

TAMIKA, WATTS. M.S. Predictors of Predominant Breastfeeding and Exclusive Breastfeeding Among Mothers of Young Infants Participating in the iGrow Study. (2023)  
Directed by Dr. Lenka Shriver. 92 pp.

Breastfeeding is considered the preferred method of infant feeding due to its health benefits. However, breastfeeding rates tend to be below desired levels in the United States. While factors such as race have been well documented in previous literature, little is known about what factors influence and contribute to these disparities. The main purpose of this study was to examine predictors of predominant breastfeeding and exclusive breastfeeding in early infancy in a racially/ethnically and socio-economically diverse sample of mother-infant dyads who participated in the Infant Growth and Development Study (iGrow). Data was collected from cohort 1 mothers at a prenatal visit and a lab visit at 2-months of infant age (cohort 1; n=151 mothers and infants). Questionnaires via Qualtrics were used to gather demographic information and the Infant Feeding Practices II was used to gather information about feeding method at 2-months and sources of information and support for breastfeeding. The significant predictors of predominant breastfeeding in our sample at the time of the 2-month visit were pre-pregnancy BMI and prenatal feeding intentions to “breastfeed only.” Exclusive breastfeeding at the time of the 2-month visit was significantly predicted by maternal pre-pregnancy BMI, prenatal feeding intentions to “breastfeed only” and vaginal birth. Our study is important as it highlights lower pre-pregnancy BMI and prenatal intentions to “breastfeed only” as the key predictors of predominant breastfeeding and exclusive breastfeeding in a diverse sample of mother-infant dyads in North Carolina. Future interventions should focus on educating women about the importance of breastfeeding, sharing information about the wide range of benefits related to breastfeeding for both the infant and the mother, and providing resources and support services related to breastfeeding issues prior to infant birth and during the postnatal period.

PREDICTORS OF PREDOMINANT BREASTFEEDING AND EXCLUSIVE  
BREASTFEEDING AMONG MOTHERS OF  
YOUNG INFANTS PARTICIPATING  
IN THE IGROW STUDY

by

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A Thesis  
Submitted to  
the Faculty of The Graduate School at  
The University of North Carolina at Greensboro  
in Partial Fulfillment  
of the Requirements for the Degree  
Master of Science

Greensboro

2023

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December 6, 2022

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## ACKNOWLEDGEMENTS

First, I would like to thank my advisor, Dr. Lenka Shriver for being an amazing mentor during this process and for the support I have received from her during the past two years. Her input and expert feedback was invaluable. I would also like to thank my committee members, Dr. Maryanne Perrin and Dr. Esther Leerkes for all their support, input and guidance as well. I would also like to thank Sally Eagleton for her review and expert feedback on the study materials, statistical analyses and overall assistance on my research project. Also, I would like to thank the entire iGrow Study staff and research graduate assistants for their continued support during my research project. I would also like to thank all of the Cohort 1 participants of the iGrow Study; this project could not have happened without them. Lastly, I would like to acknowledge all my family and friends for all the support and strength they have given me in this rigorous and long journey.

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## CHAPTER I: INTRODUCTION

Breastfeeding (BF) is considered the preferred mode for infant feeding in early life as it provides health benefits to both the infant and mother (Eidelman & Schanler, 2012, WHO, 2021). Research shows that infants who are breastfed have reduced rates of respiratory and gastrointestinal tract infections (Eidelman & Schanler, 2012, Binns et al., 2016, Chantry et al., 2006). Likewise, positive associations between BF and maternal health outcomes have been identified, including reduced blood pressure, reduced risk of postpartum depression, reduced risk of ovarian and breast cancer, type 2 diabetes and hypertension (CDC. Recommendations and Benefits, 2020; Luan et al., 2013; Schwarz et al., 2009; Turkoz et al., 2013). Provided the variety of protective health benefits to both infant and mother, national organizations, such as the American Academy of Pediatrics, recommend exclusive BF for the first six months of life as the optimal feeding practice (Eidelman & Schanler, 2012). The 2020 Dietary Guidelines for Americans also recommends that infants are exclusively breastfed for about the first six months of life and should continue to be fed human milk through at least the first year of life, and longer if desired (Snetselaar et al., 2021).

While the benefits and recommendations of BF are well established in current literature, BF rates, especially the rate of exclusive BF in the first 6 months of life, remain suboptimal in the United States (CDC Breastfeeding Report Card (BRC), 2020). Reports from a nationally representative sample in 2017 show that while 84% of infants were breastfed at least some, only 58% of infants were either exclusively or partially breastfed by the time they were six months old (CDC BRC, 2020). The rate of exclusive BF at 3 months was 47%, but it was lower than 26% at 6 months (CDC BRC, 2020). These rates indicate that only 4 in 10 women



breastfeed exclusively for 3 months and only 2 in 10 breastfeed exclusively for 6 months (CDC BRC, 2020).

Over the past decades, research has identified several potential risk factors related to lower BF rates, including self-identifying as Black/African American, having a lower income and education level, smoking, WIC participation, and having a high pre-pregnancy BMI (Ajami et al., 2018; Deubel et al., 2019; Higgins et al., 2010; Jones et al., 2011; Krause et al., 2011; Mangel et al., 2019; Marshall et al., 2019; Schindler-Ruwisch et al., 2021). Some of these factors have been consistently linked to lower BF rates while others have not been confirmed as key predictors of BF across studies (Gregory et al., 2016; Krause et al., 2011).

According to the 2020 North Carolina Women's Health Report Card (NC WHRC), the rate of EBF was lower in African American women compared to mothers of other races/ethnicities (NC WHRC, 2020). At 8 weeks postpartum, Hispanic women reported the highest rates of at least some BF (77% compared to 48% among African American and 69% among White women) (NC WHRC, 2020). To date, self-identifying as Black/African American has not been confirmed to be a key predictor of BF across all studies (Deubel et al., 2019; Krause et al., 2011). In contrast, research shows consistent findings in terms of BF rates and socioeconomic status (SES). Women living in low-income households are less likely to meet the recommendations for BF than those with higher income levels (Ajami et al., 2018; Millar et al., 2005; Temple Newhook et al., 2017). The CDC National Immunization Survey showed among mothers with a poverty-to-income ratio of less than 100%, only 38% exclusively breastfed through 3 months and 19% exclusively breastfed through 6 months (CDC National Immunization Survey, 2019). Furthermore, many low-income pregnant women and mothers of infants are eligible for the Special Supplemental Nutrition Program for Women, Infants, and

Children (WIC) program in the U.S., which provides nutrition education and puts significant efforts into promotion of breastfeeding. However, some studies have shown that WIC participants have lower BF rates than their counterparts, which may be related to the WIC participation eligibility criteria that is based on a low-income status (Francescon et al., 2016; Jensen, 2012; Oliveira et al., 2019; Ryan & Zhou, 2006).

Several strong correlates of predominant BF and exclusive BF, such as low-income status and maternal education, have been identified in previous studies (Ajami et al., 2018, Lesorogol et al., 2016, Heck et al., 2006). Findings related to other potential predictors, such as WIC participation, have been mixed (Francescon et al., 2016; Gregory et al., 2016; Jensen, 2012; Metallinos-Katsaras et al., 2015; Oliveira et al., 2019). Similarly, while racial/ethnic disparities in breastfeeding outcomes have been well documented in previous studies (Grummer-Strawn & Shealy, 2009; Jones et al., 2011; Kogan et al., 2008; Masho et al., 2015; Stough et al., 2019), race alone has not been found to be a significant predictor of breastfeeding in some studies and much less is known about what other factors influence these disparities (Deubel et al., 2019; Kraus et al., 2011). Thus, the main purpose of this study was to examine predictors of predominant BF and exclusive BF in early infancy in a racially/ethnically and socio-economically diverse sample of mother-infant dyads who participated in the Infant Growth and Development Study (iGrow).

## **Research Questions Addressed in the Current Study**

- What are the key predictors of exclusive breastfeeding during early infancy among racially/ethnically and socio-economically diverse mothers?
- Since any level of breastfeeding is considered beneficial in the first few months of life, are the predictors of exclusive breastfeeding the same as those of predominant breastfeeding?
- What are some of the experiences, beliefs and attitudes related to breastfeeding and formula feeding among mothers who start feeding formula to their infant in the first few months of infancy?

## CHAPTER II: REVIEW OF THE LITERATURE

### **Benefits of Breastfeeding & Current Recommendations**

Breastfeeding (BF) is considered the gold standard for infant feeding and promotion of optimal nutrition in early life (Eidelman & Schanler, 2012, WHO, 2021). The benefits of BF have been well established in the literature over the past several decades and includes protective benefits to both infant and mother (CDC. Recommendation and Benefits, 2020; Eidelman & Schanler, 2012; Practice Paper of the Academy of Nutrition and Dietetics, 2015; WHO, 2021). Therefore, many national and international health organizations recommend BF as the preferred mode of infant feeding (CDC. Recommendations and Benefits, 2020; Eidelman & Schanler, 2012; WHO, 2021).

Strong evidence suggests that infants who are breastfed have reduced rates of respiratory and gastrointestinal tract infections (Eidelman & Schanler, 2012, Binns et al., 2016, Chantry et al., 2006). A meta-analysis by the Evidence-based Practice Centers of the Agency for Healthcare Research and Quality (AHRQ) of the US Department of Health Human Services found that infants who are breastfed exclusively for more than 4 months have a 72% reduced risk of hospitalization for lower respiratory tract infections and exclusive BF for three months or more reduces the risk of otitis media by half. Findings from several systematic reviews and meta-analyses provide strong evidence that BF is associated with reduced risk of upper and lower respiratory tract infections, otitis media, sudden infant death syndrome (SIDS), and necrotizing enterocolitis, among infants (James & Lessen, 2009; Eidelman & Schanler, 2012; Ip et al., 2007). Additional positive influences on other infant health outcomes, such as lowered risk of asthma, increased cognitive development, and reduced obesity risk have been also reported in previous research (Binns et al., 2016; Dieterich et al., 2013; Ip et al., 2009; Kramer et al., 2007).

Breastfeeding has been also associated with a variety of positive maternal health outcomes. Research has identified immediate and short-term breastfeeding benefits for mothers, such as reduced risk of hemorrhage after delivery, greater maternal and infant bonding, delayed ovulation, reduced blood pressure, reduced risk of postpartum depression, and better success with postpartum weight loss (Bartick, 2013; Bartick et al., 2013; Dieterich et al., 2013; Figueiredo et al., 2014; James & Lessen, 2009). Additionally, mothers who exclusively breastfeed may also have reduced levels of postpartum stress (Mezzacappa et al., 2005; Groër, 2005; Mohamad Yusuff et al., 2015). Several long-term positive associations between BF and maternal outcomes have been also identified and include a reduced risk of ovarian and breast cancer, type 2 diabetes and hypertension (CDC. Recommendations and Benefits, 2020; Luan et al., 2013; Schwarz et al., 2009; Turkoz et al., 2013). Although most findings come primarily from correlational study designs and some debate exists regarding the long-term benefits of BF for the mother (Ip et al., 2009; Kramer et al., 2007; Luan et al., 2013), there is solid evidence supporting the notion that BF is beneficial for both infant and maternal health outcomes (CDC. Recommendations and Benefits, 2020; Eidelman & Schanler, 2012; Practice Paper of the Academy of Nutrition and Dietetics, 2015; WHO, 2021).

Given the many benefits of BF to both infant and mother, health organizations such as the American Academy of Pediatrics and the World Health Organization (WHO) recommend that the optimal duration of exclusive BF is six months (American Academy, 2012; World Health Organization, 2021). The 2020-2025 Dietary Guidelines for Americans also recommend that infants are exclusively breastfed for about the first six months of life (Snetselaar et al., 2021), with continued BF through at least the first year of life, or longer if desired (Snetselaar et al., 2021). If human milk is unavailable, it is recommended that infants are fed iron-fortified infant

formula during the first year of life (Snetselaar et al., 2021). From the age of six months (or sooner if the infant is developmentally ready), infants should be introduced to a variety of nutrient-dense complementary foods, in addition to continuation of BF (Snetselaar et al., 2021).

### **Breastfeeding Rates in the United States**

BF rates, especially the rate of exclusive BF during the first 6 months of life, remain suboptimal in the U.S. (CDC Breastfeeding Report Card), 2020). While the data from the CDC Breastfeeding Report Card (BRC) show that the 2017 rate of breastfeeding initiation among infants was 84 percent, only 58 percent of infants were breastfed, either exclusively or partially, by the time they were six months old (CDC BRC, 2020). The rate of exclusive BF through 3 months was even lower at 47 percent and only 26 percent of infants were exclusively breastfed at 6 months (CDC BRC, 2020). Similar trends were found in a study by Jones et al. (2011), where BF was initiated in nearly 75 percent of US infants, but a vast majority stopped exclusive BF before 6 months of age (Jones et al., 2011). Thus, it is apparent that despite the relatively high rate of BF initiation, many mothers stop exclusive or partial breastfeeding before their infant reaches 6 months of age (Jones et al., 2011; USBC, 2020). According to the North Carolina Breastfeeding Report by the United States Breastfeeding Committee (USBC), the breastfeeding initiation rate was 3 percent below the national average; however, was still relatively high at 82 percent (USBC, 2020). In addition, the rate of exclusive BF at 6 months was 23 percent for North Carolina, which is below the Healthy People 2020 target of 26 percent for EBF at 6 months (USBC, 2020).

## **Sociodemographic Factors Associated with Breastfeeding**

### ***Race/Ethnicity and Breastfeeding Outcomes***

Despite efforts to increase BF rates, racial disparities in these rates have been documented in the U.S. (Grummer-Strawn & Shealy; 2009; Kogan et al., 2008; Masho et al., 2015, Odar Stough et al., 2019, Orozco et al., 2020). Research indicates that both BF initiation and exclusive BF breastfeeding up to 6 months is lowest among non-Hispanic Black mothers compared to other races/ethnicities (Jones et al., 2011; Odar Stough et al., 2019). For example, a study with a nationally representative sample of mother-infant dyads by Jones et al (2011) found that BF initiation was significantly lower among non-Hispanic Black infants (56%) compared to Hispanic (83%) and Non-Hispanic White infants (76%). Furthermore, Heck et al. (2006) showed that maternal race/ethnicity remained a significant predictor of BF initiation in their sample even after adjusting for SES status and other covariates. Masho and colleagues (2015) analyzed data from the Pregnancy Risk Assessment Monitoring System, which included a nationally representative sample of 95,141 U.S. women who delivered a singleton baby between 2009 to 2011. The study found that the rate of not initiating BF was highest among non-Hispanic Black women (30.3%) compared to mothers in other racial/ethnic groups (Masho et al., 2015). In contrast, Hispanic mothers have been found to have the highest BF rates compared to others in some previous studies (Jones et al., 2011; Masho et al., 2015).

The national trends related to BF outcomes by race/ethnicity are closely reflected among mothers and their infants in North Carolina. According to the 2020 North Carolina Women's Health Report Card (NC WHRC), the rate of exclusive BF was lower in African American women compared to mothers of other races/ethnicities (NC WHRC, 2020). The highest rate of BF initiation of 95 percent was reported among Hispanic mothers while 88 percent of non-

Hispanic White and 73 percent of African American mothers-initiated BF (NC WHRC, 2020). The lowest rates of some BF at four or more weeks after infant birth was found among African American women (58 percent) compared to 76 percent among Non-Hispanic White and 87 percent among Hispanic women (NC WHRC, 2020). Similar trends were detected by race/ethnicity at 8 weeks postpartum, with Hispanic women reporting the highest rates of at least some BF (77 percent compared to 48 percent among African American and 69 percent among Non-Hispanic White women) (NC WHRC, 2020).

