EFFECT OF TIME OF INITIATION AND EXCLUSIVITY OF BREASTFEEDING ON POSTPARTUM WEIGHT RETENTION OF WOMEN WHO BREASTFEED AT LEAST 12 MONTHS

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Abstract

Background: Breastfeeding is a fundamental health promotion practice. Decades of research have documented mental, physical, and social benefits of breastfeeding for the child and the mother. However, the literature is inconclusive about one issue of great concern to many mothers and health care professionals: is there a significant relationship between breastfeeding and postpartum weight retention? Breastfeeding is a complex practice with many dimensions – timing of onset, duration, and whether it undertaken with or without complementary feeding – functioning in combination with myriad other factors such as maternal age. One aspect of this issue is without controversy: the importance to both maternal and child health generally of long-term breastfeeding, to one year of age and beyond. Yet the question remains if there are optimal patterns of breastfeeding that reduce the risk of postpartum weight retention. Two aspects of the breastfeeding/postpartum weight retention question require closer examination: the possible effect on weight retention of the timing of the initiation of breastfeeding, and of the duration of exclusive breastfeeding. Breastfeeding's complexity exacerbates the methodological challenges inherent in the study of health behavior. There is room for improving how concepts and variables are defined and measured in breastfeeding research, and scientific standards have not yet been widely agreed upon. Thus, methodological weaknesses in the breastfeeding literature contribute to the confusion regarding whether there is a connection between breastfeeding and postpartum weight retention.

Objective: The research reported here had two objectives. The first objective was to undertake a critical study of the existing literature on breastfeeding and postpartum weight retention in order to identify methodological approaches contributing to valid and reliable measurement and analysis of all the key constructs mentioned above. The second objective was to analyze data from an existing database, operationalizing variables and choosing analysis methods in line with the best practices as revealed in the findings from the literature study. The research question addressed for the second objective was 'what is the relationship between an optimal breastfeeding pattern (timing of initiation within one hour of birth, and duration of exclusive breastfeeding of at least four months) and postpartum weight retention in women breastfeeding at least 12 months?'

Analytical Model: The critical study undertaken to achieve the first objective led to the development of an analytical model that guided the empirical work done to meet the second study objective. The model features dimensions of breastfeeding including early breastfeeding and exclusivity of breastfeeding. It displays some of the interactions that may be occurring according to past literature. It also illustrates the complexity of the interplay between factors that affect breastfeeding, postpartum weight retention, and their relationship.

Methods: The design to accomplish the second objective was a secondary analysis of the Infant Feeding Practices Study II (IFPSII), a US nationwide longitudinal survey study. Participants who breastfed at least 12 months were examined (n = 437). Multiple linear regression analysis was performed in order to assess the relationship between postpartum weight retention and breastfeeding time of initiation and exclusivity, including the effects of other correlates and controlling for possible confounding factors. A series of models was developed with the aim to produce the maximal obtainable postpartum weight retention variance within a parsimonious model given the limits of the variables at hand.

Results and discussion: Early breastfeeding was not significantly related to postpartum weight retention. Significant correlates of postpartum weight retention were exclusive breastfeeding at four months, work for pay, and gestational weight gain. Increased gestational weight gain was highly correlated with increased postpartum weight retention ($p < .001$). Exclusive breastfeeding at 4 months had the highest inverse effect on postpartum weight retention ($p = .001$), but prenatal work for pay had a similar inverse effect ($p < .05$). Possible confounders not observed to be significantly associated with postpartum weight retention included age, pre-pregnancy weight, height, depression, ethnicity/race, and parity.

The results and subsequent conclusions drawn from this study are based on a methodology developed from a critical analysis of a somewhat chaotic literature. Thus, the validity of the present conclusions is tied closely to the methodological decisions that were taken in the initial stages of the study. A very important constraint is the nature of the study sample. The sample contained only women who breastfed for at least 12 months and who completed data collection at the 12 month point in this longitudinal study. It remains unknown what alterative conclusions one

might have come to with other methodological choices, or with a sample having a different duration of breastfeeding. Thus, the generalizability of the conclusions is open to question.

Conclusions: This study suggests that among American women who breastfeed at least to 12 months, minimizing gestational weight gain and breastfeeding exclusively for at least four months may be protective against postpartum weight retention. While numerous health benefits of early initiation of breastfeeding (within one hour of birth) are documented in the literature, this study failed to provide evidence that early breastfeeding is protective against postpartum weight retention.

1. Introduction

1.1 Background

Breastfeeding is a health promoting practice for mothers and infants both physically and psychologically (1-5). Past research has emphasized infant benefits of breastfeeding. However, benefits to the mother have also been explored. The importance of breastfeeding for one year or more has been acknowledged (6). Breastfeeding has been observed to contribute to weight loss after birth, protecting against postpartum weight retention (the average change in weight from pre-pregnancy to one year postpartum) (60). However, study results on breastfeeding's effect on postpartum weight retention are conflicting. Some studies indicate breastfeeding protects against postpartum weight retention, while others showed weak or no associations (7).

Why is the literature inconclusive despite years of scientific focus on the health impacts of breastfeeding? The effects of the dimensions of breastfeeding, including time of initiation, duration, and exclusivity (breastfeeding without complementary feeding) as well as the effects of possible confounders add considerable complexity to any relationship between breastfeeding and postpartum weight retention. Additionally, the heterogeneity of literature, including methodological and operationalization differences, exacerbates confusion (8). The complexity of breastfeeding practice along with methodological limitations in the breastfeeding literature may obscure a relationship between breastfeeding and postpartum weight retention. Therefore, additional study using methodological approaches that contribute to valid and reliable measurement and analysis is essential.

The first objective of this study is to identify such methods and definitions through a critical study of recent reviews by Neville et al. (7), He et al. (9), and other background literature. A matrix was created to identify systematic differences between studies finding vs. not finding a significant correlation between breastfeeding and postpartum weight retention. The matrix was modeled after Neville et al.'s and focused on 27 articles from Neville et al. (7) examining breastfeeding's effect on weight (10-36). An additional matrix of studies using weight as a primary outcome from both Neville et al. and He et al. was also developed (19, 21, 24, 25, 37, 38). The second matrix focused on those studies identified as 'high quality' by Neville et al. or He et al.

The second objective of this study is a secondary analysis using existing data from the US Food and Drug Administration (FDA) and Centers for Disease Control and Prevention (CDC)'s Infant feeding practices study II (IFPSII) (39). This study seeks to explore the role of breastfeeding and its dimensions in the postpartum weight retention of women who breastfed at least 12 months using methods that contribute to valid and reliable analysis.

1.2 Benefits of breastfeeding to the infant

Mental and physical benefits of being breastfed for infants are widely noted in the literature. Breastfed infants may be protected against neurological issues (40) and behavioral problems (41). Breastfeeding may even confer a slight intelligence advantage (42). Breastfed infants may have reduced risks of future obesity (43), diarrheal illnesses (44) and respiratory illnesses (45). Other conditions, including immune system disorders, have also been observed less in breastfed infants (46).

1.3 Benefits of breastfeeding to the mother

Breastfeeding has been observed to provide maternal psychological and physical benefits (1-5, 43, 47). Breastfeeding may protect against postpartum depression (48) and promote psychological bonding between mother and child (2, 49, 50). Breastfeeding may be protective against postpartum blood loss, osteoporosis, cardiovascular disease, diabetes, and breast cancer (51-54). It has been observed to protect against ovarian cancer (43), hypertension, diabetes, and abnormally elevated lipid levels (55).

1.4 Breastfeeding and postpartum weight retention

Breastfeeding has been observed to protect against postpartum weight retention barring high calorie intake (56). A statistically significant reduction in the weight retention of women meeting

specific breastfeeding criteria at 6 months (16, 32), or at 12 months (19) has noted in some studies. Other studies indicate non-significant or weak associations between breastfeeding and postpartum weight retention (14, 21, 25), or even an association between breastfeeding and increased postpartum weight retention (32).

Weight retention after pregnancy can cause concern (57). There are myriad reasons to prefer to avoid postpartum weight retention. Women who experienced high gestational weight gain during pregnancy and retained weight postpartum are at increased risk for obesity later in life (58-60). Obesity and its relationship to increased disease risk is a health concern for women of reproductive age (59, 61). The obesity rate is still increasing for these women (58, 62). Retention of postpartum weight is an area for public health concern. Clarifying the relationship between breastfeeding and postpartum weight retention will provide more refined breastfeeding information for women. This may include highlighting protective modifiable behaviors woman can adopt.

1.5 Methodological limitations in the literature

Methodological challenges are inherent in the study of health behavior. The complexity of the dimensions of breastfeeding practice add to these. Critical analysis of existing literature suggests that confusion about the relationship between breastfeeding and postpartum weight retention is exacerbated by heterogeneity of study methodologies and how concepts and variables are defined. Recognized limitations in the literature include problems with definitions of the breastfeeding variable, follow-up times, and lack of adjustment for confounders (8). Failing to account for dimensions of breastfeeding and small sample sizes have also been noted (15). Additionally, the use of retrospective studies and a tendency toward self-selection bias have been observed (42).

Some limitations may be difficult to correct. For example, self-selection bias and sampling frame issues that lead to non-representative samples may prove difficult to alter if researchers want to maintain large sample sizes of women likely to fill out lengthy questionnaires (Dennis, JM (2003) cited in 63). Other methodological limitations can and should be addressed. For example,

insufficient follow-up timeframes, lack of attention to dimensions of breastfeeding such as duration and exclusivity, failure to adjust for possible confounders, and unclear operationalization (definitions) of key variables.

Studies of insufficient length may not capture the entire picture of breastfeeding's role in postpartum weight retention. For example, Sheikh (31) looked at maternal weight only for 8 days postpartum. Other studies chose to do final follow-up measurements at time periods under 6 months (17, 23, 34-36). However, some studies have suggested that body mass index variation 15 years after giving birth may be influenced by weight retention at 6 months (64), or one year (60). Therefore, a follow-up at least 6 months if not one year may be helpful.

In some of the literature, insufficient attention has been paid to dimensions of breastfeeding, including time of initiation and exclusivity. However, the importance to both maternal and child health of long-term breastfeeding, to one year of age and beyond has been established (6, 65). Many studies, therefore, examine the breastfeeding characteristic duration (10, 16, 18, 25). Duration of breastfeeding may affect whether breastfeeding's impact on postpartum weight retention is statistically significant (8). A long duration of breastfeed is noted in much, but not all, of the literature identified in the matrix as finding a significant relationship between breastfeeding and postpartum weight retention (see section 2.6 Identifying high quality methodology). Accounting for breastfeeding duration is clearly vital. However, long breastfeeding duration alone may not be enough to significantly affect weight retention a year after delivery as in Lyu et al. (18). Studying only women who breastfed at least 12 months in order to highlight other dimensions of breastfeeding may offer a more complete picture of breastfeeding's relationship with postpartum weight retention.

Two of these dimensions of breastfeeding in particular, exclusivity and time of initiation, require further examination. The amount of exclusive breastfeeding (providing the baby no foods or beverages other than breast milk) is sometimes referred to in the literature within the context of 'breastfeeding intensity' (7, 59, 66). Intensity in these instances generally refers to how much exclusive breastfeeding is performed compared to breastfeeding in combination with

complementary feeding (providing the baby other foods and beverages). In this study exclusivity will be used to refer to the amount of breastfeeding compared to other types of feedings.

A less often examined characteristic of breastfeeding, the timing of initiation, may affect the overall success of breastfeeding (2). Early breastfeeding may increase exclusive breastfeeding in the hospital (67). In a study looking at early skin-to-skin contact between mother and infant, early contact was correlated with increased exclusive breastfeeding duration (68). The majority of early skin contact mothers also breastfed early (68). Whether through skin contact or early breastfeeding itself, early breastfeeding initiation attempts may influence breastfeeding exclusivity. This in turn may have a moderating effect on postpartum weight retention.

Another methodological weakness lies in the definition of terms. A multitude of different terms are used for similar concepts. Differences in operationalization of variables exist despite the fact that there are internationally recognized definitions (42). Further, some studies lack any specific definitions at all.

Failure to adjust for confounders also contributes to some of the literature's unclear results (57). Neville et al. (7) noted several studies included in their review that accounted for few or no possible covariates, e.g. pre-pregnancy weight, gestational weight gain, parity, socio-economic status, etc. Leaving confounders out of analyses may provide inaccurate or incomplete results.

This study sought to correct for methodological limitations, including study length, failure to account for dimensions of breastfeeding, insufficient definition of terms, and failure to adjust for confounders. In order that the study length was sufficient, this study used data from women who were still participating in IFPSII at 12 months. Further, this study refined the sample to include only women breastfeeding at 12 months (see section 3.2 Study sample). In this way a long duration of breastfeeding is implicit in the sample, and further dimensions of breastfeeding can be considered in addition to duration. The study examined two of these, exclusivity and time of

initiation. The study used past high quality research to clearly operationalize definitions of variables (for definitions and operationalizations as used in this study, see section 3.4 Variables) and it adjusted for possible confounders including age, pre-pregnancy weight, parity, gestational weight gain, etc (see section 3.5 Data analysis).

1.6 Study aims

This study sought incorporate methodology likely to promote valid analyses as discussed above in order to determine if a relationship exists between breastfeeding and postpartum weight retention. Existing data from the IFPSII (39) was analyzed using an exploratory approach. The study examined the role of an optimal breastfeeding pattern in the postpartum weight retention of women who still qualified for the IFPSII at 12 months and who breastfed at least 12 months. The World Health Organization (WHO) recommends breastfeeding initiation within an hour of life, exclusive breastfeeding for ≥ 6 months of life, and breastfeeding in addition to complementary feeding for ≥ 2 years (69). This may be considered an optimal breastfeeding pattern. However, due to IFPSII's follow-up timeframe of 12 months postpartum and an insufficient sample of women who breastfed exclusively for ≥ 6 months, a different optimal breastfeeding pattern was examined. The pattern included initiation within one hour of birth, and duration of exclusive breastfeeding of ≥ 4 months. Two dimensions of breastfeeding, early breastfeeding and exclusivity of breastfeeding, were thus examined to determine if they influenced weight retention. Further, the study sought to explore other factors that influenced postpartum weight retention distribution in this sample.

