2.50) | 0.20 | 1.28 | (0.68, 2.44) | 0.45 |
| Not enrolled | 1.00 | ----- | ----- | 1.00 | ----- | ----- |
| WIC | | | | | | |
| Enrolled | 1.08 | (0.59, 2.00) | 0.80 | 1.04 | (0.49, 2.20) | 0.92 |
| Not enrolled | 1.00 | ----- | ----- | 1.00 | ----- | ----- |

*p-value < 0.05

**Table 4. Results of Multinomial Regression Analysis between Labor Mismatch and Breastfeeding Mismatch**

| | Breastfed Shorter Than Intended | | Breastfed Longer Than Intended | |
|---|---|---|---|---|
| | Unadjusted | Adjusted | Unadjusted | Adjusted |
| | RRR (95% CI) | RRR (95% CI) | RRR (95% CI) | RRR (95% CI) |
| Mismatch | 1.30 (0.40, 4.31) | 0.35 (0.08, 1.61) | 1.23 (0.40, 3.74) | 0.44 (0.11, 1.73) |
| Breastfeeding Duration | ----- | 0.60 (0.42, 0.88)* | ----- | 1.06 (0.85, 1.31) |
| BMI | | | | |
| Overweight | ----- | 10.43 (0.82, 131.99) | ----- | 3.03 (0.28, 32.34) |
| Obese | ----- | 8.55 (1.54, 47.43)* | ----- | 2.31 (0.52, 10.38) |
| Place of Delivery | ----- | 0.99 (1.89, 5.21) | ----- | 2.02 (0.46, 8.93) |
| Education | | | | |
| < HS | ----- | 6.12 (0.49, 75.90) | ----- | 2.26 (0.22, 23.58) |
| HS/GED | ----- | 4.40 (0.69, 28.12) | ----- | 2.38 (0.43, 13.13) |
| Low Income | ----- | 0.21 (0.03, 1.44) | ----- | 0.57 (0.09, 3.40) |
| Medicaid | ----- | 0.49 (0.07, 3.43) | ----- | 0.60 (0.10, 3.56) |
| WIC | ----- | 0.94 (0.13, 6.87) | ----- | 0.73 (0.12, 4.44) |

*p-value < 0.05

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