While racial/ethnic disparities in BF initiation and exclusive BF rates have been reported across many investigations (Heck et al; 2006; Jones et al., 2011; Odar Stough et al., 2019), not all studies have confirmed these findings (Kraus et al., 2011). It is also important to note that some studies did not account for the influence of socioeconomic and other variables on breastfeeding outcomes (i.e., marital status, income, breastfeeding intentions). More importantly, little is currently known about the underlying factors that may be contributing to potential racial/ethnic differences in breastfeeding outcomes. Thus, further research is warranted to clarify the nature of these associations and examine additional factors that may be contributing to the racial/ethnic differences in breastfeeding outcomes found in previous research.

### ***Socio-economic Status & Breastfeeding***

Despite the well-known benefits of BF, low-income mother-infant dyads who are known to be at a higher risk for poor health outcomes, compared to others of higher income status, have the lowest rates for BF initiation, duration (any BF at 6 months), and exclusive BF at 6 months (Eidelman & Schanler, 2012; CDC, Results: Breastfeeding Rates, 2022). The U.S national data on mothers with a low-income poverty-to-income ratio less than 100% show that 37.5% of



mothers exclusively breastfed through 3 months and only 20.4% exclusively breastfed through 6 months (National Immunization Survey, 2019). Mothers with a poverty-to-income ratio equal or greater than 200% had a higher rate of exclusive BF at 3 months (50% or higher) and 30% of those mothers exclusively breastfed at 6 months (National Immunization Survey, 2019). Ajami et al (2018) examined the association between household SES and breastfeeding in a cross-sectional study of 150 household participants with infants ranging from 1 – 1.5 years old. The SES categories were determined by grouping households into categories using the following criteria: parental education (sum of years of maternal and paternal education), household asset ownership (as an indicator for household income) and found that those in the lower SES group had shorter duration of breastfeeding than those in the middle and high SES groups (Ajami et al., 2018). Findings of previous studies demonstrate that a low-income status appears to be negatively associated with breastfeeding duration (Millar & MacLean, 2005; Temple Newhook et al., 2017).

While income and education are often associated, it is not the case across all previous studies (Krause et al., 2011). Thus, educational status has been examined as a potential predictor of BF outcomes in some studies (Celi et al., 2006; Heck et al., 2006; Krause et al., 2011; Yang et al., 2004). Heck et al. (2006) utilized a large, population-based sample of ethnically diverse women (n = 10, 519) delivering live births in California and measured SES by the following variables: family income as a percentage of the federal poverty level, maternal education, paternal education and maternal occupation, while controlling for race/ethnicity. Consistent with previous research (Celi et al., 2005; Yang et al., 2004; Acharya and Khanal, 2015; Tang et al., 2018), maternal education was significant in predicting BF initiation and continuation, in which

those with higher education levels were more likely than their counterparts to breastfeed, even after adjusting for potential confounders (Heck et al., 2006).

Many low-income pregnant women and mothers in the U.S. are eligible for a non-entitlement program called the Special Supplemental Nutrition Program for Women, Infants, and Children (commonly referred to as the WIC program). This program serves to maintain the health of low-income women and their children up to age 5, because this population segment is considered to be at a high nutritional risk (USDA ERS, 2022). In fiscal year 2020, WIC served about 6.2 million participants per month, with roughly half of all infants born nationwide (USDA ERS, 2022). The WIC program has made BF promotion and support one of its priorities, but some studies show that BF rates among participants in the WIC program are lower than the U.S. average (Oliveira et al., 2019). For example, among children born in 2015, only 45% of those were estimated to be breastfed at 6 months (Oliveira et al., 2019). This number falling 21% points below the rate for infants not enrolled in WIC but eligible, and 28 percentage points below the rate for infants that were ineligible to participate in the WIC program (Oliveira et al., 2019). When examining EBF rates at 3 months and 6 months, infants participating in the WIC program were less likely to be exclusively breastfed than all other U.S. infants (Oliveira et al., 2019).

Current literature has controversial findings between the association of WIC participation and BF (Francescon et al., 2016; Gregory et al., 2016; Jensen, 2012; Metallinos-Katsaras et al., 2015). A study by Gregory et al. found no negative association between WIC participation and BF at 3 months postpartum (Gregory et al., 2016), which contrasts prior studies that showed a negative association between WIC and BF outcomes (Francescon et al., 2016; Jensen, 2012; Ryan & Zhou, 2006). Conducting a secondary data analysis using data from 784 low-income women who participated in the Infant Feeding Practices Study II between May 2005 and June

2007, Francescon and colleagues examined the association between WIC participation and exclusive BF at 3 months postpartum (Francescon et al., 2016). Even after adjusting for sociodemographic, anthropometric, and behavioral confounders, the odds of exclusive BF at 3 months postpartum were lower among those enrolled in WIC, compared to women who were eligible, but did not participate in the WIC program (Francescon et al., 2016). Thus, despite the emphasis that WIC places on breastfeeding promotion, a negative association between WIC participation and BF exists (Francescon et al., 2016; Ryan et al., 2004; Ryan & Zhou, 2006; Ziol-Guest & Hernandez, 2010). Further research is warranted to clarify the influence of WIC participation on breastfeeding outcomes above and beyond maternal income and education level.

### ***Employment Status and Breastfeeding***

Over the last several decades, there have been major shifts in the US. workforce, including many new mothers having to or choosing to return to work shortly after birth (Grice et al., 2007; Salganicoff, 2018). Some estimates indicate that more than 25% of new mothers return to work before their infant reaches 3 months of age (Laughlin, 2011). However, returning to work may have important implications on maternal decisions related to BF. Previous research shows that the length of BF is greater for mothers who do not work than mothers who do work, and even shorter duration for those who work full-time (Attanasio et al., 2013, Lubold, 2016; Ryan et al., 2006). Ryan et al. examined a national sample of new mothers (n = 228,000) to examine the prevalence of BF initiation and duration from birth to the first 6 months among mothers who were employed full time, part-time, or who were not employed and stayed at home (Ryan et al., 2006). Findings revealed that working full time had a significant negative effect on BF duration and that mothers who did not work were more than twice as likely to breastfeed at 6

months than those who worked full time (Ryan et al., 2006). Furthermore, mothers who return to work sooner after giving birth are more likely to have a shorter BF duration (Dagher et al., 2016). Thus, research suggests that BF initiation may be significantly influenced by women's plans to return to work after giving birth and EBF may be negatively impacted by women returning to work after birth (Ryan et al., 2006; Dagher et al., 2016). Future research is clearly needed to identify the specific associations between employment status and BF outcomes.

## **Maternal Health-related Characteristics and Breastfeeding Outcomes**

### ***Smoking***

Current evidence suggests that maternal smoking is negatively associated with BF duration (Higgins et al., 2010; Horta et al., 2001; Lande et al., 2003; Letson et al., 2002; Schindler-Ruwisch et al., 2021). Additionally, women who smoke during pregnancy are less likely to initiate BF than those who do not (Horta et al., 2001; Letson et al., 2002). The Oregon Newborn Screening Program collected information on infant feeding mode at birth and at about two weeks of age for 36,324 live births in Oregon and found that maternal smoking during pregnancy was significantly negatively associated with exclusive BF at about 2 weeks of age (Letson et al., 2002). Furthermore, research has shown that smoking cessation during pregnancy has been positively associated with increased BF initiation and duration (Carswell et al., 2018; Higgins et al., 2010) and therefore, smoking cessation interventions on BF rates should be further researched. To date, however, there is scarcity of research on the associations between smoking and breastfeeding outcomes in ethnically/racially diverse samples of new mothers.

### ***Maternal Weight Status***

Forty-two percent of women delivering a live birth in 2018 had a healthy weight prior to pregnancy (Office of Disease Prevention and Health Promotion, 2022). Previous research indicates that pre-pregnancy BMI is a significant predictor for BF non-initiation and discontinuation of BF after birth (Amir & Donath, 2007; Krause et al., 2011; Masho et al., 2015; Nomura et al., 2020; Verret-Chalifour et al., 2015). Research by Guelinckx et al. (2012) found that the prevalence of exclusive BF at 3 months was negatively associated with high pre-pregnancy BMI (Guelinckx et al., 2012) and overweight/obese women were less likely to continue BF longer than 4 months (Campbell and Shackleton, 2018). Moreover, mothers with a higher BMI were less likely to continue BF at 6 months (Mangel et al., 2019; Marshall et al., 2019).

Existing studies, including systematic reviews, also have found that high pre-pregnancy BMI is inversely associated with BF initiation (Al-Sahab et al., 2010; Harder et al., 2005; Wojcicki, 2011). An observational study of 450 women by Krause and colleagues (2011) found that the relative odds of BF initiation was reduced by 4% for every unit increase in BMI (Krause et al., 2011). Other research suggests that women who are overweight or obese prior to pregnancy may be less likely to initiate BF (Mehta et al., 2011) and obese women may have a higher risk of noninitiation of BF, even after adjusting for sociodemographic factors (Verret-Chalifour et al., 2015). The potential negative effect of maternal weight status on BF initiation is especially alarming since it diminishes the chance of any BF through the first few months of infant's life. While maternal weight status appears to be one of the potential predictors of BF outcomes, further research is warranted to confirm these associations and to inform future interventions aimed in breastfeeding promotion.

### ***Cesarean Delivery Mode & Breastfeeding Outcomes***

Previous literature suggests that there is a connection between birth mode and BF outcomes. According to the literature, women who delivered via Cesarean section (C-section) were less likely to initiate BF and continue with BF (Chen et al., 2018; Wallenborn et al., 2017; Wu et al., 2018). A prospective cohort study of mother-infant pairs (n = 2, 058) collected data in the survey from hospital records and one-to-one interviews after birth and found that mothers who had a C-section delivery were less likely to continue exclusive BF and any BF at 3 months and 6 months postpartum (Wu et al., 2018). These findings are consistent with previous literature in which BF initiation was negatively influenced by C-section delivery, compared with vaginal birth (Chen et al., 2018; Paksoy Erbaydar and Erbaydar, 2020; Wallenborn et al., 2017; Wu et al., 2018). In a nationally representative cross-sectional survey, with a total of 34,854 women in the United States, Wallenborn and colleagues found that women who had selected to have repeat C-sections were less likely to carry out initiation of BF than women who delivered via vaginally after a previous C-section (Wallenborn et al., 2017), which is consistent with findings from another study (Regan et al., 2013). However, this study did not report information on prenatal complications that could have prevented the mother from having a vaginal birth. Additionally, this study only reported BF initiation by the mother up to two days after birth (Regan et al., 2013).

The potential causes of the negative associations between C-sections and lower BF rates have been examined in some previous studies. A study by Paksoy Erbaydar et al. found that women who had a C-section experienced higher rates of delayed BF (50.5%) than mothers who had a vaginal birth (35.3%) (Paksoy Erbaydar and Erbaydar, 2020). A C-section can negatively affect the physiology of lactation and adverse events following a C-section such as increased

maternal physical pain and an increased need for the neonates to spend time in the neonatal intensive care unit, can cause decreased skin to skin contact and rooming-in arrangements after birth, which are known factors that are associated with BF initiation (Forster & McLachlan, 2007). Several studies have found that having a C-section delays BF initiation and duration (Chen et al., 2018; Paksoy Erbaydar and Erbaydar, 2020; Wallenborn et al., 2017; Wu et al., 2018), but very little is known about whether those mothers attempted to breastfeed their infant child and if so, were they successful in continuation of BF. Very little is also known about mothers' intentions to breastfeed before birth and their perception of breast milk, which is an established determinant of successful BF initiation (Chen, 2010; Tully and Ball, 2014).

### **Prenatal Breastfeeding Knowledge, Intentions and Breastfeeding Outcomes**

Maternal knowledge related to BF has been associated with prenatal breastfeeding intentions of mothers, and these intentions have been found, in turn, to be strong predictors of how a mother chooses to feed her infant (Radzynski & Callister, 2016; Raissian & Su, 2018; Stuebe et al., 2011). Stuebe and colleague examined the association between BF knowledge and intentions to exclusively breastfeed in a sample of low-income diverse urban population. The study found that mothers who were knowledgeable about infant health benefits of BF were more likely to exclusively breastfeed rather than use mixed feeding (Stuebe et al., 2011), which is consistent with findings from another study that concluded that maternal knowledge about BF and health benefits for infants were strongly correlated with exclusive BF (Panstw Zakl et al., 2017).

These findings above reinforce earlier work that examined predictors of breastfeeding intentions and found that first-time mothers who were aware of BF recommendations given by

the World Health Organization, were 5.6 times as likely to exclusively breastfeed for the first six months than others (Wen et al., 2009). In sum, there is evidence that BF knowledge and intentions to breastfeed are associated with higher rates of BF initiation and continuation of BF across studies, but it is not clear whether these associations are present across racially/ethnically and socioeconomically diverse samples of mothers (Persad et al., 2008; Radzimirski & Callister, 2016; Raissian & Su, 2018; Wen et al., 2009).

### **Purpose of the Current Study**

Although breastfeeding rates have increased in the U.S. over the past decade (CDC, Results: Breastfeeding Rates, 2022), strong breastfeeding promotion is still needed to optimize infant and maternal health outcomes, because many infants are still not exclusively or predominantly breastfed through at least the first 6 months of their life (CDC, Recommendations and Benefits, 2020; Eidelman & Schanler, 2012; Feltner et al., 2018). Previous research has established some potential correlates of breastfeeding outcomes, such as low-income status and maternal education (Ajami et al., 2018, Lesorogol et al., 2016, Heck et al., 2006). However, findings related to other potential predictors, such as WIC participation have been mixed (Francescon et al., 2016; Gregory et al., 2016; Jensen, 2012; Metallinos-Katsaras et al., 201). Similarly, while racial/ethnic disparities in breastfeeding outcomes are well documented (Grummer-Strawn & Shealy, 2009; Jones et al., 2011; Kogan et al., 2008; Masho et al., 2015; Stough et al., 2019), much less is known about what factors influence and contribute to these disparities (Deubel et al., 2019; Kraus et al., 2011).

The main purpose of the current study was to examine predictors of predominant BF and exclusive BF in a sample of mother-infant dyads who completed the 2M visit as part of their



participation in the Infant Growth and Development Study (iGrow). The secondary aim was to characterize a sub-sample of mothers who began to use formula to feed their infant prior to the 2-month visit in terms of several selected breastfeeding-related variables (i.e., breastfeeding-related support, sources of breastfeeding information, reasons for using formula, the type of social support they received).

## **Research Aims**

### **Aim 1:**

- **Aim 1a.** To examine associations between sociodemographic variables (e. g., maternal age, education, race/ethnicity, employment status), maternal/infant health-related characteristics (e.g., infant birth weight, maternal smoking, prenatal weight status, type of birth), breastfeeding intentions, and predominant breastfeeding (BF) in a sample of mother-infant dyads at a 2-month visit.
- **Aim 1b.** Based on the results of the preliminary analyses, identify significant predictors of predominant BF in the sample.

### **Aim 2:**

- **Aim 2a.** To examine associations between sociodemographic variables (e. g., education, race/ethnicity, employment status), maternal/infant health-related characteristics (e.g., smoking, prenatal weight status, type of birth) and exclusive BF at infant age of 2 months.
- **Aim 2b.** Using the preliminary analyses, identify significant predictors of exclusive BF in the sample.

**Aim 3:**

- **Aim 3a.** To examine selected characteristics, attitudes and experiences related to BF and formula feeding in a sub-sample of mothers who reported feeding their infant formula prior to the 2M visit.