1.7 Objectives and research question

This study had two objectives. Objective 1 was to identify methodological approaches contributing to valid and reliable measurement and analysis of identified key constructs via a literature study. Critical examination of existing literature on breastfeeding and postpartum weight retention identified these approaches. Objective 2 was to analyze data from an existing database. Operationalization of variables and analysis methods would be modeled after the best

practices revealed from the literature study findings. The following research question will be explored for the second objective: What is the relationship between an optimal breastfeeding pattern (timing of initiation within one hour of birth, and duration of exclusive breastfeeding of at least four months) and postpartum weight retention in women breastfeeding at least 12 months?

1.8 Contribution of the study to Health Promotion

Health is considered within Health Promotion to be a valuable resource that provides the greater opportunities of identification and realization of aspirations, satisfaction of needs, and ability to alter or cope with the external environment (70). Health Promotion emphasizes the use of personal resources to empower individuals (70). It seeks to enable personal control over health and health improvement (70). Admittedly, breastfeeding can be challenging for some women to initiate and maintain (71, 72). However, for many women breastfeeding is a modifiable behavior that can be considered a personal resource. Breastfeeding appears to confer maternal health benefits. Still, women need to know if breastfeeding aids weight loss after delivery, contributes to weight retention, or is immaterial. Education is considered a fundamental prerequisite to health (70). Educating women with nuanced and accurate breastfeeding information empowers women to make personal choices that affect the health of both their infants and themselves. If breastfeeding is protective against obesity, breastfeeding can be used as a health-promoting tool by mothers.

2. Literature review

2.1 Women's health

In the past, in an attempt to protect women and fetuses, premenopausal women were excluded from clinical health research (73). Recently, women's health research has become more prevalent in the US (74). Without research directed at women's health, medical decisions for women could be and have been based on data from research including exclusively men (74). As of 2013, females are about 50.8% of the US population (75). It is essential to study women in order to seek ways to mitigate preventable health issues for half the population (74). It is important to research conditions that present differently depending on sex/gender (74), as well as examining health concerns unique to females.

2.1.1 Obesity and women

Obesity, depending on its severity, can be associated with higher mortality from all causes (76). It is a risk factor for cardiovascular disease (77-79), the most common cause of mortality in developed countries (55). Additionally it increases risk for diabetes and cancer (78). It has also been associated with hypertension, dyslipidemia, gallbladder disease, stroke, and osteoarthritis (64). Health risks increase with increasing levels of obesity (64). About half of women aged 24 - 55 are considered overweight or obese (59, 80). Therefore, obesity's relationship with disease and disease-related mortality is important not only for the population at large, but also specifically for women (59, 61).

Obesity in women who become pregnant carries risks of obstetric complications and has a dose-response relationship (62, 79). The prevalence of obesity in women who become pregnant is increasing in the US. From 2003 to 2009 the pre-pregnancy obesity rate increased from 17.6% to 20.5% (62). The most recent available data from the CDC indicates that in 2011 27.6% of women were considered obese prior to pregnancy and 26% were overweight (81).

Postpartum weight retention may exacerbate obesity (82) or contribute to future risk of obesity (58, 59, 79, 83). In already obese women, postpartum weight retention can increase the risk of chronic obesity-related diseases (80). Additionally, weight retained in pregnancy may also be more likely to be centralized, itself an independent risk factor for disease (84).

2.2 Benefits of breastfeeding

Breastfeeding is widely considered to be a health promoting activity. The WHO recommends early breastfeeding initiation, exclusive breastfeeding for the first 6 months of life, and appropriate complementary feeding along with breastfeeding for two years or more (69). Between 1995-2002 initiation of breastfeeding rates edged slightly closer to the Healthy People 2010 goal of 75% (85). In the same time period, breastfeeding rates increased from 55% to 67% overall (85). However, despite recent increases, there are still women who never breastfeed or breastfeed insufficiently (71).

2.2.1 Breastfeeding Benefits for infants

Physical benefits of breastfeeding for infants are widely observed. Being breastfed as an infant reduced the risk of obesity in later life by between 7-24% in some meta-analyses (43). Other morbidities such as diarrheal illnesses and otitis media have been observed significantly less in breastfeed infants (44). A global cross-section on breastfeeding and health adds that there is also a decreased risk of other illnesses such as bacteremia, meningitis, respiratory illnesses, and chronic conditions later in life (45). Breastfed infants may also be protected against immune diseases and food allergies (46).

Breastfeeding may also have a positive effect on the intelligence and mental health of the infant. One example indicated breastfeeding to be protective against slight neurological abnormality (40). Another study found breastfeeding > 6 months to be associated with fewer behavioral problems, including issues such as anxiety, depression, and aggressive behavior (41). A meta-

analysis by Horta and Victora (42) observed an average increase of 2.19 points on IQ tests (adjusted for maternal intelligence) in breastfeed individuals.

2.2.2 Benefits of breastfeeding for mothers

Breastfeeding may provide psychological and physical benefits to the mother (1-5, 43, 47, 48). Good experiences of breastfeeding may be associated with lower rates of postpartum depression (48). Alternately, short or no breastfeeding has been correlated with increased postpartum depression (43, 48). Breastfeeding has been correlated with lowered levels of the stress hormone cortisol and episodic oxytocin release (86). Oxytocin attenuates anxiety and stress and encourages caring parenting behaviors (87). Psychological bonding with the infant is also an oft-cited benefit of breastfeeding (2, 49, 50). Skepticism exists regarding whether the literature has appropriately been able to identify breastfeeding as being associated with bonding (88). However, the same author acknowledges there may be an association with reduction in depression and an increased sense of empowerment in mothers who breastfeed (88).

A slight majority of 20 studies included in one review showed breastfeeding had a protective, generally dose dependent, effect on postmenopausal breast cancer (88). This agrees with other literature that observed a protective effect against breast cancer (51-54). Breastfeeding may also protect against ovarian cancer (43). In conjunction with skin-to-skin contact, breastfeeding has been observed to protect against postpartum hemorrhage, a major cause of maternal morbidity and mortality (89). It may also offer some protection against osteoporosis (51, 52). In one study of postmenopausal women, having breastfed for a sufficient duration was associated with reduced rates of cardiovascular disease, hypertension, diabetes, and abnormally elevated lipid levels (55).

2.3 Breastfeeding and postpartum weight retention

Some studies indicate breastfeeding may aid in weight loss if calorie intake is not too high (56). Estimated means between 483-538 kcal (~2092 kJ) expended daily for exclusive breastfeeding

could indicate an opportunity for the caloric deficit needed for weight loss (58, 90). In a large cohort study, breastfeeding was significantly associated with lower postpartum weight retention in all but the most obese participants (10). In a sample of 159 women, breastfeeders retained significantly less weight (1.3 kg) compared to non-breastfeeders (4.10 kg) at 6 months postpartum (37). Alternately, repeat pregnancies without lactation were associated with weight gain in rat studies (8, 83). Likewise, in humans, pregnancy with no lactation has been observed as a risk factor for obesity (83).

But, the literature is inconclusive. A recent study found breastfeeding associated with long-term reduced postpartum weight retention only in obese mothers who exclusively breastfed for ≥ 4 months and continued breastfeeding for ≥ 12 months (80). Elsewhere breastfeeding was not related to body mass index at 6 months follow-up, but participants who breastfed at least 12 weeks had a statistically significantly lower body mass index at follow-up 5–10 years later (61). A 2009 study found no relationship between breastfeeding and postpartum weight retention (18). Similarly, breastfeeding was not associated with postpartum weight retention in a study looking at dietary quality and weight retention (12). Additionally, some authors argue that despite statistically significant differences in postpartum weight retention depending on breastfeeding patterns, the difference is not large enough to warrant extreme clinical emphasis on the importance of breastfeeding for postpartum weight retention (15). However, breastfeeding is a complex practice and the dimensions of breastfeeding (such as timing of initiation and exclusivity) may impact whether breastfeeding has a material effect on postpartum weight.

2.3.1 Timing of initiation

Timing of initiation is not widely examined in the literature in relation to postpartum weight retention. However early initiation of breastfeeding has been examined in relation to breastfeeding success, measured in terms of the duration of breastfeeding. In one study, breastfeeding within 4 hours of birth was associated with increased breastfeeding duration (91). Breastfeeding within 10 minutes of birth combined with feedings every 2 hours was also correlated with longer durations of breastfeeding (92). One study noted that attempting to breastfeed within 6 hours of birth predicted more exclusive breastfeeding in the hospital (67).

Early skin-to-skin contact was correlated with increased exclusive breastfeeding duration of .39 – 1.55 months, depending on the length of the contact (68). Of the study participants, 77.8% of women who had early skin-to-skin contact also breastfeed within 2 hours of birth (68). Whether through skin contact or early breastfeeding initiation, there may be a potential for early breastfeeding attempts to influence breastfeeding exclusivity and in turn to affect postpartum weight retention. The WHO and United Nations International Children's Emergency Fund (UNICEF) recommend breastfeeding within one hour of birth in order to help mothers establish and maintain sufficient duration and exclusivity of breastfeeding (93). While duration is a relatively established factor in postpartum weight retention, relationships between early breastfeeding and postpartum weight retention are unexplored. If early breastfeeding, or the skin contact inherent in it, promotes breastfeeding exclusivity, it may be that women who initiate early breastfeeding are more likely to achieve a sufficient breastfeeding duration and exclusivity to protect against postpartum weight retention.

2.3.2 Exclusivity

Reduced weight retention has been observed in women who breastfed exclusively longer, rather than transitioning to complementary feeding (16, 94). In one study, exclusive breastfeeders' weight decreased significantly between day 7 postpartum and 6 months while non-exclusive breastfeeders' weight did not significantly decrease (95). Ohlin and Rossner found that women retained significantly less weight at 12 month follow-up if they had breastfed exclusively for 10-12 months (cited in 78 p. 154). Similarly, a Brazilian study in which women breastfed for up to 24 months, observed that longer breastfeeding duration and higher exclusivity were associated with greater weight reduction postpartum (66). Another study found a significant protective association between exclusive breastfeeding for 3 months and reduced weight retention at 12 months (19). However, they did not find a dose-response relationship between the number of weeks of exclusive breastfeeding and weight retention in all participants (19). In a series of two randomized-controlled-trials in Honduras, participants in the first trial who continued exclusively breast feeding until 6 months lost significantly more weight (94). However, there was no significant difference in the second trial (94). In a trial examining the rate of weight loss in women up to 9 months postpartum, another study found no significant difference in rates of

weight loss depending on feeding type (predominantly breastfeeding, predominantly bottle feeding, or mixed feeding) (14).

2.4 Other factors that may influence maternal weight retention

The average postpartum weight retention is not large. Some studies note weight retention of 0.5 - 1.5 kg (79). Others say retention varies 0.5 - 3.0 kg (7). However, the distribution of postpartum weight retention varies greatly, and some women retain significant amounts of weight. In one study at 24 months postpartum as many as 29% of participants retained ≥ 5 kg (25). Large gestational weight gain and high pre-pregnancy body mass index (79, 82) have been associated with an increased risk of postpartum weight retention (58, 79). Exercise (58) and parity (79) may also affect weight retention.

2.4.1 Gestational weight gain

Gestational weight gain is a variable highly correlated with postpartum weight retention in both the short and the long term (19). In a large, diverse sample, above recommended gestational weight gain was associated with three-times the risk of moving into the overweight classification (in this study, body mass index ≥ 26) post pregnancy (96). Gestational weight gain has also been noted as one of the most significant predictors of long-term weight gain (61). One study found that excessive gestational weight gain increased women's odds of overweight or obesity 21 years later (97). Additionally, one meta-analysis determined that gestational weight gain above recommendations was associated with an average of an additional 4.72 kg weight retention ≥ 15 years after delivery (98). Data from 2011 indicates that 48% of women gain more than recommended amounts of gestational weight (81).

2.4.2 Parity

Parity's influence on postpartum weight retention is unclear. Primiparity has been observed to increase the risk of postpartum weight retention ≥ 5 kg (22, 79). The risk of becoming overweight with one birth as opposed to none may be as high as 60% - 110% (79). Each additional child may present a 7% additional risk for obesity (99). In some studies, however, parity was negatively

associated with postpartum weight retention (16, 18). Additionally, in one case, having ≥ 3 children was associated with losing more weight postpartum (25).

2.4.3 High pre-pregnancy body mass index/high pre-pregnancy weight

Women who are obese or overweight before their first pregnancy are more likely to retain more postpartum weight regardless of race/ethnicity (79). Pre-pregnancy body mass index may affect breastfeeding's relationship to postpartum weight retention. Some studies indicate women with a body mass index above normal may be less likely to breastfeed and may breastfeed for shorter durations (71, 72). These women may lack confidence in their abilities to breastfeed and are at a statistically significant risk of earlier cessation of exclusive breastfeeding (71). Alternately, one 2011 study indicated that obese women were more likely than normal or even overweight women to attempt to express breast milk (47). However, in this study too, obese women were less likely to do so successfully, unless they had expressed milk previously (47).

Generally pre-pregnancy body mass index is commonly considered as a moderator throughout breastfeeding literature (14, 24, 35, 100). However, an argument can be made for separately considering maternal height and weight. Ratios such as body mass index have a potential for lack of clarity or misleading conclusions in multiple-regression analyses (101).