## CHAPTER III: METHODS

### **Design, Setting, Participants, Recruitment**

Data utilized in the current research study were collected from cohort 1 mother/infant dyads of the Infant Growth and Development Study (iGrow), a prospective longitudinal study being conducted in Greensboro, North Carolina. The larger study examines prenatal and early postnatal predictors of childhood obesity risk (Leerkes et al., 2020). Data collection for the larger study occurred during the 3rd trimester of pregnancy, and 2 months, 6 months, 14 months, and 24 months postpartum. Data collection included biological assays, physiological assessments, anthropometrics, electronic medical records, questionnaires, dietary intakes, and direct observations (Leerkes et al., 2020). Participants were recruited during their third trimester of pregnancy using various recruitment strategies. Participants were recruited from childbirth education classes at local hospitals and the Public Health Departments, prenatal classes offered by WIC, flyers posted in waiting rooms of obstetrician/gynecologist offices and around retail stores and events that targeted expectant parents. Additionally, the utilization of advertisements on social media platforms were used for recruitment purposes.

The recruitment goal of the study was to ensure that the sample mirrored the racial/ethnic composition of the surrounding county where the study is being conducted. According to US census data, Guilford County's racial/ethnic composition consists of 55% White alone, 34% Black or African American alone, and 11% other/multiple races (8% Hispanic/Latino). The participant inclusion criteria for the current study included the following: 1) mothers being 18 years or older; 2) expecting a singleton pregnancy; 3) fluent in English; and 4) planning to remain in the region for 3 years. Post-birth phone call (about 5 days after the due date) was conducted with each mother and additional screening was completed to exclude infants from the

study if born with birth defects, metabolic disorders, and pre-term (< 32 weeks). For the purposes of the current study, we included infants born pre-term (< 37 weeks). Additional details about the recruitment and study procedures in the overall study are found elsewhere (Leerkes et al., 2020). The study protocol (#18-0198) was reviewed and approved by the Institutional Review Board of the University of North Carolina at Greensboro prior to data collection. All participants gave consent to participate prior to data collection.

### **Study Procedures for the Current Study**

For the purposes of the current study, data collected from cohort 1 at a prenatal visit and a lab visit at 2–months of infant age were utilized in the final analyses (cohort 1; n=151 mothers and infants).

**Prenatal Visit.** Expectant mothers were sent a secure email link to complete a variety of questionnaires via Qualtrics prior to arrival to the prenatal visit that took place on UNCG campus. Participants provided detailed information about their sociodemographic and socioeconomic status, along with answering questions related to their household/family characteristics (i.e., parity, members of household). Prenatal visits were conducted 6 to 8 weeks prior to the expectant mother’s due date. Maternal anthropometric measurements (e.g., height, weight, arm circumference) were completed during the visit. Additionally, participants signed a medical release form allowing for the experimenters to have access to contact OB/GYNs for information that may be needed if unable to provide the information via the patient portal. Participants received \$50.00 for the prenatal visit along with a small gift with the iGrow logo.

**Post-birth Call.** Five days following the due date, an experimenter called the mother to obtain infant information, such as, birthdate, gender, name, birth weight/length, birth type and

complications. The information provided was used to confirm eligibility for continued participation. The experimenter also reminded mothers of the 2-month visit. For the purposes of the current study, we included infants born pre-term (< 37 weeks).

**2-Month Postpartum Visit.** Prior to 2-month lab visits, mothers were sent a secure link to complete questionnaires via Qualtrics to provide updated information on employment status and whether they were breastfeeding. During the 2-month visits, mothers completed a paper form describing the infant's feeding within the last 24 hours. Mothers were also asked to log into their patient portal via their OB/GYN's website to report the results of any diagnoses related to prenatal risk (e.g., preeclampsia, gestational diabetes) and their pre-pregnancy and end-of-pregnancy weight. If unable to do so, OB/GYNs were contacted to provide the information utilizing the medical release provided at the prenatal visit. Participating mother/infant dyads received \$80 for completing the 2-month visit. They also received small gifts with the iGrow logo. The measures and variables collected and analyzed for the purposes of the current study are presented below.

## **Study Variables and Measures**

### ***Socio-demographics***

Sociodemographic factors such as maternal age, race/ethnicity, education, income, and marital status were collected from mothers during the prenatal wave when they were asked to complete a questionnaire. This information was updated at the 2-month wave if necessary. Mothers were asked to self-report their age in years, as well as to describe their race with the following response options: 1) White only, 2) Native Hawaiian or Pacific Islander, 3) Asian only; 4) Black or African American only; 5) American Indian or Alaskan Native; 6) Other only;

7) biracial only; and 8) multiracial. Mothers were also asked whether or not they considered themselves to be Hispanic, Latino, or of Spanish origin with response options 0 = “no” or 1 = “yes.” For the purposes of the current study, the variable was dichotomized for selected analyses (i.e., multivariate logistic regression) into the following categories: 0 = Black/African American; 1 = Other race/ethnicity. The “other” race/ethnicity group included all others who did not identify as Black or African American only.

Maternal educational status was reported by them in one of the following 7 categories, with 1) some high school; 2) high school degree or GED; 3) attended some college; 4) 2-year college degree; 5) 4-year college degree; 6) post-graduate work; 7) graduate degree. The variable was utilized as a continuous variable with the higher value indicating a higher level of education. Income was assessed by asking participating mothers to report their family’s total annual income before taxes with the following response options: 1) less than 10,000/year; 2) 10,000 – 14,999/year; 3) 15,000 – 24,999/year; 4) 25,000 – 34,999/year; 5) 35,000 – 49,999/year; 6) 50,000 – 74,999/year; 7) 75,000 – 99,999/year; 8) 100,000 – 149,999/year; 9) 150,000 – 199,999/year; 10) 200,000 or more/year. For the analytical purposes, the income-to-needs ratio was calculated by dividing total annual household income by its corresponding poverty threshold determined by the year in which income is earned and the total number of household members. The income-to-needs ration was used as a continuous variable in the analyses. The Poverty Thresholds for 2018 and 2019 published in U. S. Census Reports was used to calculate this ration (Poverty Thresholds: US Census Bureau, 2022).

Participating mothers reported on their current marital/living arrangement status with the following response options: 1 = “married, living together,” 2 = “married but separated,” 3 = “divorced,” 4 = “not married, living with partner,” 5 = not married or living together, but in a

serious romantic relationship,” 6 = “single, not in a romantic relationship,” and 7 = “widowed.” For the multivariate logistic regression analyses, a dichotomous variable called “Intimate partner living in the household” was created and coded as “0 = no” and “1 = yes.” Mothers of infants were also asked to report their employment status during the 2-month postpartum visit using the demographics questionnaire. During the 2-month visit, they were asked if they were currently working with response options: 0 = no; 1 = yes, and if they were working full-time (1 = full-time; 33 hours or more per week) or part time (2 = part-time; 32 hours or less per week). Additionally, they were asked to report the number of total hours worked per week (# hours/week). This variable was used as a continuous variable in the preliminary analyses and in the multivariate logistic regression models (if applicable). A copy of the demographics questionnaire can be found in Appendix B.

### ***Predominant and Exclusive Breastfeeding variables & Other Feeding-related variables***

The variables of predominant BF and exclusive BF were derived from items that mothers were asked on the IFPQ II using Qualtrics survey at the 2-month visit. The IFPQ II includes questions related to breastfeeding, pumping, and formula feeding (see Appendix D for the IFPQ II). Examples of questions include: “Was your baby fed any formula in the past 7 days?; “As of today, have you completely stopped breastfeeding and pumping milk for your baby?” The IFPQ II also included a brief Food Frequency Questionnaire that included breastmilk, formula, baby cereal and several other food items. Mothers were asked whether their infant was fed any of the listed items in the last 7 days and if so, how many times per day or per week (see Appendix C for the IFPQ II). The final variables of predominant BF and exclusive BF used in the current study

were created by carefully reviewing and using all the information related to feeding that was collected from the IFPQ II.

On the FFQ section of the IFPQ, mothers were asked, “how many times during the past 7 days have you fed your baby breastmilk or formula.” They had the option to report the number of times per day or per week. All responses were converted to number of feedings per day. Based on the number of feedings per day as breastmilk and the number of feedings per day as formula, a variable was created that represented the proportion of all feeds per day as breastmilk (range of 0-1). Using this variable, infants were categorized as EBF, mixed fed, or exclusively formula fed. Mothers who reported 0 breastmilk feedings per day were coded as exclusive formula, mothers who reported 100% breastmilk were coded as exclusive breastmilk, and anyone with a score between 0 and 1 was coded as mixed feeding. From this variable, a dichotomous variable of exclusive BF was created: 0 = not exclusively BF; 1 = exclusively BF. Exclusive BF was defined as feeding the baby only breast milk, not any other foods or liquids (including infant formula or water), except for medications or vitamin and mineral supplements (CDC, Infant and Toddler Nutrition; 2022). A dichotomous variable of predominant BF was created when at least 80% of total feeds were reported to come from breastmilk (0 – no; 1 = yes).

A sub-sample for analyses in Aim 3 included all mothers who answered a “yes” to the following question in the IFPQ: “Was your baby fed formula to drink in the past two weeks, by you or anyone else?” (a yes or no response). Mothers’ responses to the FFQ were also reviewed and checked to ensure all who reported feeding formula to the infant were included in the Aim 3 analyses. This sub-sample was also assessed in terms of their prenatal beliefs about the importance of BF and their prenatal confidence about their ability to BF. During the prenatal visit, mothers were asked about what they believed the best way to feed a baby was, with the



following response options: 1) breastfeeding; 2) a mix of both breast and formula feeding; 3) formula feeding; 4) breastfeeding and formula feeding are equally good ways to feed a baby. They were also asked about how confident they were that they would be able to breastfeed as long as they planned to (response option ranging from 1= not at all confident to 5=very confident). These responses were examined as part of Aim 3 in the sub-sample of mothers who reported feeding their infant formula in the past 2 weeks.

### ***Maternal Health-related Variables***

#### **Pre-pregnancy Weight**

Prior to the prenatal visit, mothers reported their pre-pregnancy weight and height in the prenatal Qualtrics survey. To calculate pre-pregnancy Body Mass Index (BMI), height was measured at the prenatal visit and the self-reported pre-pregnancy weight was obtained from the mothers. For missing data, self-report pre-pregnancy weight was obtained using patient portal and/or medical provider patient health forms that were mailed in. Pre-pregnancy BMI was calculated using the standard formula [weight (kg)/height (m<sup>2</sup>)] (CDC, 2022) and used as a continuous variable in the preliminary analyses and in the multivariate logistic regression models. For preliminary analyses and descriptive purposes, pre-pregnancy weight status was also determined using the following categories based on the established cut off values according to the Center for Disease Control (CDC, 2022) for descriptive purposes: 1) BMI <18.5 = underweight (coded as 1); 2) BMI 18.5-24.5 = normal weight (coded as 2); 3) BMI 25-29.9 = overweight (coded as 3); 4) BMI 30.0 and above = obese (coded as 4).

## **Maternal Smoking**

To obtain information on maternal smoking, a modified version of the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) was used. The ASSIST is an 8-item questionnaire used so that participating mothers could self-report on their use of tobacco, alcohol, and cannabis by trimester (The Alcohol, Smoking and Substance Involvement Screening Test, 2010). Mothers were asked to report the number of cigarettes smoked per day for each trimester with response options, 1 = “none,” 2 = “1 to 5,” 3 = “6 to 10,” 4 = “11 to 20,” 5 = “21 or more.” For the purposes of the current analyses, a variable for smoking during pregnancy was created with the following responses: 0 = no smoking during pregnancy; 1 = smoking during one trimester; 2 = smoking during two trimesters; 3 = smoking throughout the pregnancy). The variable was utilized as a continuous variable in the multivariate logistic regression models.

## **Breastfeeding Intentions & Breastfeeding-related Attitudes**

All participants were asked to report their breastfeeding intentions when completing the prenatal Qualtrics survey. A modified version of the Infant Feeding Practices questionnaire (IFPQ) was used in which mothers were asked about their plans for feeding their baby, their confidence and beliefs about breastmilk versus formula feeding. The IFPQ comes from a longitudinal study conducted by the CDC and FDA, where 2,000 mother-infant dyads were followed from the third trimester of pregnancy to the first year of life to examine different infant feeding practices (Fein et al., 2008). For this current study, all participants were asked what method they planned to use to feed their new baby in the first few weeks with the following response options: 1) breastfeed only (baby will not be given formula); 2) formula feed only; 3) both breastfeed and formula feed; 4) don't know yet. These categories were further collapsed for

the purposes of the current study into the following 2 categories: 0 = intentions to feed formula/mix/don't know; 1= intentions to breastfeed only.

At the 2-month visit, mothers who reported that they fed formula to their infant were also asked additional questions related to their breastfeeding experience using the IFPQ. The items included questions about whether the mothers breastfed as long as they wanted to, the infant age in days (if younger than 2 weeks), what their source of breastfeeding information was, the type of social support they received while breastfeeding, and whether they enjoyed breastfeeding. A copy of the IFPQ at 2-month visit can be found in Appendix C.

### **Statistical Analyses**

Data in the current study was analyzed using the Statistical Package for Social Sciences for Windows (28.0 SPSS Inc., Chicago, IL2017). All variables were examined for outliers and normal distribution. Preliminary analyses for Aim 1a (Predominant BF Outcome) and Aim 2a (Exclusive BF Outcome) were conducted using descriptive statistics, including means and standard deviations, frequencies, bivariate correlations, chi-square tests and independent t-tests. Some variables were examined as continuous and ordinal variables but were also collapsed into categorical (e.g., dichotomous) variables to be examined further in the preliminary analyses. Independent t-tests were utilized to detect differences in continuous (note: in some cases ordinal) variables between mothers who reported predominant BF vs. those who did not at the 2-month visit. Chi-square tests were used for all categorical variables in relation to the main outcome variables (i.e., predominant breastfeeding (no=0; yes=1); exclusive breastfeeding at 2 months (no=0; yes=1)).

Two separate multivariate logistic regression models were tested to identify significant predictors of predominant BF (Aim 1b) and exclusive BF (Aim 2b). All variables that were found to be significantly associated with the main outcome in the preliminary analyses were entered into the second block of the respective logistic regression model. Due to the COVID pandemic, infant age at the originally planned 2-month visits ranged from 2 to 4 months of age in the sample. Thus, infant age at 2-month visit was used as a control variable in the first block of both regression models. All statistical tests were considered significant at p value of  $\leq 0.05$ .

Descriptive statistics (i.e., means, frequencies) were used to achieve Aim 3 of the study. Selected variables related to breastfeeding experiences of mothers who reported feeding formula to their infants prior to the 2-month visit were examined and summarized to characterize the subsample in the current study (n=43).

## CHAPTER IV: RESULTS

### Sample Characteristics

Data from a total of 151 mother-infant dyads were included in the current study (Table 1-3). Analyses were limited to participating mothers who provided data on infant feeding practices on the IFPQ at the 2-month visit. Mothers were predominantly non-Hispanic white (47.7%, n = 72), followed by non-Hispanic Black (33.8%, n = 51), and multiracial/other (18.5%; n = 28) (See Table 1). Mothers in our sample were on average 29 years old, with over half being overweight/obese, based on pre-pregnancy BMI weight categories (CDC, Defining Adult Overweight and Obesity, 2022) (See Table 2). Majority of infants lived in a 2-parent household (80.1%, n = 121) and had mothers who had at least some post-high school education (77.5%; n = 117). As shown in Table 1, there was a split between income levels reported in the sample. Approximately a third of the sample (33.8%; n = 51) reported a household income of less than \$25,000/year and nearly 20% reported an income between \$25,000 - \$49,999/year. In addition, 44% of the participants reported an annual household income of \$50,000 or greater. This was the first pregnancy for some mothers, with most mothers having a vaginal birth (73.5%) (See Table 2). When examining BF initiation, nearly all infants were ever breastfed (95%) and approximately 45.0% were exclusively breastfed at the time of the 2-month visit (See Table 3). Infants were 76 males (50.3%) and 75 females (49.7%), with a mean gestational age of 39 weeks. Infants born before 37 weeks are considered pre-term; in our sample, only 10 infants (6.6%) were pre-term. The full characteristics of the sample, including mothers and infants are presented in Tables 1-3.

### **Aim 1a: Preliminary Analyses for Predominant Breastfeeding**

The following variables derived from existing literature were examined in relation to predominant BF in the preliminary analyses: maternal age (continuous), pre-pregnancy BMI (continuous), maternal smoking ( 0 = no; 1 = yes), income-to-needs ratio (continuous), education (0 = high school/GED and below; 1 = above high school), hours worked per week at 2-month (continuous), race/ethnicity (dichotomous 0=other; 1=Non-Hispanic Black), intimate partner living in the household (dichotomous; 0=no; 1=yes), type of birth (vaginal vs. C-section), breastfeeding only intentions (dichotomous; 0= no; 1=yes), WIC participation (dichotomous; 0=no; 1=yes), infant birth weight in kg (continuous), and infant gestational age in weeks (continuous).

The preliminary analyses revealed that race/ethnicity, education, WIC enrollment, intimate partner in household, breastfeeding intentions, pre-pregnancy BMI and income-to-needs ratio were significantly associated with predominant BF. More specifically, results of the Chi-square tests showed that fewer Black moms reported predominant BF compared to others ( $\chi^2 = 18.2$ ;  $p < .001$ ; 29% vs. 66%). Predominant BF was more prevalent among mothers with education levels higher than high school compared to those with high school or below ( $\chi^2 = 8.8$ ;  $p < .01$ ; 61% vs. 31%). Household income-to-needs was significantly higher among mothers who predominantly breastfed at 2M compared to moms who did not predominantly breastfeed (3.95 +- 3.21 vs. 2.12 +- 2.53;  $p < .001$ ). Moreover, a greater number of non-WIC mothers reported predominant BF than mothers enrolled in WIC ( $\chi^2 = 17.2$ ;  $p < .001$ ; 73% vs. 39%) and those who reported living with an intimate partner were more likely to predominantly BF than those living without an intimate partner ( $\chi = 6.9$ ;  $p < .01$ ; 60% vs. 32%). Mothers who reported intentions to only breastfeed (or feed infant breastmilk) during pregnancy, were more likely to

report predominant BF at 2-months than those who reported other intentions related to feeding ( $\chi^2 = 22.8$ ;  $p < .001$ ; 66% vs. 21%).

Independent t-tests revealed that pre-pregnancy BMI was significantly lower among mothers who predominantly breastfed ( $M = 26.17 \pm 6.07$  vs.  $M = 30.55 \pm 8.13$ ;  $p < .001$ ). Type of birth (vaginal vs. caesarean delivery), maternal smoking, maternal age, infant birth weight, infant gestational age, and hours worked per week were not significantly associated with predominant BF.

### **Aim 1b: Predictors of Predominant Breastfeeding**

As noted above, race/ethnicity, education, income-to-needs ratio, WIC enrollment, partner in household, breastfeeding intentions, and pre-pregnancy BMI were significantly associated with predominant BF in the preliminary analyses. Thus, these variables were entered in the multivariate logistic regression model as predictors of predominant BF. In Block 1, infant age at 2-months was entered as a covariate and the predictors noted above were entered in Block 2.

The results of the logistic regression revealed that pre-pregnancy BMI and prenatal breastfeeding intentions significantly predicted predominant BF (Table 4). For every one unit increase in pre-pregnancy BMI, there was a 0.076 decrease in log-odds of predominant BF ( $p = .008$ ; Table 4). Mothers who reported intentions to “breastfeed only” at the prenatal visit were 7 times more likely to predominantly breastfeed at the time of the 2-month visit, compared to those mothers who had intentions to use a mixture of breastmilk and formula, formula only, or those who were not sure ( $p < 0.001$ ; Table 4). Income, race, maternal education, intimate partner in household and WIC participation did not significantly predict predominant BF. However, there

was a trend toward significance in terms of race where mothers who identified as Black had a slightly lower likelihood of predominant BF compared to other mothers in the study ( $p = .064$ ) (See Table 4 for complete model results).

### **Aim 2a: Preliminary Analyses with Exclusive Breastfeeding**

The following variables derived from existing literature were examined in relation to exclusive BF in the preliminary analyses: maternal age (continuous), pre-pregnancy BMI (continuous), maternal smoking (0 = no; 1 = yes), income-to-needs ratio (continuous), education (0 = high school/GED and below; 1 = above high school), hours worked per week (continuous), race/ethnicity (dichotomous 0=other; 1=Non-Hispanic Black), intimate partner living in the household (dichotomous; 0=no; 1=yes), type of birth (vaginal vs. C-section), breastfeeding only intentions (dichotomous; 0= no; 1=yes), WIC participation (dichotomous; 0=no; 1=yes), infant birth weight in kg (continuous), and infant gestational age in weeks (continuous).

The preliminary analyses revealed that race, education, WIC enrollment, type of birth, BF intentions, pre-pregnancy BMI and household income were all significantly associated with exclusive BF. Specifically, results of the Chi-square tests showed that fewer Black mothers reported exclusive BF compared to other mothers ( $\chi^2 = 14.4$ ;  $p < .001$ ; 24% vs. 56%). Exclusive BF was more common among mothers with education level higher than high school compared to those with high school or below ( $\chi^2 = 7.0$ ;  $p < .01$ ; 51% vs. 25%). Income-to-needs ratio was significantly higher among mothers who exclusively breastfed at 2-months compared to those who did not exclusively breastfeed (3.79 +- 2.90 vs. 2.53 +- 3.07;  $p < .05$ ). Additionally, mothers not participating in WIC exclusively breastfed more than mothers who were participants of WIC ( $\chi^2 = 13.8$ ;  $p < .001$ ; 62% vs. 32%). When examining breastfeeding intentions, more mothers



who reported feeding intentions of “breastfeeding only,” exclusively breastfed compared to those who reported feeding intentions of formula/mixed/don’t know yet ( $\chi^2 = 25.3$ ;  $p < .001$ ; 58% vs. 11%). Pre-pregnancy BMI was significantly lower among moms who exclusively breastfed at 2M (26.20 +- 6.45 vs. 29.82 +-7.76;  $p < .01$ ). Partner in the household, maternal smoking, hours worked per week, maternal age, infant birth weight or infant gestational age were not significantly associated with exclusive BF.

### **Aim 2b: Predictors of Exclusive Breastfeeding**

The logistic regression revealed that maternal pre-pregnancy BMI, vaginal birth, and prenatal feeding intentions to “breastfeed only” were significant predictors of exclusive BF in our sample (Table 5). For every unit increase in pre-pregnancy BMI, there was a 0.64 decrease in log-odds of exclusive BF at the time of the 2-month visit ( $p = .032$ ). Moms who reported feeding intentions to “breastfeed only” at the prenatal visit were nearly 12 times more likely to exclusively breastfeed compared to those mothers who had intentions to use a mixture of breastmilk and formula, formula only, or those who were not sure ( $p < 0.001$ ). Mothers who had a vaginal birth were 3 times more likely to be exclusively breastfeeding at the time of the 2-month visit ( $p = 0.046$ ). Race, income, maternal education and WIC participation were not significant predictors of exclusive BF in the sample, although identifying as Black was marginally associated with lower odds of exclusive BF ( $p = 0.077$ ).

### **Aim 3: Characteristics and Breastfeeding-related Experiences of Mothers Who Introduced Formula Prior to the 2M Visit**

The characteristics of the sub-sample of the participating mothers who reported giving formula to their infants by the time of the 2M visit are presented in Table 6 (n = 43). The subsample only included women who answered “yes” to whether or not they fed formula to their infant in the past 2 weeks. The follow up question asked them about reasons for feeding formula in the past two weeks (n=43). The average age of the sub-sample was 30 years of age. In addition, 44% of them identified as Non-Hispanic Black and 42% identified as Non-Hispanic White. The average household income of the sample was less than \$49,999/year, with roughly 40 percent having an income less than \$25,000/year. One-fourth of the subsample reported having a graduate degree. See Table 6 for complete demographics. The participating mothers were asked to report where/from whom they received information about breastfeeding. The results are presented in Table 7. Majority of them received information about breastfeeding from a lactation consultant and from a health care provider. Some mothers also reported that they received breastfeeding information from a website/Internet (63%; n = 27). In addition, a little over half of moms (55.8%; n = 23) obtained information about breastfeeding from WIC services. See Table 7 for complete results.

The most commonly reported reasons for feeding their infant formula are presented in Table 8. The responses ranged from “not at all/not very important” to “somewhat/very important” for each potential reason. The most commonly reported reason was “lack of milk supply” in our sub-sample (69.8%; n = 30). Additionally, many mothers reported that breastmilk alone “did not satisfy” their baby and that was an important reason for them to start feeding formula to their infant (55.8%; n = 24). Wanting or needing someone else to feed their baby was

reported as a “somewhat important/very important” reason for feeding formula (51.2%; n = 22). A relatively large proportion of mothers (44.2%; n =19) reported “somewhat/very important” that baby was not gaining enough weight as a reason for feeding their infant formula. See Table 8 for complete results.

This subsample of mothers were also assessed on their prenatal confidence about their ability to breastfeed. Majority of these moms reported that they were somewhat confident to very confident that they would be able to breastfeed as long as they planned to. Interestingly enough, when asked how old they think their baby would be when they first feed him /her formula, majority of the subsample ( n = 19) reported that they don’t plan on ever feeding their baby formula. Lastly, a large proportion (n = 29; 68%) of the subsample believed that the best way to feed a baby is breastfeeding.

## CHAPTER V: DISCUSSION

The current study examined maternal, infant, and family/household predictors of predominant and exclusive breastfeeding among racially/ethnically and socio-economically diverse sample of mother-infant dyads who participated in the iGrow study. We found that although breastfeeding was initiated with 95% of infants in the sample, only 45% were exclusively breastfed at the time of the 2-month visit. The AAP and WHO recommend that infants are exclusively breastfed for up to 6 months. Since majority of our participants reported initiating breastfeeding after birth, we examined predictors of pre-dominant breastfeeding in our sample (>80% of feeds coming from human milk) rather than predictors of breastfeeding “initiation” as has been done in some previous studies. Our findings advance the current knowledge on predictors of predominant and exclusive breastfeeding in early infancy and offer insights from a racially/ethnically and socio-economically diverse sample of mother-infant dyads living in an urban area of North Carolina.

The significant predictors of predominant breastfeeding in our sample at the time of the 2-month visit were pre-pregnancy BMI and prenatal feeding intentions to “breastfeed only.” Exclusive breastfeeding at the time of the 2-month visit was also predicted by maternal pre-pregnancy BMI and prenatal feeding intentions to “breastfeed only.” While these two characteristics predicted both outcomes, we identified an additional variable that was associated with exclusive breastfeeding but not with predominant breastfeeding. This predictor was “type of birth,” with mothers who had a vaginal birth having a greater likelihood of exclusive breastfeeding at the 2-month visit. Race was not a significant predictor of predominant breastfeeding in our sample. Women in our sample who identified as Black had a slightly lower likelihood of predominant breastfeeding ( $p = 0.064$ ) and slightly lower odds of exclusive

breastfeeding ( $p = 0.077$ ), but these values did not reach a statistical significance. To further examine these trends, we controlled for education in our models, but race remained a non-significant predictor of both outcomes in our sample (results now shown). Our findings contradict some previous research in this area. A study with a nationally representative sample of US children found that race/ethnicity was a significant predictor of non-exclusive breastfeeding (Stough et al., 2019). Since our study was limited to Cohort 1 of the iGrow study, our non-significant findings could potentially be explained by our relatively small sample and further research should examine race as a predictor in a larger sample that includes cohort 2 of the study to strengthen the validity. Furthermore, it is likely that racial disparities that exists in breastfeeding outcomes are influenced by a variety of complex socio-demographic, cultural and social factors. These contextual factors may interact with race to influence likelihood of predominant and exclusive breastfeeding and thus a deeper examination of these potential mechanisms is warranted in future research.

Similar to Wen and colleagues, our study found that maternal feeding intentions are associated with breastfeeding outcomes (Wen et al., 2009). We found that intentions to “breastfeed only” were higher among participants who had education “above high school” vs those with “high school and below,” and those who identified as “Others,” vs “Black.” This highlights the need to target these populations in breastfeeding promotion efforts and may also be reflective of the fact that those with lower education levels may have less knowledge and awareness about the different benefits of breastfeeding for both the mothers and infants, which in turn, may lower maternal intentions to breastfeed after birth. Previous research found that mothers who were knowledgeable about infant health benefits of breastfeeding were more likely to exclusively breastfeed rather than use mixed feeding (Stuebe et al., 2011), and maternal

knowledge related to breastfeeding has been correlated with prenatal breastfeeding intentions of mothers, and these intentions have been found to be strong predictors of how a mother chooses to feed her infant (Radzyski & Callister, 2016; Raissian & Su, 2018; Stuebe et al., 2011). Especially given the fact that previous research shows that decreased breastfeeding knowledge levels is an obstacle to breastfeeding (Brown, Raynor and Lee, 2011) and even when mothers of infants have an awareness of breastfeeding recommendations, that the odds of initiating and continuing breastfeeding are higher (Wallenborn et al., 2017).

Our findings confirm that maternal intentions to “breastfeed only” predict the likelihood of both predominant and exclusive breastfeeding. Significant intervention efforts such as the Baby Friendly Hospital Initiative, has been implemented by many hospitals in the United States to provide mothers breastfeeding information, as well as the self-assurance and skills necessary to successfully initiate and continue breastfeeding their babies (Munn et al., 2016). While most hospitals have shifted to a Baby-Friendly hospital, additional intervention is needed to support and promote breastfeeding among pregnant women prior to birth, before they finalize their plans about what and how they will feed their baby. These interventions should be aimed at increasing breastfeeding knowledge, as well as awareness of breastfeeding benefits. Overall, our study highlights the importance of breastfeeding education and promotion in healthcare settings and especially in those facilities that serve diverse populations of pregnant women living in lower socio-economic households.

Another strong predictor of both breastfeeding outcomes in our sample was maternal pre-pregnancy BMI, indicating that a higher BMI prior to pregnancy was associated with a lower likelihood of predominant as well as exclusive BF. Our findings are consistent with previous literature which has shown that higher maternal pre-pregnancy BMI is negatively associated with

breastfeeding outcomes (Amir & Donath, 2007; Campbell and Shackleton, 2018; Krause et al., 2011). Guelinckx et al. (2012) found that a high pre-pregnancy BMI was negatively associated with exclusive breastfeeding (Guelinckx et al., 2012). Likewise, high pre-pregnancy BMI/obesity can negatively influence breastfeeding outcomes due to higher adiposity causing decreased prolactin responses to suckling, therefore, interfering with milk production (Matias et al., 2014; Nommsen- Rivers et al., 2022; Rasmussen & Kjolhede, 2004). In a small-case control study, a BMI of 35 or greater was a strong risk factor for severely low milk production, which sheds light on the fact that there are biological factors that put women at risk for lack of breastfeeding (Nommsen-Rivers et al., 2022). Given previous research and the findings of the current study, early breastfeeding promotion and support is much needed for all mothers, but especially those whose BMI may be in the overweight or obese weight status category as defined by the CDC guidelines (Centers for Disease Control: Defining Adult Overweight and Obesity, 2022). Breastfeeding mothers with a higher BMI should be prioritized for closer guidance and follow-up of breastfeeding progress after being discharged from the hospital following birth. Assisting and supporting women of reproductive age to establish a healthy lifestyle and physical activity habits for optimal pregnancy outcomes (Bye et al., 2016 ) may be an effective way to promote breastfeeding and increase the rates of predominant and exclusive breastfeeding among racially/ethnically and socio-economically diverse populations of women. In addition, qualitative and clinical studies aimed at enhancing patient-focused approaches for the management of low milk supply are warranted.