2.4.4 Age

Age is a factor for which analyses are commonly adjusted (16, 38, 95, 102). It has been associated with postpartum weight retention in some studies. One study found older women were more likely to have higher postpartum weight retention (15). Alternately, other studies found that older age was associated with retaining less weight (16). Including a study observing that older women retained less weight when they were multiparous (56). And, another example that found women <19 years of age had significantly higher postpartum weight retention than older women (103).

2.5 Methodological limitations in the literature

Heterogeneity of study methodologies plays a role in breastfeeding and postpartum weight retention research's mixed and contradictory results. Measurement methods, study quality, and definitions of the dimensions of breastfeeding impact outcomes and comparability of studies (59, 80). Concern about insensitive definition of breastfeeding has been noted (8, 15). Additionally, limitations such as insufficient sample sizes of participants who breastfed more than 6 months (8), or simply not accounting for breastfeeding duration (15) have been cited. Small sample sizes (15) and self-selection bias (42) have also been discussed. Finally, failing to account for confounding factors can be a limitation (8).

The first objective of this thesis was to undertake a critical study of literature on breastfeeding and postpartum weight retention. The goal of the critical study was to identify methodological approaches that would provide valid and reliable measurement and analysis of key constructs. Recent review articles by Neville et al. and He et al. in addition to other literature were used to help identify methodological weaknesses vs. high quality approaches. Detailed literature search and eligibility criteria for studies included in these articles can be found in Neville et al. (7) and He et al. (9).

2.5.1 Variable definitions and terms

Neville et al.'s review discovered significant variation in variable definitions. They recommended clearer, more uniform definitions for breastfeeding and consistent definitions for postpartum weight retention to improve comparability of studies (7). Sometimes terms so vague as 'breast-feeding' are used without accounting for the dimensions of breastfeeding. One such study noted participants were categorized retrospectively as 'breast-feeding' if they had breastfed starting in the hospital and continued through at least 6 weeks, but offered no other details about the feedings (27). When they are accounted for in the literature, terms used to categorize breastfeeding variables and their definitions are not widely agreed upon. For example, 'exclusive' (26), 'predominant' (14), and 'full' (16), are used to refer to how exclusively a woman breastfeeds. From study to study they may be defined similarly or have nuanced differences. 'Fully' has been defined in one study as providing ≥ 75% of necessary energy per kilogram of the

child's weight in breast milk (15). Alternately, another study defined the 'full breast-feeding' group as women still breastfeeding at each data collection point without introducing formula and without ever having discontinued breastfeeding (16).

The terms 'partial', (36), 'mixed' (25) or 'combination' (35) are often used to mean complementary feeding of the infant in combination with breastfeeding. These terms may also have similar or unique definitions. One study defines 'mixed-feeding' very specifically as an intake of more than 4 ounces each of formula and breast milk daily (14). Whereas, elsewhere 'mixed' is never overtly defined in the body of the article, but referred to in a table as "mixed formula and breast milk" with no further detail (22 p. 308). Often terms such as 'partial', 'mixed', and 'combination' are not explicitly defined. There are many examples of this problem in operationalization of lactation scores. For instance, one study coded breastfeeding exclusivity as 1= bottle feeding, 2 = partial breastfeeding, 3 = full breastfeeding, (35). Another used a similar score with slightly different terms, "1=not lactating/bottle feeding only, 2=combination breast/bottle feeding, and 3=breastfeeding only" (20). The only definition of these dimensions of breastfeeding provided in each of these studies is how the terms were described in the lactation score as provided. The terms themselves were undefined.

There is an internationally recognized definition for breastfeeding exclusivity (42). The WHO and UNICEF define 'exclusive breastfeeding' as infant breast milk feedings without any other food, water, or other drinks (93). There are examples of studies that use WHO and UNICEF's definition, for instance, Martin et al. (19). However, many more studies fail to define the term exclusive at all (13, 22, 25). The tendency to employ commonly used terms without providing any definition is problematic. Another study grouped participants into 'fully breastfeeding', 'partially breastfeeding', or 'bottle-feeding', but did not offer definitions for each category (36). The lack of standardized definitions reduces comparability between studies. Further, lack of "best practices" that include clearly defined terms impedes replication of results.

2.6 Identifying high quality methodology

Neville et al. retained 45 total observational studies looking at breastfeeding and weight or body composition for their review. The majority of the studies showed little or no association between breastfeeding behavior and weight (7). However, there was an significant association between breastfeeding and weight in four of five studies Neville et al. considered high quality (7). Quality criteria included studies controlling for covariates that measured postpartum weight change for a period of ≥12 months (7). As the IFPSII dataset had only weight measures, this study reviewed the 27 studies included in Neville et al.'s review that examined breastfeeding's effect on weight change only (7). Preliminary examination of these studies sought to identify high quality methodologies including operationalization of definitions.

Neville et al.'s 27 weight specific articles (10-36) were placed in a matrix and divided into two categories: those that found a statistically significant correlation between breastfeeding and weight change and those that did not (see Table I). Eleven of 27 (40.7%) studies found a significant relationship between breastfeeding and lower postpartum weight retention (10, 13, 15, 16, 19-21, 24, 28, 31, 32). Fifteen of 27 (55.6%) did not find a significant correlation between breastfeeding and weight change (11, 12, 14, 17, 18, 22, 23, 25, 26, 29, 30, 33-36). Finally, one of 27 (3.7%) found a correlation between breastfeeding and increased postpartum weight retention (27).

Many studies purporting to consider breastfeeding's effect on postpartum weight retention do not take into account nuances of the dimensions of breastfeeding. For example, studies that classify all women who breastfed for more than one week as breast-feeders (11). Other research has considered only duration but not exclusivity of breastfeeding (28, 38). However, dimensions of the breastfeeding behavior including breastfeeding duration and exclusivity appeared to affect the bulk of the studies in Neville et al.'s review (7). A couple of patterns emerged that support the importance of taking into account the duration as well as the exclusivity of breastfeeding when looking for correlations with postpartum weight retention. Of the 15 studies that found no association between breastfeeding and weight change, 3 (20%) took into account both duration and exclusivity (14, 25, 26). One of these (25), was identified by Neville et al. as the sole high quality study that did not find a significant association between breastfeeding and weight change

(7). Nine of 15 articles (60%) finding no association took neither duration nor exclusivity into account (11, 12, 17, 22, 23, 29, 30, 33, 34). Of the remaining studies, 2 (13.3%) took exclusivity but not duration into account (35, 36), and one (6.7%) took duration but not exclusivity into account (18).

Within the studies that found a statistically significant association between breastfeeding and reduced postpartum weight retention, 8 of 11 (72.7%) looked at both breastfeeding duration and exclusivity (10, 13, 15, 16, 19-21, 24). Two studies (18.2%) took duration, but not exclusivity into account (28, 32). And one study (9%) took neither breastfeeding nor exclusivity into account (31). The single study finding a significant association between breastfeeding and an increased risk of postpartum weight retention also looked at neither duration nor exclusivity (27).

One final matrix was created in order to examine only those studies identified as high quality by Neville et al. (7) or He et al (9). Neville et al. focused on studies controlling for covariates that measured postpartum weight change for a period of ≥ 12 months (7). He et al. considered studies with a control group to be higher quality (9). He et al. also emphasized studies with a follow-up rate ≥ 75% (9). They expected high quality studies to have clearly operationalized definitions for exposure and outcome variables as well as clearly defined criteria for inclusion and exclusion (9).

Studies looking at weight as a primary outcome that were identified by Neville et al. as high-quality (19, 21, 24, 25) and studies looking at weight as a primary outcome identified as high quality (37, 38, 94) by He et al. (9) were placed into a matrix. In the Neville/He matrix (Table II), all of the studies (100%) took breastfeeding duration into account (19, 21, 24, 25, 37, 38, 94). Five of 7 studies (71.4%) looked at both duration and exclusivity of breastfeeding (19, 21, 24, 25, 94). Two of 7 studies (28.6%) did not find a statistically significant correlation between breastfeeding and weight change (25, 38). One of these (25) considered both duration and exclusivity, and the other (38) considered only duration. Four studies (57.1%) found a statistically significant correlation between breastfeeding and weight change. Three of these (19, 21, 24) considered duration and exclusivity and one (37) considered only duration. The last paper wrote

up two related studies, one of the two found a statistically significant correlation and the other did not (94). These studies took both duration and exclusivity into consideration (94).

Table I: Characteristics of studies reviewed by Neville et al. related to breastfeeding's effect on weight change

Study	BF[a] duration effect on weight change examined	BF[a] exclusivity effect on weight change examined	BF[a] sig. associated with weight change
Boardley et al. (11)	N	N	N
Haiek et al. (14)	Y	Y	N
Oken et al. (22)	N	N	N
Walker et al. (36)	N	Y[c]	N
Laskey et al. (17)	N	N	N
Lyu et al. (18)	Y	N	N
Østbye et al. (25)	Y	Y	N
Schauberger et al. (29)	N	N	N
Scholl et al. (30)	N	N	N
Walker (33)	N	N	N
Walker et al. (35)	N	Y	N
Fowles & Walker (12)	N	N	N
Olsen & Mundt (23)	N	N	N
Walker & Freeland-Graves (34)	N	N	N
Parker & Abrams (26)	Y	Y	N
Martin et al. (19)	Y	Y	Y
Nuss et al. (20)	Y	Y	Y
Olson et al. (24)	Y	Y	Y
Slotkin & Herbold (32)	Y	N	Y
Ohlin & Rössner (21)	Y	Y	Y[d]
Janney et al. (15)	Y	Y	Y
Sheikh (31)	N[b]	N	Y
Gunderson et al. (13)	Y	Y	Y
Baker et al. (10)	Y	Y	Y
Gould Rothberg et al. (28)	Y	N	Y
Krause et al. (16)	Y[e]	Y	Y
Potter et al. (27)	N	N	Y[f]

a. BF, breastfeeding
b. Neville said Y, but duration in relation to breastfeeding isn't mentioned, and the study is only 8 days long
c. Women categorized as: 'fully' BF, 'partially' BF, 'bottle-feeding', but no operationalized definitions are offered
d. Statistically significant association between breastfeeding and weight change, but with a small r
e. Breastfeeding significantly associated with reduced postpartum weight retention except at 1-3 months
f. Breastfeeding associated with retaining more postpartum weight rather than less

Table II: Characteristics of studies identified as high quality by Neville et al. or He et al. that are related to breastfeeding's effect on weight change

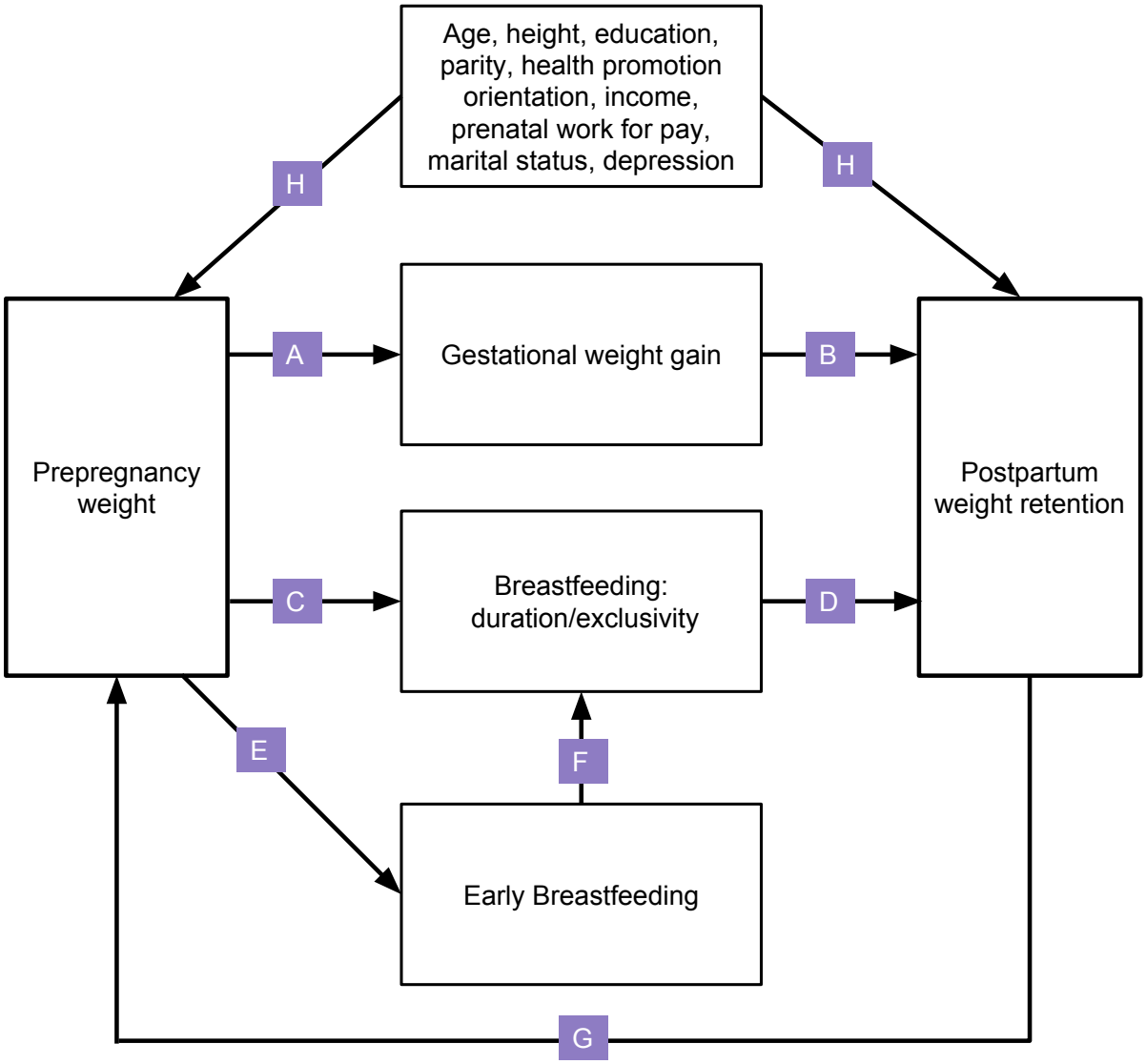
Study	BF[a] duration effect on weight change examined	BF[a] exclusivity effect on weight change examined	BF[a] sig. associated with weight change
Østbye et al. (25)	Y	Y	N
Martin et al. (19)	Y	Y	Y
Olson et al. (24)	Y	Y	Y
Ohlin & Rössner (21)	Y	Y	Y[b]
Ly et al. (38)	Y	N	N
Dewey et al. (94)	Y	Y	Y/N[c]
Dujmović et al. (37)	Y	N	Y

a. BF, breastfeeding
b. Statistically significant association between breastfeeding and weight change, but with a small r
c. Breastfeeding was significantly associated with weight change in one study but not in the second in this article

2.7 Analytical model

Figure I illustrates the factors examined in this thesis, informed by the review of the literature and the variables available in the IFPSII dataset. Prepregnancy weight may affect gestational weight gain (path A). Gestational weight gain may be associated with postpartum weight retention (path B). Prepregnancy weight may affect the duration and exclusivity of breastfeeding (path C). Duration and exclusivity may affect postpartum weight retention (path D). Pre-pregnancy weight may affect early breastfeeding initiation (path E). Early breastfeeding initiation may increase the duration and exclusivity of breastfeeding (path F), and in turn affect postpartum weight retention (path D). Postpartum weight retention may influence weight (path G), if the woman becomes pregnant again, these factors may once again come into play. Lifestyle and other factors (see Figure I for examples) may affect pre-pregnancy weight or postpartum weight (paths H).

Figure I: An analytical model: breastfeeding and postpartum weight retention



3. Data and methods

3.1 Study design

The second objective of the research reported here was a secondary analysis on a subsample of the US's IFPSII. The information in this section is from Fein et al. unless otherwise noted. Further details can be accessed in their description of the IFPSII (63). IFPSII was a nationwide longitudinal survey study intended to reach a large number of mothers in the US in order to gather information on infant feeding practices through their child's first year. Data were collected May 2005 – June 2007.

Questionnaires were developed by the FDA and the CDC. Questionnaires included prenatal, neonatal, infant feeding, health, care, and related topics as well as maternal dietary assessments. Data were collected primarily via mail and included:

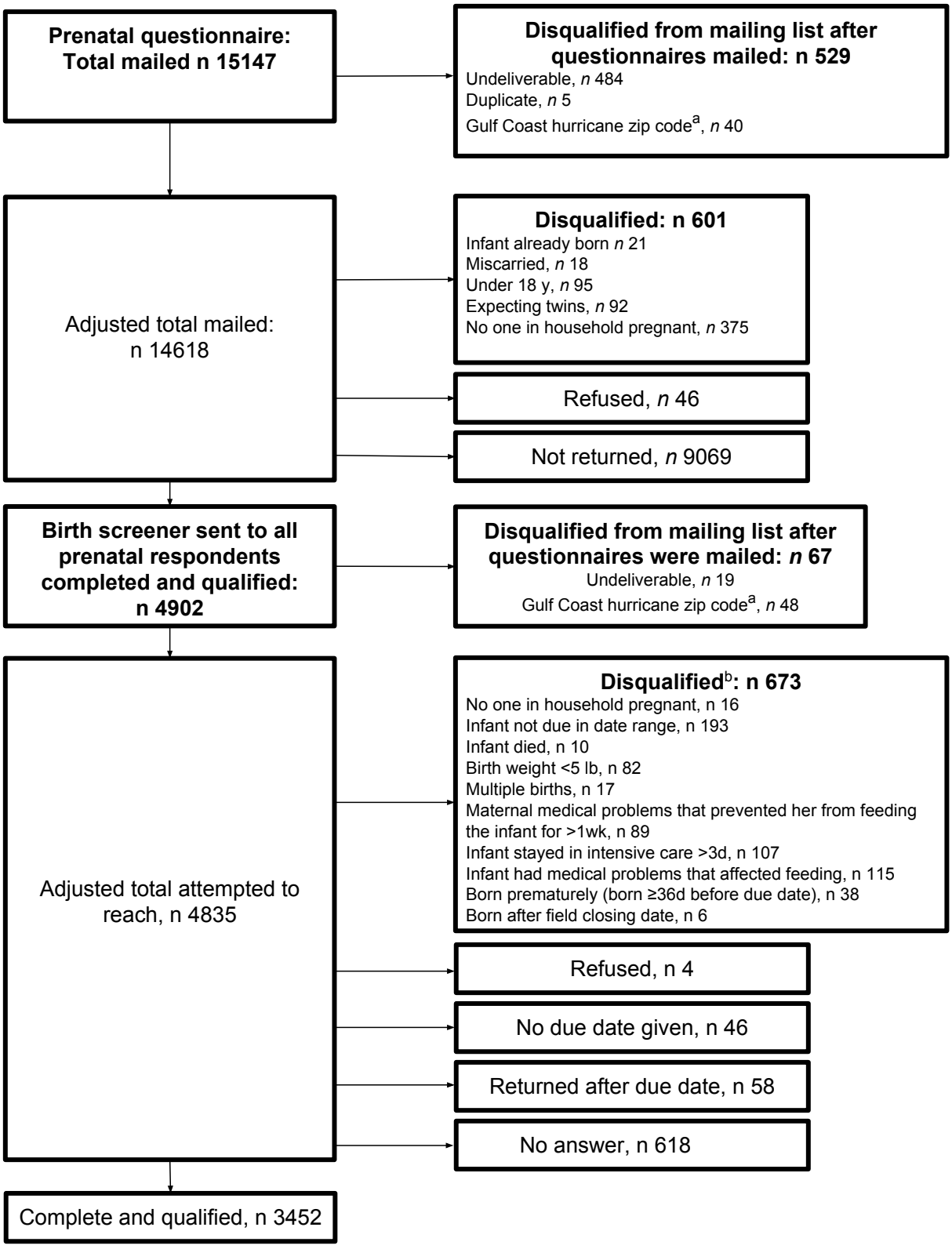
- A prenatal questionnaire
- The birth screener (a brief telephone interview near delivery)
- A neonatal questionnaire at ~1 month after birth
- Questionnaires regarding infant feeding, care, health and related issues sent approximately monthly from ages 2-7 months, and approximately every 7 weeks between 7 months and 12 months of age.

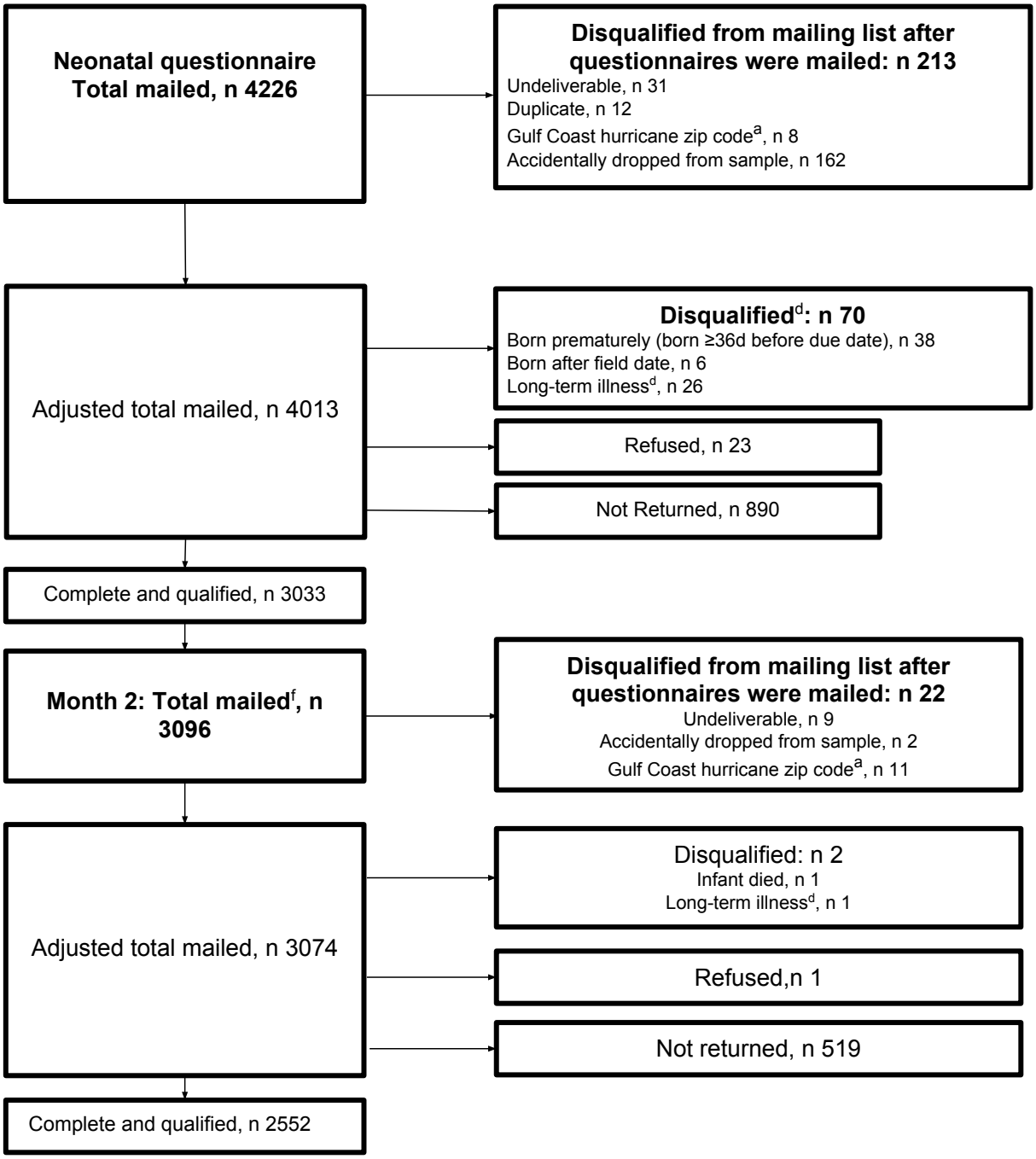
3.2 Study sample

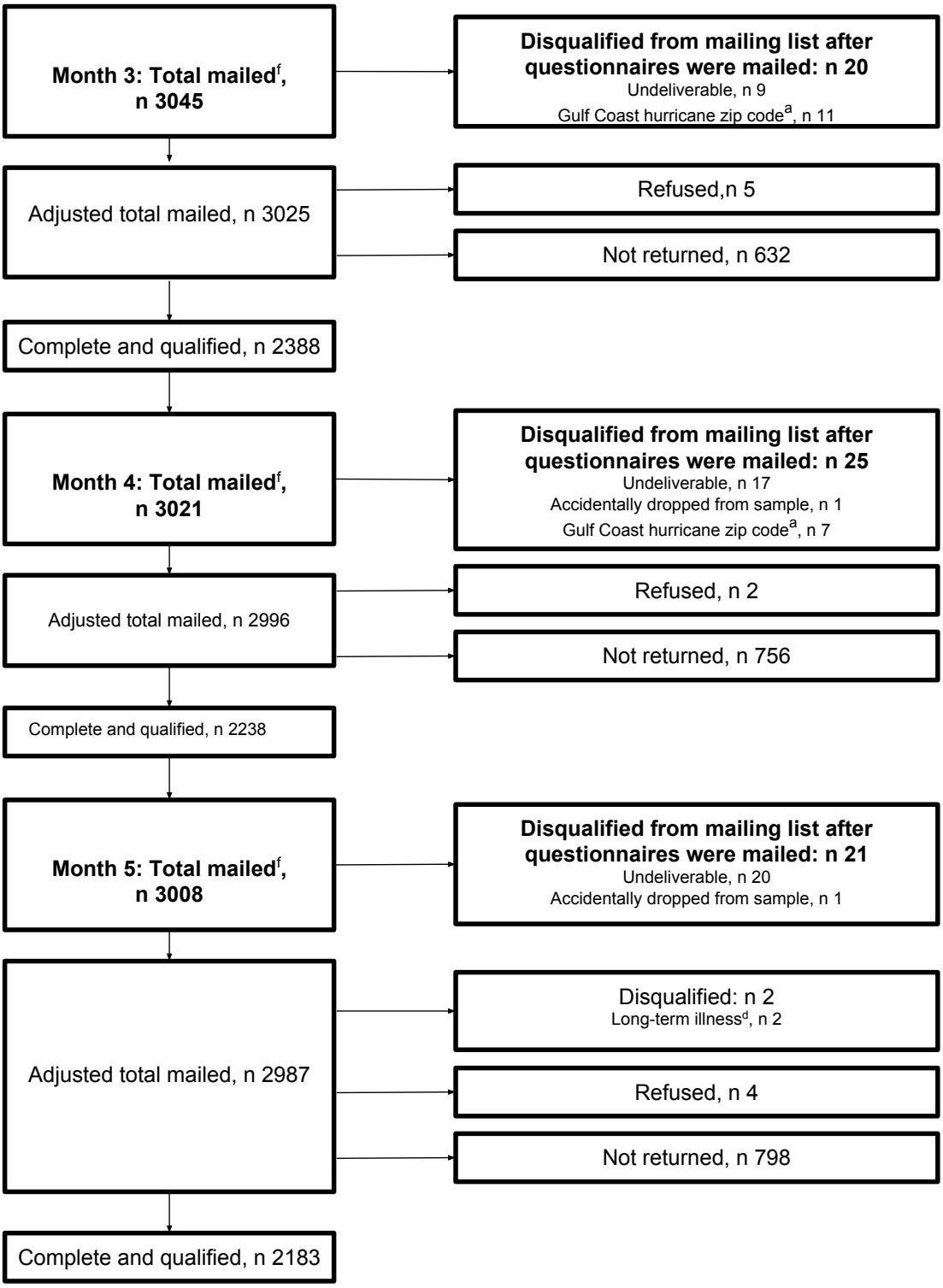
In order to limit the study to woman with sufficient breastfeeding duration, this study's sample was the sub-set of IFPSII respondents who completed the study's 12-month post-natal questionnaire who were still breastfeeding the child at 12 months (n = 437). The sample was selected in several stages. The sampling frame was a national consumer opinion panel whose 500 000 households agreed to provide data on their purchasing practices (2). Sampling at convenience, about a fourth of the households were also asked to provide information about pregnancies in the household. In these households, 15 147 pregnant women were identified over a period of about eight months and invited to participate in the IFPSII. The IFPSII study sample included 4 902 women who completed a prenatal questionnaire in their 3rd trimester of