In addition, previous studies have shown that there is an association between birth mode and breastfeeding outcomes, in which women who delivered via C-section were less likely to continue exclusive breastfeeding and any breastfeeding 3 months postpartum (Wu et al., 2018).

These results are partly reflective of our findings in the current study. We observed a higher likelihood of exclusive breastfeeding, but not predominant breastfeeding, among participants who had a vaginal birth versus a C-section. The physiology of lactation can be negatively affected by a C-section delivery and adverse events following a C-section may arise, such as increased maternal physical pain (Forster & McLachlan, 2007). A C-section may also contribute to an increased need for the neonates to spend time in the neonatal intensive care unit, which can cause decreased skin to skin contact and less time of the infant rooming in with the mother after birth, which are known factors that are associated with breastfeeding initiation (Forster & McLachlan, 2007). Oxytocin is a key hormone that is released in response to breastfeeding that plays a role in milk let down or flow and induces physiological changes to promote milk production (Uvnas Moberg et al., 2020). Oxytocin levels are known to be different in women who have a vaginal birth versus women who have a C-section. Women who have a vaginal birth are more likely to have increased maternal oxytocin levels 5-7 days after birth due to the onset of suckling or other types of breast stimulation or skin to skin contact following birth (Chiodera et al., 1991). Studies that examined women who formula-fed or without suckling, revealed no rise of oxytocin levels (Chiodera et al., 1991; Cox et al., 2015). This biological factor may adversely affect breastfeeding outcomes (Uvnas Moberg et al., 2020) and more clinical studies are needed for further investigation.

While these are serious physiological barriers to BF after a C-Section, there is also a need for more qualitative studies that would more deeply examine maternal perceptions and attitudes and perceived barriers to breastfeeding after having a C-section to better understand the needs and support these women needs to successfully breastfeed their infants.



In contrast to previous literature, we found that maternal smoking during pregnancy, birth weight, gestational age, the number of hours of work per week, maternal age and WIC participation were not associated with our two breastfeeding outcomes. Smoking during pregnancy has been identified in several previous studies as being negatively associated with the duration of breastfeeding (Higgins et al., 2010; Horta et al., 2001; Lande et al., 2003; Letson et al., 2002; Schindler-Ruwisch et al., 2021). However, only 13% of mothers in our sample reported smoking during pregnancy and was not found as a significant predictor for our two outcomes. This could be due to not having much variance in our sample, compared to other larger studies (Letson et al., 2002), but it is important to note that our outcome differs from this larger study, so this variable may still matter for variability in breastfeeding cessation in terms of duration over time.

Participation in WIC was not found to be a significant predictor of breastfeeding outcomes in our study. Interestingly, findings on this potential predictor have been mixed in previous research. For example, Gregory and colleagues found no negative association between WIC participation and breastfeeding at 3-months postpartum (Gregory et al., 2016). However, some studies found that WIC participation was negatively associated with breastfeeding outcomes (Francescon et al., 2016; Jensen, 2012; Ryan & Zhou, 2006). When examining exclusive breastfeeding rates at 3 months and 6 months postpartum, infants of mothers participating in the WIC program were less likely to be exclusively breastfed than all other US infants (Oliveira et al., 2019). The rationale for why women participating in WIC may have better BF outcomes is founded on the argument that WIC's mission is to promote BF and provide BF education to all enrolled pregnant moms. However, WIC also provides formula to mothers who do not breastfeed and thus, could negatively impact BF rates among WIC

participants. Additionally, WIC eligibility is based on low income requirements and thus WIC participants come from populations with lower socioeconomic status and lower income, and both have been associated with lower BF rates compared to women with a higher income and education level (Ajami et al., 2018; Heck et al., 2006; Miller et al., 2005). Therefore, it is important to consider that lower breastfeeding rates among those who are enrolled in WIC may be caused by a selection bias rather than the WIC program having a negative effect on breastfeeding outcomes (Jiang et al., 2010). Sutter et al. (2018) found that women enrolled in WIC were in fact at greater risk for breastfeeding cessation and reported lower rates of breastfeeding information and support than women not enrolled in WIC and these findings are consistent with other previous literature (Chatterji & Brooks-Gunn, 2004; Jensen, 2012).

However, it is important to note that WIC represents a very cost-effective nutrition education and food assistance program, and it is currently the only federal program that supports the health of pregnant women and promotes BF in the US for socio-economically vulnerable populations (Special Supplemental Nutrition Program for Women, infants, and children, 2022). The mission of WIC is to improve the health of mothers and young children and while efforts in breastfeeding promotion have been impressive over the last few years (Kline et al., 2020), more effective methods of delivery of BF information and support are needed to meet the needs of at-risk mothers. Because prenatal intentions related to infant feeding appeared to predict whether mothers were more or less likely to BF in our sample, increasing maternal awareness of BF benefits for both the mothers and infants should be a key priority among pregnant women. Importantly, BF-related information and support should be tailored to individual circumstances of new mothers. For example, more information about pumping could be provided to those mothers who have to return to work soon after birth while mothers who may work from home

may receive more information about direct breastfeeding. BF information should also be delivered using culturally and racially/ethnically appropriate information, as there is a need for more diverse lactation specialists in the lactation field (Davis et al., 2021). Currently, an estimated 71% of lactation consultants are White, 10% are Black and roughly 9% are Latina (Crumpler, 2022). Lack of diversity in the lactation field could inhibit the progression of increasing BF rates among at-risk populations.

Our study also examined a sub-sample of caregivers who reported feeding formula to their infant prior to the 2-month visit to further examine selected characteristics and also take a closer look at their attitudes and experiences related to BF and formula feeding. We found that majority of the sub-sample received breastfeeding information from a lactation consultant and/or health care provider, which is consistent with findings from Sutter and colleagues (Sutter et al., 2018). However, our data do not provide detailed information and thus we do not know how much information they received and what the quality of the BF-related information was. Nonetheless, our finding that health care providers offered BF information to most of the mothers in our sample is encouraging especially since previous research shows that breastfeeding information support is significantly related to feeding method at 6 weeks postpartum (Sutter et al., 2018). A relatively large proportion of the participants in our sub-sample reported that breastmilk alone did not satisfy their infant and that was an important reason for them to start feeding formula. Likewise, some mothers started feeding formula because they thought that their infant was not gaining enough weight. Interestingly, a closer look at the infants of these mothers revealed that none of them were below the cut-offs for underweight. Some of them were closer to the 90<sup>th</sup> percentile for weight for length/height and weight for age. Thus, some mother's concerns may be based on their own perceptions of infant hunger or weight. Educating mothers

on a healthy weight for infants and taking the time to show them growth charts may help reduce their worries and tendencies to start introducing formula.

The findings addressing Aim 3 of the current study revealed that the sub-sample of participants who started offering formula to their infants was diverse, not only racially/ethnically but also in terms of socio-economic status, WIC participation, having an intimate partner in the house and the employment status. Therefore, our findings indicate that the reasons for feeding infant formula in early infancy are complex and individualized because they are likely influenced by a variety of beliefs, attitudes and experiences related to feeding and infant health. Thus, future research should examine the quality and quantity of breastfeeding information received and further explore maternal barriers (e.g., infant not sleeping through the night, being fussy, etc.) and reasoning for introducing formula to their infants prior to 6 months of age using both quantitative and qualitative approaches.

The current study has several strengths that should be noted. First, data for these analyses came from a longitudinal sample of pregnant women participating in the iGrow study who provided data while pregnant as well as after their baby was born when they visited our lab around the infant age of 2 months. Thus, we were able to collect prenatal data, including prenatal intentions related to infant feeding before the baby was born, which is unique in studies on infant feeding. Second, our sample was diverse in terms of race/ethnicity as well as socio-economic status, with participants representing all levels of income and education. Third, the utilization of the IFPQ postnatally allowed us to ask detailed BF-related questions that were addressed in Aim 3, including the reasons for feeding formula and the source of BF-related information. However, our study has also some limitations that need to be noted. A limitation in the current study is the relatively small sample size. Our sample only includes mother-infant dyads from cohort 1 of the

iGrow Study and thus further research should examine predictors of the BF outcomes in both cohorts once data collection is completed from cohort 2 (n=299). Lastly, infant age at the time of the 2M visit varied among infants due to the impacts of the COVID-19 pandemic on data collection (a 3-month cessation of data collection in 2020). Infants were supposed to be seen at 2-months of their age (plus or minus two weeks from their 2-month birthday). However, our research team had to extend the recruitment time period, so some infants were closer to three or four months. While our average age of infants at the time of the 2-month visit was still close to two months (2.2 +- .567), we did control for infant age at 2-month visit in both regression models. Finally, the subsample only included data from 43 women who answered “yes” to whether or not they fed formula to their infant in the past two weeks and with a follow up question that asked them about reasons for feeding formula in the past two weeks (n= 43), therefore, it may not have captured all mothers who could have answered these reason items.

## **Conclusions and Implications**

While the breastfeeding rates in the US have increased somewhat in the past few years, there is still much room for improvement. With the Healthy People 2010 and 2020 initiatives, the rates of exclusive breastfeeding through 6 months of infant age has improved over the last decade, however, these rates still remain suboptimal in the United States. While the efforts to promote breastfeeding are ongoing, it is important to continue to examine the associations between various socio-demographic, personal, behavioral and household characteristics and BF outcomes to better understand which ones help promote BF versus those that serve as barriers to new mothers and their infants. Our study is important as it highlights lower pre-pregnancy BMI and prenatal intentions to breastfeed only as the key predictors of predominant BF and exclusive

BF in a diverse sample of mother-infant dyads in NC. Since both factors are modifiable, they can be addressed in programs designed to improve health of women of reproductive health prior to pregnancy. Future intervention efforts should include educating women about the importance of breastfeeding, sharing information about the wide range of benefits related to BF for both the infant and the mother, and providing resources and support services related to BF issues prior to infant birth.

Finally, our findings suggest that the facilitators and barriers to BF in early infancy are diverse and likely highly individualized within the maternal family/household/cultural context. Thus, there is a great need to utilize qualitative research approaches to further explore the interactions between maternal socio-demographic characteristics, maternal feeding intentions, maternal beliefs and attitudes related to breastfeeding and infant health outcomes, including weight outcomes. Although our study did not identify race/ethnicity as a predictor of BF outcomes, qualitative approach to studying this topic would allow a deeper investigation into factors that may be responsible for the racial/ethnic disparities in BF outcomes that have been observed in the U.S.

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APPENDIX A: TABLES

**Table 1. Maternal and Family Characteristics**

	Total (n = 151)
<b>Maternal age, years, mean (SD)</b>	29.4 (6.22)
<b>Maternal Race</b>	
Non-Hispanic Black	51 (33.8)
Non-Hispanic White	72 (47.4)
Multiracial/Other	28 (18.5)
<b>Ethnicity<sup>a</sup></b>	
Hispanic	10 (6.6)
<b>Maternal Education<sup>b</sup></b>	
High school/GED or below	32 (21.2)
Some college	33 (21.9)
College degree or above	84 (55.6)
<b>Household Income<sup>c</sup></b>	
Less than \$25,000/year	51 (33.8)
\$25,000 - \$49,999	28 (18.5)

\$50,000 - \$99,999	38 (25.2)
Greater than \$100,000/year	28 (18.5)
<b>Income-to needs ratio<sup>d</sup>, mean (SD)</b>	3.1 (3.05)
<b>Intimate Partner Living in Household<sup>e</sup></b>	
Yes	121 (80.1)
No	28 (18.5)
<b>Intentions to Exclusively Breastfeed<sup>f</sup></b>	
Yes	111 (73.5)
No	38 (25.2)

Note: Data presented as n (%) except as noted; <sup>a</sup> Missing for n = 2; <sup>b</sup> Missing for n = 2;

<sup>c</sup> Missing for n = 6; <sup>d</sup> Income prior year divided by hh size poverty threshold value p, missing

for n = 6; <sup>e</sup> Missing for n = 2; <sup>f</sup> Missing for n = 2

**Table 2. Maternal Health Characteristics**

	Total (n = 151)
<b>Pre-pregnancy BMI (kg/m<sup>2</sup>)<sup>a</sup>, mean, (SD)</b>	28.2 (7.39)
<b>Pre-pregnancy weight status<sup>b</sup></b>	
Underweight	4 (2.6)
Normal	63 (41.7)
Overweight	34 (22.5)
Obese	48 (31.8)
<b>Maternal smoking during pregnancy<sup>c</sup></b>	
No	129 (85.4)
Yes	20 (13.2)
<b>Type of birth</b>	
Vaginal	111 (73.5)
Caesarean	40 (26.5)
<b>WIC participation<sup>d</sup></b>	
No	66 (43.7)
Yes	85 (56.3)



<b>First pregnancy</b>	
No	85 (56.3)
Yes	66 (43.7)

Data presented as n (%) except as noted; <sup>a</sup> Missing data n = 2; BMI = Body Mass Index;

<sup>b</sup> Weight status defined by CDC guidelines; <sup>c</sup> Missing data (n = 2); <sup>d</sup>WIC = Special

Supplemental Nutrition Program for Women, Infants, and Children.

**Table 3. Infant and Feeding Characteristics**

	Total (n = 151)
<b>Biological Sex at Birth</b>	
Female	75 (49.7)
Male	76 (50.3)
<b>Gestational age in weeks; mean (SD)</b>	39.2 (1.5)
<b>Preterm birth (&lt; 37 weeks)</b>	10 (6.6)
<b>Child ever breastfed</b>	
Yes	143 (94.7)
No	8 (5.3)
<b>Breastfeeding Cessation prior to 2-month visit<sup>a</sup></b>	33 (21.9)
<b>Predominantly breastfed at 2-month visit<sup>a,b</sup></b>	
Yes	81 (53.6)
No	70 (46.4)

<b>Exclusively breastfed at 2-month visit<sup>a</sup></b>	
Yes	68 (45.0)
No	83 (55.0)

Data presented as n (%) except as noted; <sup>a</sup> Infants age range from 2-4 months old in the sample; <sup>b</sup> Predominantly breastfed defined as “at or above 80% of the feeds from breastmilk.