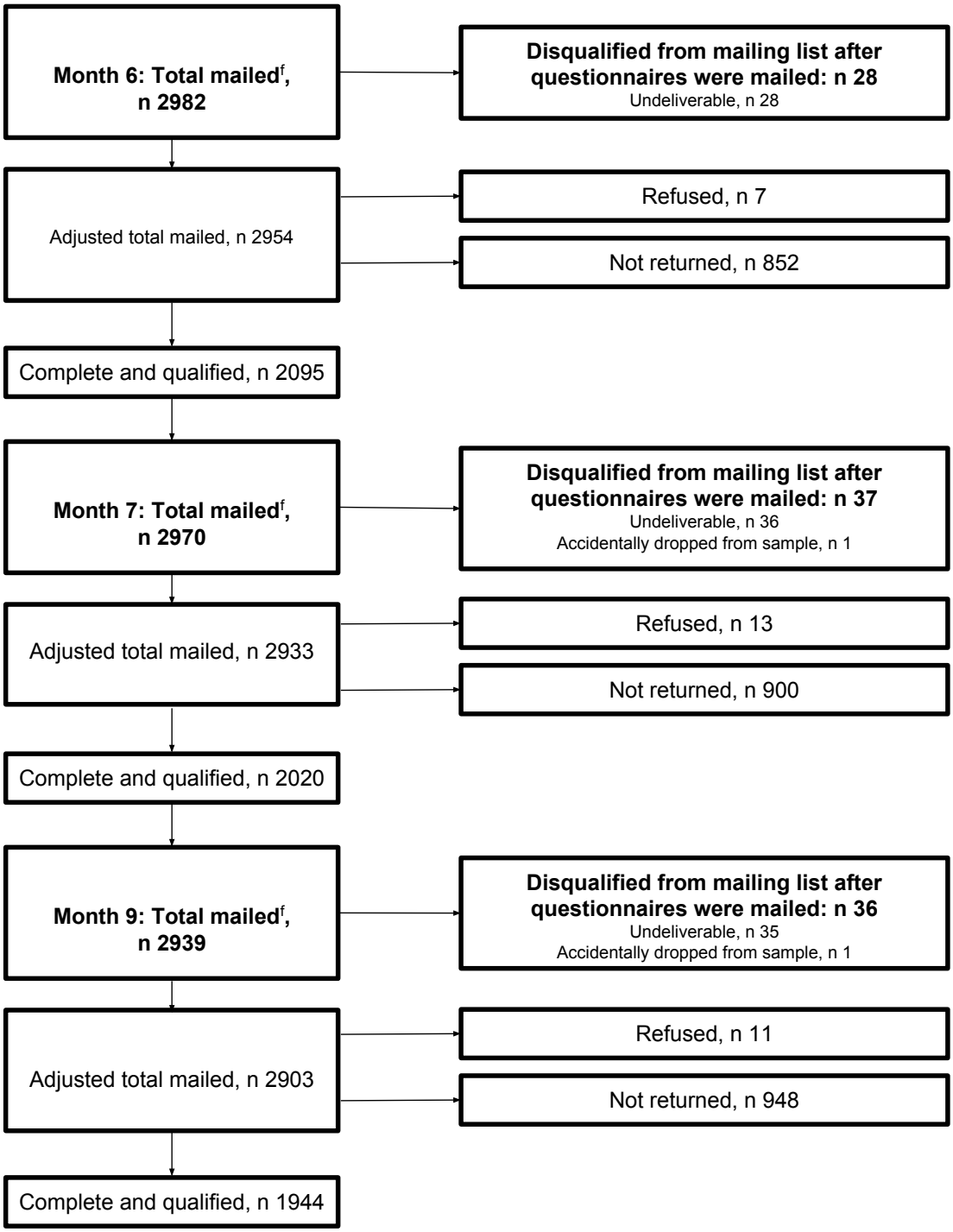
pregnancy. All who completed the prenatal questionnaire and whose babies met eligibility requirements were contacted – or attempted to be contacted -- repeatedly until the child attained 12 months of age. Mother-child dyads were eligible for neonatal follow-up if the mother and child were healthy, if the child was born single and at full- or near-term, and whose birth weight was at least five pounds. Figure II details how the sample gradually decreased throughout the study period; women were no longer included in the study if they became ineligible, refused to continue, did not return questionnaires, or dropped out for other reasons given in Figure II.

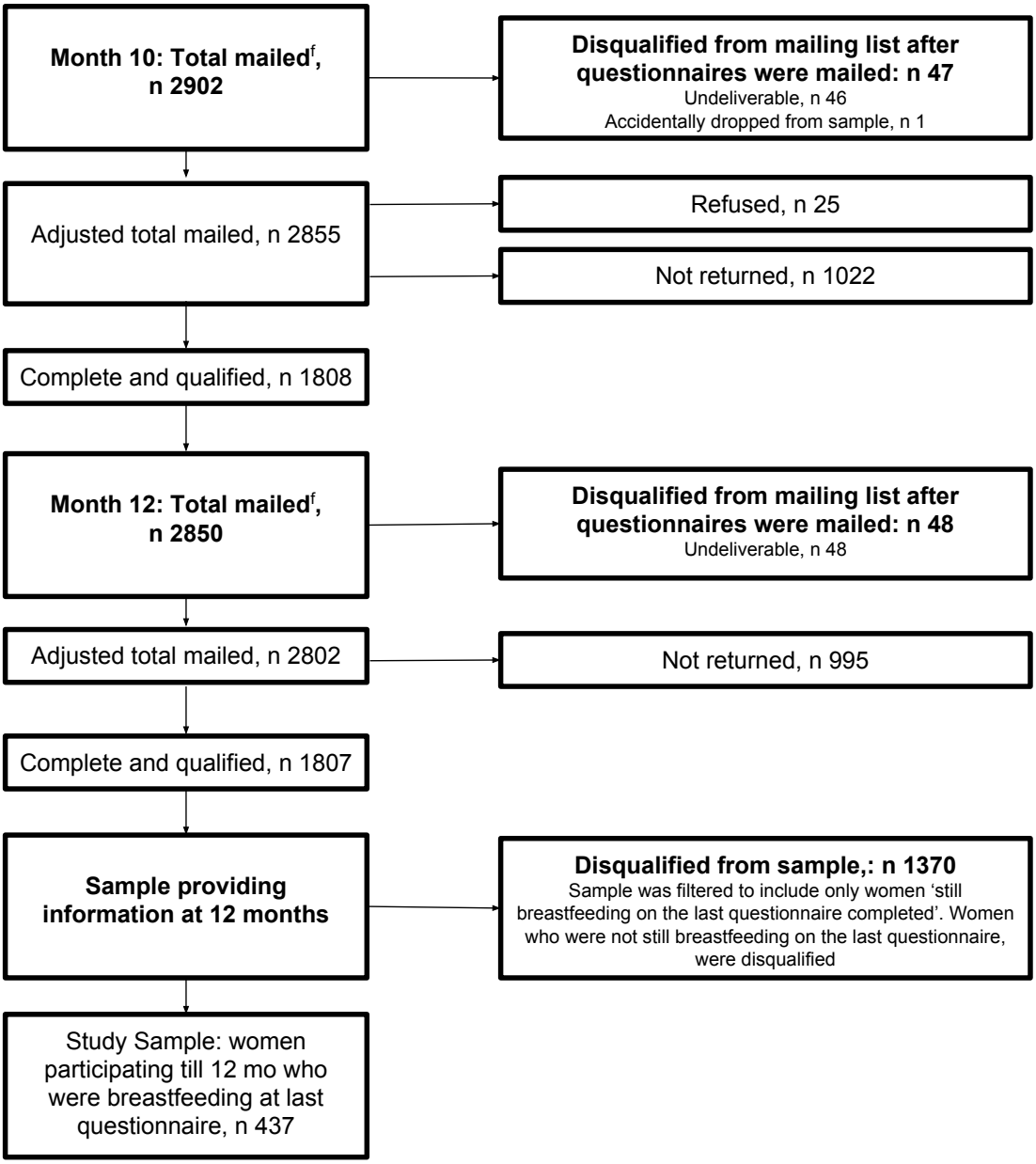
Figure II: Study Sample




Neonatal questionnaire
Total mailed, n 4226
Disqualified from mailing list after questionnaires were mailed: n 213
Undeliverable, n 31
Duplicate, n 12
Gulf Coast hurricane zip code[a], n 8
Accidentally dropped from sample, n 162
Adjusted total mailed, n 4013
Disqualified[d]: n 70
Born prematurely (born ≥36d before due date), n 38
Born after field date, n 6
Long-term illness[d], n 26
Refused, n 23
Not Returned, n 890
Complete and qualified, n 3033
Month 2: Total mailed[f], n 3096
Disqualified from mailing list after questionnaires were mailed: n 22
Undeliverable, n 9
Accidentally dropped from sample, n 2
Gulf Coast hurricane zip code[a], n 11
Adjusted total mailed, n 3074
Disqualified: n 2
Infant died, n 1
Long-term illness[d], n 1
Refused,n 1
Not returned, n 519
Complete and qualified, n 2552


Month 3: Total mailed[f], n 3045
Disqualified from mailing list after questionnaires were mailed: n 20
Undeliverable, n 9
Gulf Coast hurricane zip code[a], n 11
Adjusted total mailed, n 3025
Refused,n 5
Not returned, n 632
Complete and qualified, n 2388
Month 4: Total mailed[f], n 3021
Disqualified from mailing list after questionnaires were mailed: n 25
Undeliverable, n 17
Accidentally dropped from sample, n 1
Gulf Coast hurricane zip code[a], n 7
Adjusted total mailed, n 2996
Refused, n 2
Not returned, n 756
Complete and qualified, n 2238
Month 5: Total mailed[f], n 3008
Disqualified from mailing list after questionnaires were mailed: n 21
Undeliverable, n 20
Accidentally dropped from sample, n 1
Adjusted total mailed, n 2987
Disqualified: n 2
Long-term illness[d], n 2
Refused, n 4
Not returned, n 798
Complete and qualified, n 2183


Month 6: Total mailed[f], n 2982
Disqualified from mailing list after questionnaires were mailed: n 28
Undeliverable, n 28
Adjusted total mailed, n 2954
Refused, n 7
Not returned, n 852
Complete and qualified, n 2095
Month 7: Total mailed[f], n 2970
Disqualified from mailing list after questionnaires were mailed: n 37
Undeliverable, n 36
Accidentally dropped from sample, n 1
Adjusted total mailed, n 2933
Refused, n 13
Not returned, n 900
Complete and qualified, n 2020
Month 9: Total mailed[f], n 2939
Disqualified from mailing list after questionnaires were mailed: n 36
Undeliverable, n 35
Accidentally dropped from sample, n 1
Adjusted total mailed, n 2903
Refused, n 11
Not returned, n 948
Complete and qualified, n 1944



a. Individuals living within zip codes to which the US Postal Service halted delivery due to the 2005 Gulf Coast hurricanes were excluded from the rest of the study.
b. Respondents were disqualified on the birth screener for the first disqualifying condition, further disqualifiers were not assessed. Conditions are listed in the same order as on the questionnaire (the first being multiple births). There was no question inquiring about infant death, but respondents were expected to give this information.
c. N is larger than completed and qualified from birth screener due to mailing birth screeners and neonatal questionnaires simultaneously to mothers who were not reached for birth screener via telephone or interactive voice-response interview.
d. The birth screener and neonatal questionnaire were received simultaneously from some individuals, and those individuals may have been disqualified for identical reasons on the birth-screener and neonatal questionnaire. The first 2 disqualifications listed for the neonatal questionnaire are duplicates of disqualifications from the birth screener.
e. Mother-infant pairs were disqualified if, at any point, mothers indicated an infant diagnosis of a long-term illness or condition.
f. Disqualifications each month led to decreases in numbers of questionnaires mailed, however, some disqualified subjects were unable to be removed from the next mailing due to the rapidity with which questionnaires were mailed, therefore, some individuals were mailed questionnaires despite not qualifying.

Diagram adapted and expanded from Fein et al. (2008)

3.3 Quality assurance

The FDA, CDC, and their consultants developed IFPSII questionnaires using experience from the first Infant Feeding Practices Study (IFPSI). Questionnaires were pre-tested and data collection procedures were pilot tested with women having infants, sampled from the consumer opinion panel (63). Data were checked for missing data, outliers, and conflicting information. After initial collection, the data were cleaned by IFPSII investigators (63).

3.4 Variables

3.4.1 Dependent variable

'Postpartum weight retention' is calculated as the difference between the mother's self-reported pre-pregnancy weight and her self-reported weight at 12 months postpartum, transformed into a Z score.

3.4.2 Predictor Variables

'Early breastfeeding' is a measure of breastfeeding initiation defined using WHO and UNICEF criteria (93), coded 1 if the mother reported initiating breastfeeding within one hour of the birth, and coded 0 otherwise.

'Exclusive breastfeeding' is defined using American Academy of Pediatrics (AAP) guidelines (5), coded 1 if the mother reported having fed the infant with breast milk exclusively at four months postpartum, and coded 0 otherwise.