**Table 4. Logistic Regression Model of Predictors of Predominant Breastfeeding<sup>a</sup> at the Time of the 2-Month Visit**

Variable	B	S.E.	P	Exp (B)
Block 1				
Age in months 2m visit	-.073	.366	.843	.930
Block 2				
Income-to- needs ratio	-.048	.094	.609	.953
Maternal education level	.183	.152	.228	1.201
Race	-.910	.491	.064	.402
WIC participation	-.431	.629	.493	.650
Pre-pregnancy BMI	-.076**	.029	.008**	.927
Partner in household	.188	.555	.734	1.207
Feeding intentions	1.895***	.528	<.001***	6.655
Constant	.79	1.59	.61	2.22

<sup>a</sup> The outcome of predominant breastfeeding (0 = no; 1 = yes); Age in months 2m visit (continuous); income-to-needs ratio (continuous); Maternal education level (ordinal variable range 1-7 from 1 = some HS to 7= graduate degree); Race: categorical, dichotomous variable with 0 = Other (reference group); 1 = Black; WIC participation: categorical, dichotomous variable with 0 = no; 1 = yes; Pre-pregnancy BMI (continuous); Partner in household: categorical, dichotomous variable with 0 = no partner in household; 1 = partner living in the household; Feeding intentions (0 = all other; 1 = breastfeeding only); \*\* p <0.01; \*\*\* p <0.001

**Table 5 . Logistic Regression Model of Predictors of Exclusive Breastfeeding<sup>a</sup> at the Time of the 2-Month Visit**

<b>Variable</b>	<b>B</b>	<b>S.E.</b>	<b>P</b>	<b>Exp (B)</b>
Block 1				
Age in months 2m visit	.241	.391	.537	1.273
Block 2				
Income-to-needs ratio	-.128	.089	.151	.880
Maternal education level	.180	.150	.231	1.197
Race	-.916	.518	.077	.400
Pre-pregnancy BMI	-.064	.030	.032*	.938
Type of birth	.946	.475	.046*	2.575
Feeding intentions	2.483***	.630	<.001***	11.975
WIC participation	-.736	.619	.234	.479
Constant	-1.32	1.62	.41	.26

<sup>a</sup> The outcome of exclusive BF (0 = no; 1 = yes); Age in months 2m visit (continuous); income-to-needs ratio (continuous); maternal education level (ordinal variable range from 1-7 from 1 = some HS to 7= graduate degree); Race: categorical, dichotomous variable with 0 = Other (reference group); 1 = Black; Pre-pregnancy BMI (continuous); Type of birth: categorical, dichotomous variable with 0 = caesarean; 1 = vaginal birth; Feeding intentions (0 = all other; 1 = breastfeeding only); WIC participation: categorical, dichotomous variable with 0 = no; 1 = yes; \* p < 0.05; \*\*\* p <0.001

**Table 6. Characteristics of Mothers Who Offered Formula Before 2-Month Visit**

	Total (n = 43)
<b>Maternal age, years, mean (SD)</b>	30 (6.36)
<b>Maternal Race</b>	
Non-Hispanic Black	19 (44.2)
Non-Hispanic White	18 (41.9)
Multiracial/Other	6 (14.0)
<b>Ethnicity</b>	
Hispanic	4 (9.3)
<b>Maternal Education</b>	
Some high school	1 (2.3)
High school degree or GED	8 (18.6)
Attended some college	7 (16.3)
2-year college degree	6 (14.0)
4-year college degree	9 (20.9)
Post-graduate work	2 (4.7)
Graduate degree	10 (23.3)

<b>'Household Income'<sup>a</sup></b>	
Less than \$25,000/year	17 (39.5)
\$25,000 - \$49,999	8 (18.6)
\$50,000 - \$99,999	7 (16.3)
Greater than \$100,000/year	10 (23.3)
<b>Income-to needs ratio<sup>b</sup>, mean (SD)</b>	3.22 (3.48)
<b># Hours worked per week, mean (SD)</b>	15 (19.2)
<b>Partner in the household</b>	37 (86.0)
<b>Partner not in the household</b>	6 (14.0)
<b>WIC participation</b>	
No	18 (41.9)
Yes	25 (58.1)
<b>Pre-pregnancy weight status</b>	
Underweight	1 (2.3)
Normal weight	13 (30.2)
Overweight	15 (34.9)
Obese	14 (32.6)

Note: Data presented as n (%) except as noted; <sup>a</sup> Missing for n = 1; <sup>b</sup> Missing

for n = 1; income prior year divided by hh size poverty threshold value p

**Table 7. Sources of Breastfeeding Information Among Mothers Who Offered Formula Before 2-Month Visit**

<b>Sources of BF Information</b>	<b>N (%)</b>
	Total (n = 43)
<b>Lactation consultant</b>	35 (81.4)
<b>Health care provider</b>	32 (74.4)
<b>Website</b>	27 (62.8)
<b>WIC</b>	23 (55.8)
<b>Relatives or friends</b>	21 (48.8)
<b>Birthing or baby care class</b>	20 (46.5)
<b>Books or videos</b>	19 (44.2)
<b>Dietitian/Nutritionist</b>	5 (11.6)
<b>Newspapers or magazine</b>	3 (7.0)
<b>Newsletters</b>	1 (2.3)
<b>Telephone support helpline or hotline</b>	1 (2.3)
<b>Other</b>	1 (2.3)



**Table 8. Reasons for Feeding Formula to the Infant Prior to 2-Month Visit**

Characteristic	Somewhat/very important	Not all all/not very important
	N (%)	N (%)
Low milk supply	30 (69.8)	13 (30.2)
Breast milk alone did not satisfy baby	24 (55.8)	19 (44.2)
Wanted or needed someone else to feed baby	22 (51.2)	21 (48.9)
Trouble sucking or latching on	20 (46.5)	23 (53.5)
Mom thought baby was not gaining enough weight	19 (44.2)	24 (55.9)
Someone else wanted to feed the baby	17 (39.6)	26 (60.5)
Nipples were sore, cracked, or bleeding	17 (39.5)	24 (60.5)
Breastfeeding mom wanted to be able to leave baby for several hours at a time	15 (34.9)	28 (65.1)
Health professional said baby was not gaining enough weight	15 (34.9)	28 (65.1)
Breastfeeding mom was sick or had to take medicine	11 (25.6)	32 (74.4)
Did not want to breastfeed in public	10 (23.3)	33 (76.7)
Breastfeeding was too painful	10 (23.3)	33 (76.8)
Breastfeeding was too tiring	8 (18.7)	35 (81.4)
Not present to feed my baby for reasons other than work	8 (18.6)	35 (81.4)
Baby lost interest in nursing/began to wean him/herself	7 (16.3)	36 (83.7)

Infant being sick and could not breastfeed	6 (14.0)	37 (86.0)
Difference between breastmilk & formula no longer mattered	6 (14.0)	37 (86.1)
Breastfeeding was too inconvenient	6 (13.9)	37 (86.1)
Could not or did not want to pump or breastfeed at work <sup>a</sup>	5 (11.7)	37 (86)
Breasts were infected or abscessed	5 (11.7)	38 (88.4)
Pumping milk no longer seemed worth the effort that it required	2 (4.7)	41 (95.3)

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Data presented as n (%), total (n = 43); <sup>a</sup>Missing for n = 1

APPENDIX B: IGROW DEMOGRAPHIC QUESTIONNAIRE (DEMO)

iGrow - Demographics  
Family Questionnaire

1. What is your due date? \_\_\_\_\_  
(Month/Day)

2. Have there been any complications/concerns regarding your pregnancy or the baby?  Yes  No

2a. If yes, please explain. \_\_\_\_\_  
\_\_\_\_\_

3. Please list the age and your relationship to all the people who currently live in your household.

Age	Relationship

4. What is your current age? \_\_\_\_\_

5. Are you currently working? (Please circle one)  Yes  No

5a. If yes, are you working: (Please circle one)  Full-time  Part-time

5b. Name of employer? \_\_\_\_\_

5c. Your job or occupation title? \_\_\_\_\_

5d. What are your most important activities or duties? \_\_\_\_\_  
\_\_\_\_\_

6. Do you plan to work after your baby is born? (Please circle one)  Yes  No

6a. If yes, when will you return/begin to work? \_\_\_\_\_

6b. How many hours per week? \_\_\_\_\_

6c. Do you know who will take care of your baby while you are at work?

Yes No

7. Are you in school of any kind now? (Please circle one)

Yes No

8. What level of school have you completed? (Please check one)

\_\_\_\_ Some High School      \_\_\_\_ 2 Year College Degree      \_\_\_\_ Post-graduate Work  
\_\_\_\_ High School Degree or GED      \_\_\_\_ 4 Year College Degree      \_\_\_\_ Graduate Degree  
\_\_\_\_ Attended Some College

9. How would you describe your ethnicity? (Please check ALL THAT APPLY)

\_\_\_\_ White      \_\_\_\_ Hispanic      \_\_\_\_ Asian or Asian-American  
\_\_\_\_ Black      \_\_\_\_ Native American      \_\_\_\_ Other \_\_\_\_\_

10. How would you describe the ethnicity of your baby's biological father? (Please check ALL THAT APPLY)

\_\_\_\_ White      \_\_\_\_ Hispanic      \_\_\_\_ Asian or Asian-American  
\_\_\_\_ Black      \_\_\_\_ Native American      \_\_\_\_ Other \_\_\_\_\_

11. Please circle the word that best describes how much experience you've had caring for/interacting with INFANTS? (Please circle one)

None      A little      Some      A lot

12. Please circle the word that best describes how much experience you've had caring for/interacting with OLDER CHILDREN? (Please circle one)

None      A little      Some      A lot

13. Please check ALL of the following that describe the experiences you have had interacting with children. (Please check ALL THAT APPLY)

\_\_\_\_ Caring for younger siblings      \_\_\_\_ Job: Describe \_\_\_\_\_  
\_\_\_\_ Playing with neighborhood children      \_\_\_\_ Volunteering: Describe \_\_\_\_\_  
\_\_\_\_ Babysitting      \_\_\_\_ Other: Describe \_\_\_\_\_

***How much money we have can make a big difference in our lives. We appreciate your answering the following question about your family's financial situation as accurately as you can, remembering that this information is confidential and will not be associated with your name.***

14a. **What is your family's total ANNUAL income?** (Before taxes)

Please check the category that is closest to your family's total yearly income:

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Less than \$2,000/yr | <input type="checkbox"/> \$20,000-\$24,999/yr | <input type="checkbox"/> \$60,000-\$69,999/yr   |
| <input type="checkbox"/> \$2,000-\$4,999/yr   | <input type="checkbox"/> \$25,000-\$29,999/yr | <input type="checkbox"/> \$70,000-\$79,999/yr   |
| <input type="checkbox"/> \$5,000-\$9,999/yr   | <input type="checkbox"/> \$30,000-\$39,999/yr | <input type="checkbox"/> \$80,000-\$89,999/yr   |
| <input type="checkbox"/> \$10,000-14,999/yr   | <input type="checkbox"/> \$40,000-\$49,999/yr | <input type="checkbox"/> \$90,000-\$99,999/yr   |
| <input type="checkbox"/> \$15,000-19,999/yr   | <input type="checkbox"/> \$50,000-\$59,999/yr | <input type="checkbox"/> more than \$100,000/yr |

15. **Will your baby's biological father play an active role in your child's life?** (Please circle)  Yes  No

16. **What is your current marital status?** (Please check one)

- |   |  |
|---|--|
| <input type="checkbox"/> Married, living together         | <input type="checkbox"/> Not married but have a continuing romantic relationship |
| <input type="checkbox"/> Married but separated            | <input type="checkbox"/> Single, never married, not in a romantic relationship   |
| <input type="checkbox"/> Divorced                         | <input type="checkbox"/> Widowed   |
| <input type="checkbox"/> Not married, living with partner |  |

16a. **If in a relationship, how long have you been together as a couple?** \_\_\_\_\_

16b. **Is your spouse/partner your baby's biological father?** (Please circle one)  Yes  No

**If your spouse or partner will live in the same household with you and your child, please complete this section.**

17. **What is the current age of your spouse/partner?** \_\_\_\_\_

18. **Is your partner:** (Please circle one)  Male  Female

19. **Does your spouse/partner have other children?** (Please circle one)  Yes  No

19a. **If yes and they don't live with you full-time, please list their age(s) below:**

+	<b>Age</b>

20. **Is your spouse/partner working outside of the home now?** (Please circle one)  Yes  No

20a. **If yes, is your spouse/partner working:** (Please circle one)  Full-time  Part-time

20b. **Name of employer?** \_\_\_\_\_

20c. **Job or occupation title?** \_\_\_\_\_

20d. **What are your spouse/partner's most important activities or duties?** \_\_\_\_\_

\_\_\_\_\_

21. **Is your spouse/partner in school of any kind now?** (Please circle one)  Yes  No

22. **What level of school has your spouse/partner completed?** (Please check one)

- Some High School                       2 Year College Degree                       Post-graduate Work  
 High School Degree or GED                       4 Year College Degree                       Graduate Degree  
 Attended Some College

APPENDIX C: INFANT FEEDING PRACTICES STUDY QUESTIONNAIRE II



Global Opinion Panels

synovate  
Research reinvented

Job No: R868-02  
OMB # 0910-0558  
Expiration Date: 12/31/2007

**SECTION A: BABY'S FEEDING AND HEALTH**

If your baby is regularly cared for by someone else, it is very important that you ask your child care provider to give you information for the feeding questions.  
If you have older children, please think only about your youngest baby when you answer the questions.

*Section A-1: Feeding*

1. In the past 7 days, how often was your baby fed each food listed below? Include feedings by everyone who feeds the baby and include snacks and night-time feedings.  
If your baby was fed the food once a day or more, write the number of feedings per day in the first column. If your baby was fed the food less than once a day, write the number of feedings per week in the second column. **Fill in only one column for each item.** If your baby was not fed the food at all during the past 7 days, write in 0 in the second column.

	FEEDINGS PER DAY	FEEDINGS PER WEEK	
Breast milk .....	_____	_____	
Formula.....	_____	_____	
Cow's milk.....	_____	_____	Other
milk: soy milk, rice milk, goat milk, etc .....	_____	_____	
Other dairy foods: yogurt, cheese, ice cream, pudding, etc. ....	_____	_____	Other
soy foods: tofu, frozen soy desserts, etc. ....	_____	_____	
100% fruit or 100% vegetable juice .....	_____	_____	
Sweet drinks: juice drinks, soft drinks, soda, sweet tea, Kool-Aid, etc. ....	_____	_____	
Baby cereal.....	_____	_____	
Other cereals and starches: breakfast cereals, teething biscuits, crackers, breads, pasta, rice, etc.....	_____	_____	
Fruit.....	_____	_____	
Vegetables.....	_____	_____	
French fries.....	_____	_____	Meat,
chicken, combination dinners .....	_____	_____	
Fish or shellfish.....	_____	_____	
Peanut butter, other peanut foods, or nuts .....	_____	_____	
Eggs.....	_____	_____	Sweet
foods: candy, cookies, cake, etc.....	_____	_____	
Other (Please specify) .....	_____	_____	

2. What type of baby cereal was your baby fed in the past 7 days? (PLEASE "X" ALL THAT APPLY)  
Baby was not fed baby cereal..... Dry cereal that you added a liquid to ..... Cereal in a jar already mixed.....
3. Which of the following was your baby given in vitamin or mineral drops or pills at least 3 days a week during the past 2 weeks? If your baby was given drops or pills that contained more than one of the items listed, please mark each of the separate items. (PLEASE "X" ALL THAT APPLY) Fluoride..... Vitamin D ..... None of these .....  
Iron ..... Other vitamins.....
4. Has your baby used a pacifier in the past 7 days? Yes ..... No .....
5. During the past 2 weeks, how often was your baby put to bed with a bottle of formula, breast milk, juice, juice drink, or any other kind of milk?  
At most bedtimes, including naps .....  
At most night bedtimes, but not naps.....  
At most naps, but not night bedtimes.....  
Only occasionally at bedtimes, including naps.....  
Never.....
6. How often have you added each of the following items to your baby's bottle of formula or pumped (or expressed) breast milk in the past 2 weeks? If you have not given your baby a bottle in the past 2 weeks, "X" here ... and go to Instruction above Question 7.



	<b>NEVER</b>	<b>ONLY RARELY</b>	<b>EVERY FEW DAYS</b>	<b>ABOUT ONCE A DAY AT MOST FEEDINGS</b>	<b>EVERY FEEDING</b>
Vitamins or minerals .....	...	...	...	...	...
Baby cereal.....	...	...	...	...	...
Sweetener .....	...	...	...	...	...
Medicine .....	...	...	...	...	...
Other (Specify).....	...	...	...	...	...
.....					