Maternal 'height' and pre-pregnancy 'weight' were self-reported.

‘Gestational weight gain’ is self-reported in pounds and transformed into a Z score.

‘Parity’ is coded 0 if women had no previous children, 1 if women had indicated one previous child, and 2 if women had indicated having ≥ 2 children.

‘Race/ethnicity’ is coded 1 if women indicated they were white, 2 if they indicated they were black, 3 if they indicated they were Hispanic, and 4 if they indicated another race or ethnicity.

‘Education’ is coded 2 if women reported they had graduated from college or beyond, 1 if they had indicated attending college but did not graduate, and 0 if they went to high school or less.

‘Martial status’ is coded 1 if women were married, and coded 0 otherwise.

‘Age’ is the mother’s self-reported age in years, transformed into a Z score.

‘Maternal health promotion orientation’ was created using a variable looking at prenatal vitamin consumption as an indicator of health promotion orientation (63). Those women who indicated they ate more vitamins are coded 1, having a prenatal Health Promotion orientation, whereas those women who answered otherwise are coded 0.

‘Income’ is defined based on the federal poverty level (FPL), women whose households fall into the highest percentage of the FPL (＞300%) are coded 1, women whose households are ≤ 300% of the FPL are coded 0.

‘Work for pay’ is a prenatal measure, coded 1 for women who reported working at the same or reduced hours as before pregnancy, and 0 if they did otherwise.

‘Depression’ is a sum of scores from the Edinburgh Postpartum (Postnatal) Depression Scale questions included in the month 2 IFPSII questionnaire (63) using
Edinburgh Postnatal Depression Scale specifications (104) (see Appendix IV for Edinburgh specifications and Appendix V for scoring as completed in this study.). The maximum possible score is 30, a score of ≥ 10 indicates possible depression (104).

3.5 Data analysis

Statistical Packages for Social Sciences (SPSS) version 23 was used to assess the relationship between breastfeeding and 'postpartum weight retention'. Analyses were run excluding cases pairwise with no replacement for missing data in order to produce analyses that reflect variation present in the sample. Sample sizes were sufficient despite missing data. The variables were created as described above. To avoid difficulties with comparison of different distributions' raw scores (105), continuous variables were transformed into Z scores. Variables were screened for outliers. Outliers classified as 'extreme' by SPSS were investigated. All outliers were retained given that they were reasonably few, naturally occurring, within realistic ranges, and did not overly affect the outcomes.

Statistical analyses were run in three steps. 1) Basic descriptive statistics were obtained for all variables. 2) Bivariate relationships between the outcome variable postpartum weight retention and the predictor variables were explored using Pearson's product-moment correlation coefficients, independent samples t-tests, or one-way ANOVAs. 3) Multiple linear regression was performed to assess the relationship between postpartum weight retention and breastfeeding time of initiation and exclusive feeding at 4 months. Factors that were controlled for included age, weight, education, income, martial status, height, parity, prenatal health promotion orientation, depression, prenatal work for pay, and gestational weight gain.

The aim of analysis was to produce a parsimonious model accounting for the maximal obtainable variance in postpartum weight retention given the limits of available variables. A series of models was developed to achieve this aim. Variables were removed from base (initial) model, which included all variables listed above, in order to run simplified models (see 4.3 Linear multiple regression for details). Interactions were run on all variables retained for the simplified models. Ultimately, only the main effects variables and maternal age were retained in the final parsimonious model.

3.6 Ethical considerations

In the US, the Federal Policy for the Protection of Human Subjects is in place to protect human participants in research (106). All research involving humans preformed, supported, or regulated by US federal departments or agencies must comply with the policy (106). This thesis uses existing data from the IFPSII. No direct contact was made with past participants. At the time of the study, the IFPSII's questionnaires, materials and procedures were approved by the FDA's institutional review board, Research Involving Human Subjects Committee (RIHSC), as well as the US Office of Management and Budget (63). As per panel policy, small gifts (<$3) were given for completed questionnaires (63).

Possible harms to the participants, beyond just legality, must also be taken into consideration. The first three questionnaires had mostly novel questions (63). However, repeated questionnaires were necessary later in the IFPSII in order to gather the same information at intervals (63). These detailed and potentially tedious questionnaires may have taken significant effort on behalf of the study participants. They may have taken time away from other activities, including work, relaxation activities, family bonding, etc. Further, the questionnaires may have caused stress, anxiety, boredom, or felt obligatory to participants. Additionally, certain questions could have caused undue concern about parental abilities or the correctness of infant feeding decisions.

The informed consent was in a brochure format and was identified as Synovate Consumer Opinion Panel (see Appendix I). This may have affected the number of people who read it carefully. Additionally, the association with a consumer opinion panel may have given participants ideas about the nature of the questions and the types of information that would be collected that were not wholly in line with the reality of the study questionnaires.

The consent form assured individuals that their anonymity would be protected and they could leave the study at any time. A description of the time commitment was also provided. The consent form described the study as a 15-month study seeking information about the feeding and care of infants. It was disclosed that questionnaires will be mailed nearly every month until one year postpartum, and a time frame of 10-30 minutes was estimated after the first few surveys (due

to the similarities between surveys). It is difficult to know the accuracy of the time estimates provided. The information given may or may not have accurately reflected the actual experience of participation.

At a minimum, participants should have gotten a sense of how their participation helped further the infant feeding knowledge base and been informed of any potential benefits to scientific research. The brochure did address how the FDA would use the information to understand policy effects and improve the information they provide to the public. It informed potential participants that the goal was to help the FDA better understand maternal experiences in order to develop programs for future new mothers and compare to the past IFPS study (completed about a decade before). Gifts were offered, but their nature was not described. However, because of their similarity to other panel gifts, the participants may have felt they understood what they were expected to get from their participation. The informed consent also appealed to potential participant desire to help with research that may improve others' lives in the future. However, it did not address how the information may affect additional scientific research.

4. Results

Participants were followed for about 15 months each (107). Data were gathered through a series of questionnaires, rates of response varied from 63%-87% (63). Woman in the study sample tended to be white, already have one or more children, and were likely to display a health promotion orientation. The majority of women in the sample were not in the highest income category. Women in the sample tended to breastfeed exclusively at 4 months and initiate breastfeeding within an hour of birth. Additionally, most of women in the sample had completed college or beyond, were married, and were working for pay prenatally. See Table 1 for descriptive statistics of categorical variables.

4.1 Univariate analyses

Initial descriptive analyses of sociodemographic characteristics were run on study participants (N=437). The study sample mostly consisted of white participants. Ninety percent of the study sample participants were white, 2.6% were black, 3.3% were Hispanic and 4.2% were other races and ethnicities. Data were missing for 2.1% of the sample. Among study sample women, 22.4% had 0 previous children, 40.3% had 1, and 37.3% had ≥ 2 (.7% missing). A majority of study sample participants (70.5%) showed a prenatal health promotion orientation.

Most of the sample were not in the highest income bracket, 64.3% had a federal poverty level that was 300% or lower. The majority (87.4%) were still breastfeeding exclusively at 4 months (7.3% missing). Women in the sample also tended to breastfeed within one hour of birth, 69.8% reported initiation within one hour. Data were missing for 1.6%. Most women in the sample (59.8%) graduated from college or beyond. Thirty-one percent of study participants had some college education, and 9.2% of the study sample had gone to high school or less (3.2% missing). Participants in the study sample were also more likely to be married (90.1%) than unmarried, 2.7% of marriage data was missing. Seventy-six point five percent of women in the study sample reported working for pay prenatally. Data related to prenatal work were missing for 40.5%.

Table 1: Frequencies of ethnicity/race, parity, health promotion orientation, income, exclusive breastfeeding at 4m, early breastfeeding, education, martial status, and prenatal work for pay in women breastfeeding at least 12 months

Characteristic	Frequency	Percent (Valid Percent)
Ethnicity/Race		
White	385	88.1 (90)
Black	11	2.5 (2.6)
Hispanic	14	3.2 (3.3)
Other	18	4.1 (4.2)
Total	428 (missing, N=9)	97.9 (missing, 2.1)
Parity		
0	97	22.2 (22.4)
1	175	40 (40.3)
≥2	162	37.1 (37.3)
Total	434 (missing, N=3)	99.3 (missing, .7)
Health Promotion Orientation (prenatal)		
Other	129	29.5
Displays HPO[a]	308	70.5
Total	437	100
Income		
Other	281	64.3
Income >300% FPL[b]	156	35.7
Total	437	100
Exclusive Breastfeeding at 4m		
Other	51	11.7 (12.6)
Exclusive BF[c] at 4m	354	81 (87.4)
Total	405 (missing, N=32)	92.7 (missing, 7.3)
Early Breastfeeding		
Other	130	29.7 (30.2)
BF[c] within 1hr	300	68.6 (69.8)
Total	430 (missing, N=7)	98.4 (missing, 1.6)
Education		
High School or less	39	8.9 (9.2)
Some College	131	30 (31)
College Graduate	253	57.9 (59.8)
Total	423 (missing, N=14)	96.8 (missing, 3.2)
Marital Status		
Unmarried	42	9.6 (9.9)
Married	383	87.6 (90.1)
Total	425 (missing, N=12)	97.3 (missing, 2.7)
Work for Pay (prenatal)		
Other	61	14 (23.5)
Working for pay	199	45.5 (76.5)
Total	260 (missing, N=177)	59.5 (missing, 40.5)

a. HPO, Health Promotion Orientation
b. FPL, Federal Poverty Level
c. BF, Breastfeeding

In the study sample, pre-pregnancy weight ranged from 91 pounds to 305 pounds, the mean pre-pregnancy weight was 156.63 pounds (±38.43). Women ranged in age from 19-47 years, the mean age was 30.73 years (±5.02). Gestational weight gain ranged from -25 pounds to 70 pounds.

The mean gestational weight gain was 31.17 pounds (±13.02). Maternal height ranged from 58 to 73 inches. The mean maternal height was 65.2 inches (±2.72). Postpartum weight retention in the study sample ranged from -106 to 115 pounds. The mean postpartum weight retention was 1.05 pounds (±16.42). Depression scores out of 30 points ranged from 0 to 20. Mean depression in the sample was 6.13 (±4.04). See Table 2 for descriptive statistics of continuous variables.

Table 2: Descriptive Statistics of pre-pregnancy weight, age, gestational weight gain, height, postpartum weight retention and depression in women breastfeeding at least 12 months

	N	Missing	Min	Max	Mean	Std. Deviation
Prepregnancy weight	433	4	91	305	156.63	38.43
Age	437	0	19	47	30.73	5.02
GWG[a]	422	15	-25	70	31.17	13.02
Height	437	0	58.00	73.00	65.20	2.72
PPWR[b]	425	12	-106.00	115.00	1.05	16.42
Depression	401	36	.00	20.00	6.13	4.04

a. GWG, gestational weight gain
b. PPWR, postpartum weight retention

4.2 Bivariate analyses

4.2.1 T-tests of dichotomous variables

Independent samples t-tests were used to compare postpartum weight retention in the following dichotomous variables: health promotion orientation, income, exclusive breastfeeding at 4 months, early breastfeeding, marital status, and prenatal work for pay. Women who exclusively breastfed at 4 months (N=345) had a mean postpartum weight retention of .11 (±14.28) pounds. This was significantly less than the mean weight retention of 7.12 (±22.23) pounds of women who did not exclusively breastfeed at 4 months ('Other', N=51). The magnitude of differences of the means was small, eta squared =.012. The mean difference between groups was 7.01 pounds t (56.25) = 2.19, $p < .05$ (two-tailed), 95% CI: .58 to 11.58. The relationship between income and postpartum weight retention was also significant. Those whose federal poverty level ≤ 300% (other) had a mean weight retention of 2.21 (±17.97) pounds. Women whose income was > 300% the federal poverty level had a mean weight retention of -1.03 (±13.02) pounds. The magnitude of differences of the means was small, eta squared = .011. The mean difference between groups was 3.24 pounds, t (396.79) = 2.14 $p < .05$ (two-tailed), 95% CI: .26 to 6.22. Women who did not

prenatally work for pay (other) had a statistically significant larger mean weight retention, 5.25 (±18.37) pounds, than their counterparts who worked for pay prenatally, -.63 (±12.74). The magnitude of differences of the means was small, eta squared =.021. The mean difference between groups was 5.89 pounds t (75.51) = 2.30, p <.05 (two-tailed), 95% CI: .79 to 10.99. Health promotion orientation, early breastfeeding, and marital status, did not show statistically significant differences in means (see Table 3 for details).

Table 3: T-tests of postpartum weight retention in women who breastfed at least 12 months by health promotion orientation, income, exclusive breastfeeding at 4m, early breastfeeding, martial status, and prenatal work for pay

Variable	N	Mean (Std deviation)	Mean Diff.	t	df	Sig. (2-tailed)	95% Confidence Interval	
							Lower	Upper
HPO[a]								
Other	125	-.42 (.14.74)	-.2.07[d]	-1.19	423	.236	-5.51	1.36
Displays HPO[a]	300	1.66 (17.06)						
Total	425							
Income								
Other	272	2.21 (17.97)	3.24[e]	2.14	396.79	.033*	.26	6.22
Income >300% FPL[b]	153	-1.03 (13.02)						
Total	425							
Exclusive BF[c] at 4m								
Other	51	7.12 (22.23)	7.01 [e]	2.19	56.25	.033*	.58	11.58
Exclusive BF[c] at 4m	345	.11 (14.28)						
Total	396							
Early BF[c]								
Other	127	1.86 (20.65)	.96[d]	.55	416	.580	-2.46	4.39
BF[c] within 1hr	291	.89 (14.15)						
Total	418							
Marital Status								
Unmarried	40	.48 (18.57)	-.09[d]	-.04	413	.972	-5.11	4.93
Married	375	.57 (14.98)						
Total	415							
Work for Pay (prenatal)								
Other	59	5.25 (18.37)	5.89[e]	2.30	75.51	.024*	.79	10.99
Working for pay	194	-.63 (12.74)						
Total	253							

a. HPO, Health Promotion Orientation (prenatal)
b. FPL, Federal Poverty Level
c. BF, Breastfeeding
d. Equal variances assumed
e. Equal variances not assumed
*p<.05

4.2.2 Continuous variables

The relationships between postpartum weight retention and pre-pregnancy weight, age, gestational weight gain, height, and depression were investigated using Pearson product-moment correlation coefficients. Only pre-pregnancy weight and gestational weight gain were significant correlates of postpartum weight retention. Pre-pregnancy weight was somewhat negatively correlated with postpartum weight retention ($r = -.171$, $n = 425$, $p < .01$). Whereas gestational weight gain was more strongly positively correlated with postpartum weight retention ($r = .332$, $n=422$, $p < .01$). The remaining variables, age ($r=-.055$, $n=425$, $p= .257$), height ($r =-.002$, $n=425$, $p= .965$) and depression ($r=.068$, $n=391$, $p=.179$) were not significant correlates of postpartum weight retention, see Table 4.