IF YOUR BABY WAS FED FORMULA IN THE PAST 7 DAYS, PLEASE CONTINUE. ALL OTHERS GO TO INSTRUCTION ABOVE QUESTION 13 ON PAGE 2.

- How often does your baby drink all of his or her bottle of formula?  
Never ..... Rarely ..... Sometimes..... Most of the time..... Always .....
- In the past 7 days, about how many ounces of formula did your baby drink at each feeding?  
1 to 2..... 3 to 4 ..... 5 to 6 ..... 7 to 8..... More than 8 .....
- How often is your baby encouraged to finish a bottle if he or she stops drinking before the formula is all gone?  
Never ..... Rarely ..... Sometimes..... Most of the time..... Always .....
- Which formula was fed to your baby in the past 7 days? Infant formulas are listed alphabetically on the Formula List insert along with a group number. Please "X" the group number for each infant formula your baby was fed. (PLEASE "X" ALL THAT APPLY)  
**Group 1**      **Group 2**      **Group 3**      **Group 4**      **Group 5**      **Group 6**  
.....
- What type of formula was your baby fed? (PLEASE "X" ALL THAT APPLY)  
Ready-to-feed..... Powder from a can that makes more than one bottle.....  
Liquid concentrate ..... Powder from single serving packs .....
- Which of the following describes the iron content of the formula you usually use?  
With iron ..... Low iron (additional iron may be necessary) .....

IF YOUR BABY WAS BREASTFED OR FED BREAST MILK IN THE PAST 7 DAYS, PLEASE CONTINUE. ALL OTHERS GO TO SECTION A-2 ON THIS PAGE.

- Does your baby usually feed from both breasts at each feeding?  
Yes ..... No ..... Baby is only fed pumped milk ..... **! (GO TO QUESTION 16)**
- Does your baby usually let go of the breast him or herself?  
Yes, both breasts ..... Yes, first breast only ..... Yes, second breast only ..... No .....
- About how long does an average breastfeeding last?  
Less than 10 minutes ..... 20 to 29 minutes ..... 40 to 49 minutes .....  
10 to 19 minutes ..... 30 to 39 minutes ..... 50 or more minutes.....
- In an average 24-hour period, what is the LONGEST time for you, the mother, between ~~breastfeedings~~ breastfeeding or pumping milk? Please count the time from the start of one breastfeeding or pumping session to the start of the next. Please think of time between feedings during both night and day to find the longest time. (WRITE IN THE NUMBER OF HOURS AND MINUTES)  
\_\_\_\_\_ HOURS AND \_\_\_\_\_ MINUTES
- How many times in the past 7 days was your baby fed pumped breast milk to drink? Include breast milk you expressed in any way as pumped milk. (Write in 0 if your baby was not fed pumped milk to drink.)  
\_\_\_\_\_ TIMES **! (IF 0, GO TO SECTION A-2 ON THIS PAGE)**
- How often does your baby drink all of his or her cup or bottle of pumped milk?  
Never ..... Rarely ..... Sometimes..... Most of the time..... Always .....
- How often is your baby encouraged to finish a cup or bottle if he or she stops drinking before the pumped breast milk is all gone?  
Never ..... Rarely ..... Sometimes..... Most of the time..... Always .....

**Section A-2 Health**

- Which of the following problems did your baby have during the past 2 weeks? (PLEASE "X" ALL THAT APPLY)



Fever .....	Runny nose or cold.....
Diarrhea.....	Respiratory Syncytial Virus (RSV).....
Vomiting.....	Cough or wheeze .....
Ear infection.....	Asthma.....
Colic.....	Food allergy .....
Fussy or irritable .....	Eczema (atopic dermatitis) .....
Reflux .....	None of these .....

21. Did your baby receive any of the following medicines in the past 2 weeks? (Please do not include vitamins or minerals.)

	YES	NO
Antibiotics .....	...	...
Other prescription medicines.....	...	...
Non-prescription medicines.....	...	...

22. Was your baby given any herbal or botanical preparation or any kind of tea in the past 2 weeks? (Do not count preparations applied to the baby's skin or anything the baby may have received through breastfeeding after you took an herbal or botanical preparation.)

Yes ..... No ..... (GO TO QUESTION 25)

23. Please list all the kinds of herbal or botanical preparations or teas your baby was given in the past 2 weeks.

24. Why was your baby given the preparations or teas listed in Question 23? (PLEASE "X" ALL THAT APPLY)

- To ease diaper rash.....
- To ease colic .....
- To ease digestion .....
- To ease fussiness.....
- To help the baby relax .....
- To ease a cold or other respiratory symptoms .....
- To ease an illness other than a cold or respiratory symptoms .....
- To stimulate the baby's immune system .....
- Other (SPECIFY).....

25. How many stools (dirty diapers) does your baby usually have in a 24-hour period? If less than one a day, how many days usually pass between stools?

NUMBER OF STOOLS IN 24 HOURS OR ONE STOOL EVERY \_\_\_\_\_ DAYS

26. How would you describe your baby's stool in the past 7 days? (PLEASE "X" ALL THAT APPLY)

Hard ..... Formed..... Soft ..... Semi-watery ..... Watery .....

27. Has your baby been hospitalized for any reason or has your baby been taken to a hospital for any outpatient procedure or surgery in the past 4 weeks?

Yes ..... No ..... (GO TO QUESTION 29)

28. How many nights was your baby in the hospital for the most recent problem? (Write in 0 if your baby did not stay overnight.)

\_\_\_\_\_ NIGHTS

29. It is not easy being a new mother, and it is OK to feel unhappy at times. As you have recently had a new baby, we would like to know how you are feeling. Please state the answer which comes closest to how you have felt during the past several days, not just how you are feeling today.

29a. I have been able to laugh and see the funny side of things:

As much as I always could ... Not quite so much now ..... Definitely not so much now..... Not at all .....

- 29b. I have looked forward with enjoyment to things:  
 As much as I ever did ..... Rather less than I used to..... Definitely less than I used to ..... Hardly at all .....
- 29c. I have blamed myself unnecessarily when things went wrong:  
 Yes, most of the time ..... Yes, some of the time ..... Not very often..... No, never.....
- 29d. I have felt worried and anxious for no real reason:  
 No, not at all..... Hardly ever..... Yes, sometimes..... Yes, very often .....
- 29e. I have felt scared or panicky for no real reason:  
 Yes, quite a lot ..... Yes, sometimes ..... No, not very much..... No, not at all .....
- 29f. Things have been too much for me:  
 Yes, most of the time I haven't been able to cope at all ..... No, most of the time I have coped quite well .....  
 Yes, sometimes I haven't been coping as well as usual..... No, I have been coping as well as ever .....
- 29g. I have been so unhappy that I have had trouble sleeping:  
 Yes, most of the time ..... Yes, sometimes ..... Not very often..... No, not at all .....
- 29h. I have felt sad or miserable:  
 Yes, most of the time ..... Yes, quite often ..... Not very often..... No, not at all .....
- 29i. I have felt so unhappy I have cried:  
 Yes, most of the time ..... Yes, quite often ..... Only occasionally ..... No, never.....
- 29j. I have thought of hurting myself:  
 Yes, quite often..... Sometimes ..... Hardly ever..... Never.....

**SECTION B: STOPPED BREASTFEEDING**

1. Did you ever breastfeed this baby (or feed this baby your pumped milk)?  
 Yes ..... Î(CONTINUE) No..... Î(GO TO SECTION E ON PAGE 7)
  2. Have you completely stopped breastfeeding and pumping milk for your baby?  
 Yes ..... Î(CONTINUE) No..... Î(GO TO SECTION D ON PAGE 4)
  3. Did you breastfeed as long as you wanted to?  
 Yes ..... No .....
  4. How old was your baby when you completely stopped breastfeeding and pumping milk?  
 \_\_\_\_\_ DAYS (if younger than 2 weeks) OR \_\_\_\_\_ WEEKS
  5. How important was each of the following reasons for your decision to stop breastfeeding your baby? (PLEASE ANSWER EACH ITEM)
- |   | NOT AT ALL<br>IMPORTANT | NOT VERY<br>IMPORTANT | SOMEWHAT<br>IMPORTANT | VERY<br>IMPORTANT |
|---|-------------------------|-----------------------|-----------------------|-------------------|
| My baby had trouble sucking or latching on .....  | ...                     | ...                   | ...                   | ...               |
| My baby became sick and could not breastfeed .....  | ...                     | ...                   | ...                   | ...               |
| My baby began to bite .....   | ...                     | ...                   | ...                   | ...               |
| My baby lost interest in nursing or began to wean him or herself .....                              | ...                     | ...                   | ...                   | ...               |
| My baby was old enough that the difference between breast milk and formula no longer mattered ..... | ...                     | ...                   | ...                   | ...               |
| Breast milk alone did not satisfy my baby .....   | ...                     | ...                   | ...                   | ...               |
| I thought that my baby was not gaining enough weight.....   | ...                     | ...                   | ...                   | ...               |
| A health professional said my baby was not gaining enough weight .....                              | ...                     | ...                   | ...                   | ...               |
| I had trouble getting the milk flow to start .....  | ...                     | ...                   | ...                   | ...               |
| I didn't have enough milk .....   | ...                     | ...                   | ...                   | ...               |
| My nipples were sore, cracked, or bleeding .....  | ...                     | ...                   | ...                   | ...               |

My breasts were overfull or engorged	...	...	...	...
My breasts were infected or abscessed	...	...	...	...
My breasts leaked too much	...	...	...	...
Breastfeeding was too painful	...	...	...	...
Breastfeeding was too tiring	...	...	...	...
I was sick or had to take medicine	...	...	...	...
Breastfeeding was too inconvenient	...	...	...	...
I did not like breastfeeding	...	...	...	...
I wanted to be able to leave my baby for several hours at a time	...	...	...	...
I wanted to go on a weight loss diet	...	...	...	...
I wanted to go back to my usual diet	...	...	...	...
I wanted to smoke again or more than I did while breastfeeding	...	...	...	...
I had too many household duties	...	...	...	...
I could not or did not want to pump or breastfeed at work	...	...	...	...
Pumping milk no longer seemed worth the effort that it required	...	...	...	...
I was not present to feed my baby for reasons other than work	...	...	...	...
I wanted or needed someone else to feed my baby	...	...	...	...
Someone else wanted to feed the baby	...	...	...	...
I did not want to breastfeed in public	...	...	...	...
I wanted my body back to myself	...	...	...	...
I became pregnant or wanted to become pregnant again	...	...	...	...

6. Did any of the following people want you to stop breastfeeding? (Mark "does not apply" if you do not have the person listed, such as "employer" if you do not work for pay.)

	YES	NO	DOES NOT APPLY/ DON'T KNOW
The baby's father	...	...	...
Your mother	...	...	...
Your mother-in-law	...	...	...
Your grandmother	...	...	...
Another family member	...	...	...
A doctor or other health professional	...	...	...
Your employer or supervisor	...	...	...

7. Using 1 to mean "Very unfavorable" and 5 to mean "Very favorable," how do you feel about the experience of having breastfed your baby?

VERY UNFAVORABLE					VERY FAVORABLE
1	2	3	4	5	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Using 1 to mean "Not at all likely" and 5 to mean "Very likely," how likely is it that you would breastfeed again if you had another child?

NOT AT ALL LIKELY					VERY LIKELY
1	2	3	4	5	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**SECTION D: BREASTFEEDING**  
*Section D-1: General Information*

1. Did you ever breastfeed this baby (or feed this baby your pumped milk)?

Yes .....  (CONTINUE)

No.....  (GO TO SECTION E ON PAGE 7)

2. Have you obtained information about breastfeeding, your diet while breastfeeding, or breast pumps from any of the following sources for this baby or a previous one?

INFORMATION	INFORMATION ABOUT	INFORMATION	NO INFORMATION	ABOUT	MY DIET WHILE	ABOUT
	BREASTFEEDING	ABOUT			BREAST	FROM THIS

	BREASTFEEDING...	BREASTFEEDING...	PUMPS...
Doctor or physician assistant.....			
<b>SOURCE ..</b>			
Nurse, nurse midwife, or nurse practitioner.....			
Nutritionist or dietician .....			
WIC food program .....			
Lactation consultant.....			
Relatives or friends .....			
Birthing or baby care class .....			
Breastfeeding support group .....			
Telephone support helpline or hotline .....			
Books or videos .....			
Newsletters .....			
Newspapers or magazines .....			
Television or radio .....			
The web site <a href="http://www.4woman.gov">www.4woman.gov</a> .....			
The web site <a href="http://www.womenshealth.gov">www.womenshealth.gov</a> .....			
Other web site.....			

3. Using 1 to mean "Very Uncomfortable" and 5 to mean "Very Comfortable," how comfortable would you be in the following situations?

	<b>VERY UNCOMFORTABLE</b>				<b>VERY COMFORTABLE</b>	
	(1)	(2)	(3)	(4)	(5)	
Nursing your baby in the presence of close women friends.....	...	...	...	...	...	Nursing your baby
in the presence of men and women who are close friends.....	...	...	...	...	...	Nursing your baby in the presence of men and women who are not close friends.....

4. Have you breastfed your baby or pumped breast milk in the past 7 days?

Yes ..... 1 (CONTINUE) No ..... 1 (GO TO SECTION D-2 ON PAGE 5)

5. How old do you think your baby will be when you completely stop breastfeeding?

2 months.....	5 months.....	8 months.....	11 months.....
3 months.....	6 months.....	9 months.....	12 months.....
4 months.....	7 months.....	10 months.....	More than 12 months.....

6. Using 1 to mean "Not at all Confident" and 5 to mean "Very Confident," how confident are you that you will be able to breastfeed until the baby is the age you marked in Question 5?

<b>NOT AT ALL CONFIDENT (1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>VERY CONFIDENT (5)</b>
...	...	...	...	...

7. Since you have been breastfeeding, have you eaten more, less, or about the same of the following foods? If you did not eat the food before you began breastfeeding and you don't eat the food now, please mark "Did Not Eat Before or Now."

	<b>EAT MORE</b>	<b>EAT LESS</b>	<b>EAT ABOUT THE SAME</b>	<b>DID NOT EAT BEFORE OR NOW</b>
Milk or other dairy foods .....	...	...	...	...
Eggs.....	...	...	...	...
Canned tuna .....	...	...	...	...
Swordfish, shark, tile fish, or king mackerel.....	...	...	...	...
Any other type of fish .....	...	...	...	...
Shellfish .....	...	...	...	...
Luncheon meats .....	...	...	...	...
Nuts, peanuts, or peanut butter .....	...	...	...	...
Alcoholic drinks.....	...	...	...	...
Vitamin or mineral supplements .....	...	...	...	...
Any herbal or botanical supplement .....	...	...	...	...

8. For each food that you are eating less of, please indicate the reason. (PLEASE "X" ALL THAT APPLY) If you are not eating less of any food, go to Question 9.

	<b>THE FOOD IS NOT HEALTHY FOR MY</b>				<b>RECOMMENDED BY</b>				
	<b>BABY</b>	<b>PROFESSIONAL</b>	<b>RELATIVE</b>	<b>OTHER</b>	<b>TO PREVENT FOOD</b>	<b>A HEALTH</b>	<b>A FRIEND OR</b>	<b>BABY</b>	<b>ALLERGY IN MY</b>
Milk or other dairy foods .....	...	...	...	...	...	...	...	...	...

Eggs .....	...	...	...	...	...
Canned tuna .....	...	...	...	...	...
Swordfish, shark, tile fish, or king mackerel .....	...	...	...	...	...
Any other type of fish .....	...	...	...	...	...
Shellfish .....	...	...	...	...	...
Luncheon meats .....	...	...	...	...	...
Nuts, peanuts, or peanut butter .....	...	...	...	...	...
Alcoholic drinks.....	...	...	...	...	...
Vitamin or mineral supplements .....	...	...	...	...	...
Any herbal or botanical supplement .....	...	...	...	...	...