Table 4: Pearson product-moment correlations between postpartum weight retention and pre-pregnancy weight, age, gestational weight gain, height and depression in women who breastfeed at least 12 months

Variable	N	Missing	Pearson Correlation	Sig (2-tailed)
Prepregnancy weight	425	12	-.171**	.000
Age	425	12	-.055	.257
Gestational Weight Gain	422	15	.332**	.000
Height	425	12	-.002	.965
Depression	391	46	.068	.179

** Correlation is significant at the 0.01 level (2-tailed).

4.2.3 One-way between-groups ANOVA

One-way between groups analysis of variance was used to explore differences in means of postpartum weight retention between groups based on education, parity, and race/ethnicity (see Table 5). Race/ethnicity was divided into four groups (missing = 20). White women (N = 376) had a mean weight retention of 1.20 pounds (± 15.6) with a range of -45 to 115 pounds. Black women's (N = 11) mean weight retention was lower in these data, -1 pound (±12.87). Black women's weight retention ranged from -24 to 21 pounds. Hispanic women's (N = 13) mean weight retention was the lowest in this study, -4.46 pounds (±35.14). Hispanic women's weight retention -106 to 50 pounds. Women of other races/ethnicities (N = 18) had a mean weight retention of 2.39 pounds (±13.6) with a range from -19 to 46 pounds. There were no statistically significant differences between group means ($F(3,414) = .6$, $p = .615$). Levene's test for homogeneity of variances indicated a violation of the assumption of homogeneity of variance (p

< .05). A Welch F test was consulted, but no statistically significant between groups differences were found ($F(3,414) = .6$, $p = .615$). See Table 6 for details.

Table 5: Postpartum weight retention descriptives by race/ethnicity in women who breastfeed at least 12 months

Race/ ethnicity	N	Mean	SD[a]	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower	Upper		
White	376	1.20	15.60	.80	-.38	2.78	-45	115
Black	11	-1.00	12.87	3.88	-9.65	7.65	-24	21
Hispanic	13	-4.46	35.14	9.75	-25.70	16.78	-106	50
Other	18	2.39	13.60	3.21	-4.37	9.15	-19	46
Total	418	1.02	16.34	.80	-.55	2.59	-106	115

a. SD, Standard Deviation

Table 6: One-way between-groups ANOVA for postpartum weight retention depending on race/ethnicity in women who breastfed at least 12 months

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	481.700	3	160.567	.600	.615
Within Groups	110844.147	414	267.739		
Total	111325.847	417			

Parity comprised 3 groups (missing = 15): women who having given birth to no previous children, women having delivered one previous child, and women having ≥ 2 previous children. See Table 7 for details. Primiparous women (N= 95) had a mean weight retention of .40 pounds (±15.86). Their weight retention ranged from -42 to 50 pounds. Women who had one previous child (N = 169) had a mean weight retention of .91 pounds (±17.3). Their weight retention ranged from -35 to 115 pounds. Women who had two or more previous children (N = 158) had a mean weight retention of 1.48 pounds (±15.84). Their retention ranged from -106 to 46 pounds. Levene's test for homogeneity of variances indicated no violation of the assumption of homogeneity of variance (p > .05). However, there was no statistically significant difference between groups based on parity, ($F(2,419) = .13$, $p = .875$). See Table 8.

Table 7: Postpartum weight retention descriptives by parity in women who breastfeed at least 12 months

Parity	N	Mean	SD[a]	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower	Upper		
0	95	.40	15.86	1.63	-2.83	3.63	-42	50
1	169	.91	17.30	1.33	-1.72	3.53	-35	115
≥2	158	1.48	15.84	1.26	-1.01	3.97	-106	46
Total	422	1.01	16.41	.799	-.56	2.58	-106	115

a. SD, Standard Deviation

Table 8: One-way between-groups ANOVA for postpartum weight retention depending on parity in women who breastfed at least 12 months

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	72.25	2	36.13	.134	.875
Within Groups	113314.73	419	270.44		
Total	113386.98	421			

The study sample was divided into three groups according to education level (missing = 25): high school or less, some college, and college graduate. See Table 9. Women with a high school education or less (N = 37) had a mean weight retention of 3.84 pounds (±16.27) and a range from -22 to 46 pounds. Women who had some college (N = 126) had a mean weight retention of .23 pounds (±19.21) and a range from -106 to 62 pounds. Women who were college graduates (N = 249) had a mean weight retention of .12 pounds (±12.65) with a range of -32 to 95 pounds. Levene's test for homogeneity of variances indicated a violation of the assumption of homogeneity of variance ($p < .05$). A Welch F test was consulted, but no statistically significant differences were present ($F(2,409) = .98$, $p = .375$). See Table 10.

Table 9: Postpartum weight retention descriptives by education in women who breastfeed at least 12 months

Education	N	Mean	SD[a]	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower	Upper		
High School or less	37	3.84	16.27	2.67	-1.59	9.26	-22	46
Some College	126	.23	19.21	1.71	-3.16	3.62	-106	62
College Graduate	249	.12	12.65	.80	-1.46	1.70	-32	95
Total	412	.49	15.27	.75	-.99	1.96	-106	95

b. SD, Standard Deviation

Table 10: One-way between-groups ANOVA for postpartum weight retention depending on education in women who breastfed at least 12 months

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	457.938	2	228.97	.982	.375
Within Groups	95346.975	409	233.12		
Total	95804.913	411			

4.3 Linear multiple regression

4.3.1 Base model

A base model was constructed to assess the effect of an optimal breastfeeding pattern (timing of initiation within one hour of birth, and duration of exclusive breastfeeding of at least four months) on postpartum weight retention in the study sample, while controlling for age, pre-pregnancy weight (pounds), education, income, race/ethnicity, martial status, height, parity, health promotion orientation (prenatal), depression, work for pay (prenatal), and gestational weight gain.

Linear multiple regression was performed via the enter method. Preliminary analyses indicated no violations of linearity, normality, homoscedasticity or multicollinearity. The only statistically significant variables were exclusive breastfeeding at 4 months ($\beta = -.193$, $p < .05$), work for pay ($\beta = -.165$, $p < .05$) and gestational weight gain ($\beta = .335$, $p < .01$). See table 12 for details. The base model explained 19.8% of variance *($F(14, 219) = 3.85$, $p < .001$, $R^2 = .198$, $R^2_{Adjusted} = .146$)* in the study participants (see Table 11). Several factors that the literature suggests might be related to postpartum weight retention were not significant in these data: age, education, income,

race/ethnicity, marital status, height, and parity. These factors were removed from further analyses.

Table 11: Base model summary[b] of multiple linear regression of postpartum weight retention

Model	R	R^2	Adj. R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	.445[a]	.198	.146	.924	.198	3.85	14	219	.000

a. Predictors: (Constant), Z score gestational weight gain, work for pay (prenatal), parity, height, marital status, health promotion orientation, exclusive breastfeeding at 4m, depression, early breastfeeding, race/ethnicity, Z score age, education, income, Z score: pre-pregnancy weight (pounds)
b. Dependent Variable: Z score postpartum weight retention

Table 12: Base model coefficients of multiple linear regression of postpartum weight retention

Model		Unstandardized Coefficients		Std Coefs	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower	Upper
1	(Constant)	.918	1.657		.554	.580	-2.35	4.19
	Age	.023	.069	.023	.330	.742	-.11	.16
	PrPW[b]	-.095	.072	-.095	-1.319	.189	-.24	.05
	Education	.003	.106	.002	.031	.975	-.21	.21
	Income	-.143	.147	-.068	-.974	.331	-.43	.15
	Race/Ethnicity	-.106	.090	-.074	-1.173	.242	-.28	.07
	Marital Status	.164	.214	.049	.767	.444	-.26	.59
	Height[c]	-.002	.025	-.006	-.085	.932	-.05	.05
	Parity	-.010	.094	-.008	-.108	.914	-.20	.18
	HPO[d]	.098	.135	.045	.730	.466	-.17	.36
	Depression	.010	.016	.040	.643	.521	-.02	.04
	Work for Pay[e]	-.389	.158	-.165	-2.468	.014*	-.70	-.08
	GWG[f]	.335	.068	.335	4.938	.000**	.20	.47
	Early BF[g]	-.095	.138	-.044	-.686	.493	-.37	.18
	Exclusive BF[g] at 4m	-.581	.188	-.193	-3.090	.002*	-.95	-.21

a. Dependent Variable: Z score postpartum weight retention
b. PrPW, pre-pregnancy weight (pounds)
c. Maternal height (in)
d. HPO, Health Promotion Orientation (prenatal)
e. Work for Pay (prenatal)
f. Gestational Weight Gain
g. BF, breastfeeding

** Correlation is significant at the 0.01 level.
* Correlation is significant at the 0.05 level.

4.3.2 Simplified models

A series of additional simplified models were made retaining age, health promotion orientation, early breastfeeding, exclusive breastfeeding at 4 months, work for pay, prepregancy weight, and gestational weight gain (Tables 13 and 14). Age was retained as a socio-demographic factor. Behavioral factors and significant correlates of weight retention were also retained. Linear multiple regression in a series of models using the enter method resulted in 4 models that showed statistical significance: Model 5 *($F(5, 233) = 2.61$, $p < .05$, $R^2 = .053$, $R^2_{Adjusted} = .033$);* Model 6 *($F(6, 232) = 3.66$, $p < .05$, $R^2 = .086$, $R^2_{Adjusted} = .063$)*; and Model 7 *($F(7, 231) = 7.49$, $p < .001$, $R^2 = .185$, $R^2_{Adjusted} = .160$)*. Models 5-7 explained 5.3%, 8.6% and 18.5% of variance respectively (see Table 13). The variables exclusive breastfeeding at 4 months, work for pay, and gestational weight gain remained consistently statistically significant in all models in which they were included. Prepregnancy weight was statistically significant in Model 6, ($\beta = -.184$, $p < .005$), but its significant correlation with postpartum weight retention disappeared when gestational weight gain was added in Model 7 (see Table 14).

Table 13: Simplified models summary of multiple linear regression of postpartum weight retention

Model	R	R^2	Adj. R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	.055[a]	.003	-.001	1.00	.003	.722	1	237	.396
2	.078[b]	.006	-.002	1.00	.003	.718	1	236	.398
3	.082[c]	.007	-.006	1.00	.001	.174	1	235	.677
4	.176[d]	.031	.015	.99	.024	5.876	1	234	.016
5	.230[e]	.053	.033	.98	.022	5.382	1	233	.021
6	.294[f]	.086	.063	.97	.033	8.479	1	232	.004
7	.430[g]	.185	.160	.92	.099	27.944	1	231	.000

a. Predictors: (Constant), age
b. Predictors: (Constant), age, health promotion orientation (prenatal)
c. Predictors: (Constant), age, health promotion orientation (prenatal), early breastfeeding
d. Predictors: (Constant), age, health promotion orientation (prenatal), early breastfeeding, exclusive breastfeeding at 4m
e. Predictors: (Constant), age, health promotion orientation (prenatal), early breastfeeding, exclusive breastfeeding at 4m, work for pay (prenatal)
f. Predictors: (Constant), age, health promotion orientation (prenatal), early breastfeeding, exclusive breastfeeding at 4m, work for pay (prenatal), pre-pregnancy weight
g. Predictors: (Constant), age, health promotion orientation (prenatal), early breastfeeding, exclusive breastfeeding at 4m, work for pay (prenatal), pre-pregnancy weight, gestational weight gain

Table 14: Simplified models' coefficients[a] of multiple linear regression of postpartum weight retention