For each food that you are eating more of, please indicate the reason. (PLEASE "X" ALL THAT APPLY) If you are not eating more of a food, go to Question 10.

	THE FOOD IS HEALTHY FOR ME	IMPROVES THE AMOUNT OR QUALITY OF MY MILK	CRAVED THE FOOD MORE	RECOMMENDED BY A HEALTH PROFESSIONAL	RECOMMENDED BY A FRIEND OR RELATIVE	OTHER
Milk or other dairy foods.....	...	...	...	...	...	...
Eggs .....	...	...	...	...	...	...
Canned tuna.....	...	...	...	...	...	...
Swordfish, shark, tile fish, or king mackerel.....	...	...	...	...	...	...
Any other type of fish .....	...	...	...	...	...	...
Shellfish.....	...	...	...	...	...	...
Luncheon meats .....	...	...	...	...	...	...
Nuts, peanuts, or peanut butter.....	...	...	...	...	...	...
Alcoholic drinks .....	...	...	...	...	...	...
Vitamin or mineral supplements.....	...	...	...	...	...	...

9.

Any herbal or botanical supplement.....

10. Did you work for pay any time during the past 4 weeks? Yes ..... No ..... (GO TO INSTRUCTION ABOVE QUESTION 12 ON THIS PAGE)

11. Which of the following circumstances describe your situation during the past 4 weeks? (If you have stopped breastfeeding or stopped working for pay, please answer for the time you were breastfeeding and working. If you have worked for less than 4 weeks, please answer for the time you have been working.) (PLEASE "X" ALL THAT APPLY)

I keep my baby with me while I work and breastfeed during my work day.....	...	I pump milk during my work day and save it for my baby to drink later .....	...
I go to my baby and breastfeed him or her during my work day.....	...	I pump milk during my work day, but I do not save it for my baby to drink later .....	...
My baby is brought to me to breastfeed during my work day.....	...	I neither pump milk nor breastfeed during my work day .....	...

IF YOU ANSWERED SECTION B - STOPPED BREASTFEEDING - ON THIS QUESTIONNAIRE, GO TO SECTION D-2 ON THIS PAGE.

12. Was your baby fed formula to drink in the past 2 weeks, by you or by anyone else?  
 Yes ..... No ..... (GO TO SECTION D-2 ON THIS PAGE)

13. How important was each of the following reasons for feeding your baby formula? (PLEASE ANSWER EACH ITEM)

	NOT AT ALL IMPORTANT	NOT VERY IMPORTANT	SOMEWHAT IMPORTANT	VERY IMPORTANT
My baby had trouble sucking or latching on .....	...	...	...	...
My baby became sick and could not breastfeed .....	...	...	...	...
My baby lost interest in nursing or began to wean him or herself .....	...	...	...	...
My baby was old enough that the difference between breast milk and formula no longer mattered .....	...	...	...	...
Breast milk alone did not satisfy my baby .....	...	...	...	...







\_\_\_\_\_ TIMES IN PAST 2 WEEKS (If 0, GO TO SECTION E ON PAGE 7)

33. Are you now pumping milk on a regular schedule?  
 Yes ..... No ..... (GO TO QUESTION 35)
34. How old was your baby when you first began pumping milk on a regular schedule?  
 \_\_\_\_\_ DAYS OR \_\_\_\_\_ WEEKS
35. On average, in the past 2 weeks, how many ounces of milk did you pump each time?  
 1 ounce or less ..... 3 to 4 ounces ..... 7 to 8 ounces .....  
 2 ounces ..... 5 to 6 ounces ..... More than 8 ounces .....
36. For what reasons have you pumped milk in the past 2 weeks? (PLEASE "X" ALL THAT APPLY)  
 To relieve engorgement..... To keep my milk supply up when my baby could not nurse (such as while you were away from your baby or when your baby was too sick to nurse) .....  
 Because my nipples were too sore to nurse..... baby or when your baby was too sick to nurse) .....  
 To increase my milk supply ..... To mix with cereal or other food.....  
 To get milk for someone else to feed to my baby ... To have an emergency supply of milk..... breastfeed or when baby cannot breastfeed ..... To donate to a baby other than my own .....
37. How often do you collect milk from both breasts at the same time (double pumping)?  
 Never ..... Rarely..... Sometimes..... Most of the time..... Always .....
38. How long was your milk usually stored in the refrigerator in the past 2 weeks? (Include cooler with cold source such as freezer packs.)  
 1 day or less ..... 4 to 5 days ..... More than 8 days .....  
 2 to 3 days ..... 6 to 8 days ..... I do not store milk in a refrigerator .....
39. How long was your milk usually kept at room temperature and then fed to your baby in the past 2 weeks?  
 Less than 1 hour... 5 to 8 hours ..... More than 16 hours .....  
 1 to 2 hours..... 9 to 11 hours ..... I do not keep my milk at room temperature .....  
 3 to 4 hours..... 12 to 16 hours .....
- Babies are fed pumped breast milk in a lot of different situations, and bottles of milk may have to be prepared in a lot of different places. Please think of all of these situations and places as you answer the next few questions.**
40. In the past 2 weeks, how often were the bottle nipples used to feed pumped breast milk cleaned in the following ways before being used again? If you don't use bottle nipples, "X" here ... and go to Question 41.
- |  | RARELY OR NEVER | SOME OF THE TIME | MOST OF THE TIME | ALL OF THE TIME |
|--|-----------------|------------------|------------------|-----------------|
| Rinsed with water only.....  | ...             | ...              | ...              | ...             |
| Washed in an automatic dish washer.....  | ...             | ...              | ...              | ...             |
| Washed by hand with dish detergent .....   | ...             | ...              | ...              | ...             |
| Boiled or sterilized .....   | ...             | ...              | ...              | ...             |
| Not cleaned between uses – used to feed more milk without rinsing or washing ..... | ...             | ...              | ...              | ...             |
41. In the past 2 weeks, how often were the following items boiled, sterilized in a microwave kit, sterilized with a chemical dip, or washed in a dishwasher?
- |   | AFTER EACH | ONCE EVERY 2 TO 6 | ABOUT ONCE IN 2 WEEKS | ABOUT ONCE IN 2 WEEKS | ITEM IS NEVER USED | DAY DISPOSABLE |
|---|------------|-------------------|-----------------------|-----------------------|--------------------|----------------|
| Pump collection kit, including container used to collect the milk ..... | ...        | ...               | ...                   | ...                   | ...                | ...            |
| Container used to store the milk .....                                  | ...        | ...               | ...                   | ...                   | ...                | ...            |
42. How often have you and others who feed your baby heated your baby's cup or bottle of pumped milk in a microwave oven?  
 Rarely or never..... Sometimes, but less than half the time ..... About half the time ..... Most of the time .....
43. In the past 2 weeks, has your baby been fed formula mixed with breast milk in the same bottle?  
 Yes ..... No ..... (GO TO SECTION E ON THIS PAGE)
44. How were the formula and breast milk usually mixed? (PLEASE "X" ALL THAT APPLY)  
 Added formula powder to breast milk ..... Added prepared (mixed up) formula or



Added formula concentrate to breast milk ..... ready-to-feed formula to breast milk .....

**SECTION E: INFANT FORMULA**

1. In your opinion, how likely is it for each of the following forms of formula to contain germs?
 

	<u>NOT AT ALL LIKELY</u>	<u>SOMEWHAT UNLIKELY</u>	<u>SOMEWHAT LIKELY</u>	<u>VERY LIKELY</u>
Ready-to-feed .....	...	...	...	...
Liquid concentrate .....	...	...	...	...
Powder .....	...	...	...	...
  
2. Was your baby fed infant formula in the past 2 weeks, by you or by anyone else?
 

Yes ..... **Ġ (CONTINUE)**      No ..... **Ġ (GO TO SECTION J ON PAGE 8)**
  
3. Formula packages have several types of directions and statements. Which of these kinds of information have you read on the package of the formula you use most often? (**PLEASE "X" ALL THAT APPLY**)
 

Written directions for preparing the formula .....	What to do with formula left over in the
How to store the package after opening it .....	bottle after feeding the baby .....
How to store formula after it is prepared .....	Have not read any of this information ..... <b>Ġ (GO TO QUESTION 9)</b>
  
4. Were any of the directions and statements you read hard to understand?
 

Yes .....      No ..... **Ġ (GO TO QUESTION 6)**
  
5. Which were hard to understand? (**PLEASE "X" ALL THAT APPLY**)
 

Written directions for preparing the formula .....	What to do with formula left over in the	
How to store the package after opening it .....	bottle after feeding the baby .....	How to store
formula after it is prepared .....		formula after it is prepared .....
  
6. Was all of the information you wanted included in all of the directions and statements you read?
 

No, some information I wanted was missing .....      Yes, all information I wanted was on the package ..... **Ġ (GO TO QUESTION 8)**
  
7. Which of the directions or statements were missing a piece of information that you wanted? (**PLEASE "X" ALL THAT APPLY**)
 

Written directions for preparing the formula .....	What to do with formula left over in the	
How to store the package after opening it .....	bottle after feeding the baby .....	How to store
formula after it is prepared .....		formula after it is prepared .....
  
8. Was the print size for the directions and statements too small or large enough to read easily?
 

Too small to read easily .....      Large enough to read easily .....
  
9. Have you looked at the pictures on the formula container showing how to prepare the formula? Yes .....      No ..... **Ġ (GO TO QUESTION 11)**
  
10. How useful did you find the pictures?
 

Not at all useful .....      A little useful.....      Somewhat useful.....      Very useful .....
  
11. In your opinion, how important for your baby's health is it to follow the label directions that say to feed or refrigerate the prepared formula immediately or discard the formula?
 

Not at all important .....      Somewhat important.....      Very important .....
  
12. Infant formula cans have a list of ingredients that tells what is in them. Have you looked at this list? Yes .....      No ..... **Ġ (GO TO QUESTION 14)**
  
13. Did you use the ingredient list to compare brands of infant formula?
 

Yes .....      No .....
  
14. Did you look for any specific ingredients or formula characteristics (such as lactose-free or hypoallergenic) in the ingredient list or on any other part of the label?
 

Yes .....      No ..... **Ġ (GO TO QUESTION 16)**
  
15. In the table below, please write in what ingredient or characteristic you were looking for and "X" whether you wanted to avoid or include the ingredient or characteristic in your baby's diet.
 

<u>INGREDIENT OR CHARACTERISTIC</u>	<u>AVOID</u>	<u>INCLUDE</u>
	<input type="checkbox"/>	<input type="checkbox"/>

_____	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>

16. Did a doctor, health professional, or birthing class tell you how to prepare formula? Yes .....  No .....
17. Did a doctor, health professional, or birthing class tell you how to store the prepared bottles of formula? Yes .....  No .....
18. During the past 2 weeks, what type of water have you and others who feed your baby used for mixing your baby's formula? (PLEASE "X" ALL THAT APPLY)
- |  |  |
|--|--|
| Tap water from the cold faucet .....     | Bottled water.....   |
| Warm tap water from the hot faucet ..... | No water used; baby is fed only ready-to-feed formula .... |
- ↑ (GO TO QUESTION 20)

19. Was the water you used to mix the formula boiled?
- |                    | YES | NO  | NOT USED |
|--------------------|-----|-----|----------|
| Tap water.....     | ... | ... | ...      |
| Bottled water..... | ... | ... | ...      |

20. How often have you and others who feed your baby heated your baby's bottle of formula in a microwave oven?
- |                      |  |                           |                        |
|----------------------|--|---------------------------|------------------------|
| Rarely or never..... | Sometimes, but less than half the time ..... | About half the time ..... | Most of the time ..... |
|----------------------|--|---------------------------|------------------------|

**Babies are fed formula in a lot of different situations, and formula may have to be prepared in a lot of different places. Please think of all of these situations and places as you answer the next few questions.**

21. During the past 2 weeks, how often were the bottle nipples used to feed formula cleaned in the following ways before being used again?
- |   | NEVER | SOME OF THE TIME | MOST OF THE TIME |
|---|-------|------------------|------------------|
| Rinsed with water only.....   | ...   | ...              | ...              |
| Washed in an automatic dish washer.....   | ...   | ...              | ...              |
| Washed by hand with dish detergent .....  | ...   | ...              | ...              |
| Boiled or sterilized .....  | ...   | ...              | ...              |
| Not cleaned between uses – used to feed more formula without rinsing or washing ..... | ...   | ...              | ...              |

22. During the past 2 weeks, how often did you clean your hands in each of the following ways before preparing formula?

	NEVER	SOME OF THE TIME	MOST OF THE TIME	ALL OF THE TIME
Rinsed my hands with water only .....	...	...	...	...
Wiped my hands only .....	...	...	...	...
Washed with soap .....	...	...	...	...
Used hand sanitizer (such as gel or wipes ).....	...	...	...	...
Prepared formula without cleaning my hands .....	...	...	...	...

23. How long were bottles of prepared formula usually kept at room temperature and then fed to your baby in the past 2 weeks? Less than 1 hour..... 5 to 8 hours ..... More than 16 hours .....
- |                    |                      |  |
|--------------------|----------------------|--|
| 1 to 2 hours ..... | 9 to 11 hours .....  | I do not keep prepared formula at room temperature ..... |
| 3 to 4 hours ..... | 12 to 16 hours ..... |  |

24. How did you decide to use the formula you fed your baby in the past 7 days? (PLEASE "X" ALL THAT APPLY)

A doctor or other health professional recommended the formula ..... I chose a formula labeled as useful for a problem my baby had ..... I chose the same formula fed to my baby at the hospital..... I use the formula given by WIC .....

I heard that the formula is better for my baby in some way ..... I chose the same formula I fed an older child .....

I chose the formula I received samples or coupons for..... Friends or relatives recommended the formula.....

I saw an advertisement for the formula and wanted to try it..... I chose a formula based on low price.....

25. Did you discuss your choice of formula with the baby's doctor? Yes ..... No .....

26. During the past 2 weeks, how many times have you switched the formula you feed your baby?
- None ..... (GO TO SECTION J) 1 ..... 2 ..... 3 ..... 4..... 5 or more .....

27. Which formulas did you stop using in the past 2 weeks? Infant formulas are listed alphabetically on the Formula List insert along with a group number. Please "X" the group number for each infant formula you stopped using. (PLEASE "X" ALL THAT APPLY)

<u>Group 1</u>	<u>Group 2</u>	<u>Group 3</u>	<u>Group 4</u>	<u>Group 5</u>	<u>Group 6</u>
...	...	...	...	...	...

28. Did you switch formula because your baby had a problem with the formula you were using?  
Yes ..... No ..... (GO TO SECTION J ON THIS PAGE)

29. What type of problem did your baby have with the formula(s)? (PLEASE "X" ALL THAT APPLY)  
An allergic reaction or intolerance ..... Too much gas.....  
Constipation..... Too much spit up..... Diarrhea .....  
Vomiting .....  
Too much mucus ..... Other problem (Please specify \_\_\_\_\_) .....

**SECTION J: OTHER INFORMATION**

1. In the past month, were you or your baby enrolled in the WIC program or did you get WIC food or vouchers for yourself or for your baby? (WIC is a program that gives food to pregnant and nursing women, babies, and young children.) (PLEASE "X" ALL THAT APPLY)

Yes, I was enrolled or got WIC food for myself..... Yes, my baby was enrolled or got WIC formula or food ..... No.....

2. Does your baby have any serious, long-term medical problems?  
No..... Yes ..... (PLEASE EXPLAIN BRIEFLY) \_\_\_\_\_

3. Date you completed this form: Month \_\_\_\_\_ Day\_\_ Year \_\_\_\_\_