Model		Unstd Coefficients		Std Coefs	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower	Upper
1	(Constant)	.000	.065		.00	1.000	-.128	.128
	Age	-.055	.065	-.055	-.85	.396	-.183	.073
2	(Constant)	-.085	.119		-.71	.477	-.320	.150
	Age	-.052	.065	-.052	-.81	.421	-.180	.076
	HPO	.121	.142	.055	.85	.398	-.160	.401
3	(Constant)	-.101	.126		-.81	.421	-.350	.147
	Age	-.053	.065	-.053	-.82	.414	-.182	.075
	HPO[b]	.119	.143	.054	.83	.406	-.162	.400
	Early BF[f]	.059	.142	.027	.42	.677	-.220	.338
4	(Constant)	.323	.215		1.50	.135	-.101	.746
	Age	-.073	.065	-.073	-1.12	.263	-.201	.055
	HPO[b]	.114	.141	.052	.81	.418	-.164	.393
	Early BF[f]	.037	.140	.017	.27	.790	-.239	.314
	Exclusive BF[f]	-.474	.196	-.158	-2.42	.016*	-.860	-.089
5	(Constant)	.573	.239		2.40	.017	.103	1.043
	Age	-.027	.067	-.027	-.40	.693	-.159	.106
	HPO[b]	.083	.141	.038	.59	.556	-.194	.360
	Work for Pay[c]	-.370	.160	-.157	-2.32	.021*	-.685	-.056
	Early BF[f]	.078	.140	.036	.56	.577	-.198	.355
	Exclusive BF[f]	-.425	.195	-.141	-2.18	.030*	-.810	-.041
6	(Constant)	.604	.235		2.57	.011	.141	1.067
	Age	-.016	.066	-.016	-.23	.815	-.146	.115
	HPO[b]	.087	.138	.040	.62	.531	-.186	.359
	Work for Pay[c]	-.373	.157	-.158	-2.37	.018*	-.682	-.063
	PrPW[d]	-.184	.063	-.184	-2.91	.004*	-.308	-.059
	Early BF[f]	.096	.138	.044	.70	.487	-.176	.368
	Exclusive BF[f]	-.468	.193	-.155	-2.43	.016*	-.847	-.089
7	(Constant)	.715	.224		3.20	.002	.274	1.155
	Age	.007	.063	.007	.115	.909	-.117	.131
	HPO[b]	.093	.131	.043	.713	.477	-.165	.351
	Work for Pay[c]	-.382	.149	-.162	-2.57	.011*	-.675	-.089
	PrPW[d]	-.074	.063	-.074	-1.17	.243	-.199	.051
	GWG[e]	.338	.064	.338	5.27	.000**	.212	.463
	Early BF[f]	.079	.131	.036	.602	.548	-.179	.336
	Exclusive BF[f]	-.586	.184	-.195	-3.19	.002*	-.948	-.224

a. Dependent Variable: Postpartum Weight Retention
b. HPO = Health Promotion Orientation (prenatal)
c. Work for Pay (prenatal)
d. PrPW = Maternal Prepregnancy Weight (pounds)
e. Gestational Weight Gain
f. BF, breastfeeding
** Correlation is significant at the 0.01 level.
* Correlation is significant at the 0.05 level

4.3.3 Interaction effects

Interaction effects were tested for all variables included in the base model. Two potential effect modifier variables showed statistical significance: the work for pay and exclusive breastfeeding at 4 months interaction, and the income and exclusive breastfeeding at 4 months interaction. These were therefore initially retained and modeled (Tables 15 and 16) with age and all variables showing statistical significance. However, the interaction of work for pay (prenatal) and exclusive breastfeeding at 4 months had to be removed due to a problem with mulitcollinearity within the model containing: postpartum weight retention, age, gestational weight gain, work for pay (prenatal), exclusive breastfeeding at 4 months, work for pay (prenatal) and exclusive breastfeeding at 4 months interaction, and income and exclusive breastfeeding at 4 months interaction. The work for pay (prenatal) and exclusive breastfeeding at 4 months interaction was highly correlated with its two component parts: work for pay and exclusive breastfeeding at 4 months. Pallant suggests removing a highly intercorrelated independent variable from the model (108). Therefore the work for pay (prenatal) and exclusive breastfeeding at 4 months interaction variable was removed from the model. Once the work for pay (prenatal) and exclusive breastfeeding at 4 months interaction was removed, the income and exclusive breastfeeding at 4 months interaction became insignificant in the model (Tables 17 and 18). It was therefore also removed from further models.

Table 15: Interaction effects models' summary[g] of multiple linear regression of postpartum weight retention

Model	R	R^2	Adj. R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	.055[a]	.003	-.001	1.00	.003	.72	1	237	.396
2	.333[b]	.111	.103	.95	.108	28.58	1	236	.000
3	.375[c]	.141	.130	.93	.030	8.25	1	235	.004
4	.421[d]	.177	.163	.91	.036	10.34	1	234	.001
5	.479[e]	.229	.213	.89	.052	15.71	1	233	.000
6	.553[f]	.306	.288	.84	.077	25.64	1	232	.000

a. Predictors: (Constant), age
b. Predictors: (Constant), age, gestational weight gain
c. Predictors: (Constant), age, gestational weight gain, work for pay (prenatal)
d. Predictors: (Constant), age, gestational weight gain, work for pay (prenatal), exclusive breastfeeding at 4m
e. Predictors: (Constant), age, gestational weight gain, work for pay (prenatal), exclusive breastfeeding at 4m, work for pay and exclusive breastfeeding interaction
f. Predictors: (Constant), age, gestational weight gain, work for pay (prenatal), exclusive breastfeeding at 4m, work for pay and exclusive breastfeeding interaction, income and exclusive breastfeeding interaction
g. Dependent Variable: postpartum weight retention

Table 16: Interaction effects models' coefficients[a] of multiple linear regression of postpartum weight retention

Model		Unstd. Coeff.		Std Coeff.			95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower	Upper	Tolerance	VIF
1	(Constant)	.000	.065		.00	1.000	-.13	.13		
	Age	-.055	.065	-.055	-.85	.396	-.18	.07	1.00	1.00
2	(Constant)	.000	.061		.00	1.000	-.12	.12		
	Age	-.022	.062	-.022	-.36	.721	-.14	.10	.99	1.01
	GWG[b]	.330	.062	.330	5.35	.000	.21	.45	.99	1.01
3	(Constant)	.327	.129		2.54	.012	.07	.58		
	Age	.031	.064	.031	.49	.626	-.09	.16	.91	1.10
	GWG[b]	.335	.061	.335	5.51	.000	.22	.46	.10	1.01
	Work for pay[c]	-.427	.149	-.181	-2.87	.004	-.72	-.13	.92	1.09
4	(Constant)	.805	.195		4.13	.000	.42	1.19		
	Age	.003	.063	.003	.06	.956	-.12	.13	.89	1.12
	GWG[b]	.362	.060	.362	6.01	.000	.24	.48	.97	1.03
	Work for pay[c]	-.381	.147	-.162	-2.60	.010	-.67	-.09	.91	1.10
	Exclusive breastfeeding at 4m	-.587	.183	-.195	-3.22	.001	-.95	-.23	.96	1.05
5	(Constant)	3.630	.737		4.92	.000	2.18	5.08		
	Age	.104	.066	.104	1.58	.116	-.03	.23	.76	1.32
	GWG[b]	.338	.059	.338	5.75	.000	.22	.45	.96	1.04
	Work for pay[c]	-3.391	.773	-1.440	-4.39	.000	-4.91	-1.87	.03	32.52
	Exclusive BF[d] at 4m	-3.571	.773	-1.186	-4.62	.000	-5.10	-2.05	.05	19.95
	Work for pay + exclusive BF[d] interaction	3.417	.862	1.669	3.96	.000	1.72	5.12	.02	53.61
6	(Constant)	7.065	.976		7.24	.000	5.14	8.99		
	Age	.302	.074	.302	4.08	.000	.16	.45	.55	1.83
	GWG[b]	.303	.056	.303	5.38	.000	.19	.41	.95	1.06
	Work for pay[c]	-7.056	1.031	-2.996	-6.84	.000	-9.09	-5.02	.02	64.09
	Exclusive BF[d] at 4m	-6.979	.997	-2.318	-7.00	.000	-8.94	-5.02	.03	36.65
	Work for pay + exclusive BF[d] interaction	7.716	1.180	3.769	6.54	.000	5.39	10.04	.01	111.12
	Income + exclusive BF[d] interaction	-.929	.183	-.425	-5.06	.000	-1.29	-.57	.42	2.36

a. Dependent Variable: postpartum weight retention
b. GWG, Gestational Weight Gain
c. Work for pay, work for pay (prenatal)
d. BF, breastfeeding

Table 17: Refined interaction effects model summary[f] of multiple linear regression of postpartum weight retention

Model	R	R^2	Adj. R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	.055[a]	.003	-.001	1.00	.003	.722	1	237	.396
2	.333[b]	.111	.103	.95	.108	28.578	1	236	.000
3	.375[c]	.141	.130	.93	.030	8.245	1	235	.004
4	.421[d]	.177	.163	.91	.036	10.340	1	234	.001
5	.422[e]	.178	.160	.92	.001	.229	1	233	.633

a. Predictors: (Constant), age
b. Predictors: (Constant), age, gestational weight gain
c. Predictors: (Constant), age, gestational weight gain, work for pay (prenatal)
d. Predictors: (Constant), age, gestational weight gain, work for pay (prenatal), exclusive breastfeeding at 4m
e. Predictors: (Constant), age, gestational weight gain, work for pay (prenatal), exclusive breastfeeding at 4m, income and exclusive breastfeeding interaction
f. Dependent Variable: postpartum weight retention

Table 18: Refined interaction effects models' coefficients[a] of multiple linear regression of postpartum weight retention

Model		Unstd. Coeff.		Std Coeff.	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower	Upper	Tolerance	VIF
1	(Constant)	.000	.065		.00	1.000	-.13	.13		
	Age	-.055	.065	-.055	-.85	.396	-.18	.07	1.000	1.00
2	(Constant)	.000	.061		.00	1.000	-.12	.12		
	Age	-.022	.062	-.022	-.36	.721	-.14	.10	.990	1.01
	GWG[b]	.330	.062	.330	5.35	.000	.21	.45	.990	1.01
3	(Constant)	.327	.129		2.54	.012	.07	.58		
	Age	.031	.064	.031	.49	.626	-.09	.16	.906	1.10
	GWG[b]	.335	.061	.335	5.51	.000	.22	.46	.989	1.01
	Work for pay[c]	-.427	.149	-.181	-2.87	.004	-.72	-.13	.915	1.09
4	(Constant)	.805	.195		4.13	.000	.42	1.19		
	Age	.003	.063	.003	.06	.956	-.12	.13	.889	1.12
	GWG[b]	.362	.060	.362	6.01	.000	.24	.48	.970	1.03
	Work for pay[c]	-.381	.147	-.162	-2.60	.010	-.67	-.09	.907	1.10
	Exclusive BF[d] at 4m	-.587	.183	-.195	-3.22	.001	-.95	-.23	.955	1.05
5	(Constant)	.797	.196		4.06	.000	.41	1.18		
	Age	.009	.064	.009	.14	.893	-.12	.13	.865	1.16
	GWG[b]	.362	.060	.362	5.10	.000	.24	.48	.970	1.03
	Work for pay[c]	-.373	.148	-.158	-2.52	.012	-.66	-.08	.893	1.12
	Exclusive BF[d] at 4m	-.563	.190	-.187	-2.96	.003	-.94	-.19	.885	1.13
	Income + exclusive BF[d] interaction	-.066	.138	-.030	-.48	.633	-.34	.21	.880	1.14

a. Dependent Variable: postpartum weight retention
b. GWG, Gestational Weight Gain
c. Work for pay, work for pay (prenatal)
d. BF, breastfeeding

4.3.4 Final analyses

In order to produce a parsimonious final model, all variables that did not show statistical significance apart from age were removed. The final analyses retained age, exclusive breastfeeding at 4 months, work for pay (prenatal), and gestational weight gain (Table 19). These four variables were analyzed via linear multiple regression using the enter method in four separate models. Age shows a modest, statistically insignificant contribution that disappears in the final model (Model 4). Gestational weight gain shows a stable and statistically significant contribution in all models where it is included in analysis, β ranges from .330 to .362, $p < .001$. The effect of work for pay (prenatal) decreases somewhat from β = -.181 ($p < .005$) in Model 3 to β = -.162 ($p < .05$) in Model 4. Exclusive breastfeeding at 4 months offers a statistically significant contribution (β = -.195, $p < .005$) in the model in which it was included (Model 4).

Table 19: Final analyses coefficients of multiple linear regression of postpartum weight

Model		Unstandardized Coefficients		Std Coefs			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	.000	.065		.000	1.000	-.128	.128
	Age	-.055	.065	-.055	-.850	.396	-.183	.073
2	(Constant)	.000	.061		.000	1.000	-.121	.121
	Age	-.022	.062	-.022	-.357	.721	-.144	.099
	GWG[a]	.330	.062	.330	5.346	.000	.208	.451
3	(Constant)	.327	.129		2.537	.012	.073	.581
	Age	.031	.064	.031	.488	.626	-.094	.156
	GWG[a]	.335	.061	.335	5.508	.000	.215	.455
	Work for pay[c]	-.427	.149	-.181	-2.871	.004	-.721	-.134
4	(Constant)	.805	.195		4.126	.000	.421	1.190
	Age	.003	.063	.003	.056	.956	-.120	.127
	GWG[a]	.362	.060	.362	6.010	.000	.243	.481
	Work for pay[c]	-.381	.147	-.162	-2.600	.010	-.670	-.092
	Exclusive BF[b] at 4m	-.587	.183	-.195	-3.216	.001	-.947	-.227

a. Gestational weight gain
b. BF, Breastfeeding
c. Work for pay, work for pay (prenatal)

Main effects model

Ultimately the main effects model consists of 3 predictor variables, exclusive breastfeeding at 4 months, work for pay (prenatal), gestational weight gain, and one socio-demographic variable, age. The main effects model explained 17.7% of variance *($F(4, 234) = 12.6, p < .001, R^2 = .177, R^2_{Adjusted} = .163$)*. Gestational weight gain was most highly correlated with increased postpartum weight retention ($\beta = .362$, $p < .001$). Exclusive breastfeeding at 4 months was the most highly inversely related to postpartum weight retention ($\beta = -195$, $p = .001$). Prenatal work for pay had a similar inverse effect ($\beta = -.162$, $p < .05$) (Table 21). See Graphs 1-3 for an illustration of the direction of interactions of main effects variables with postpartum weight retention. Age remained insignificant, ($\beta = .003$, $p = .956$). The final model was checked for Tolerance, VIFs, and violations of assumptions including outliers, normality, linearity, homoscedasticity, and independence of residuals. Normal P-P plot and Scatterplot of Standardized Residuals were not concerning; only a few outliers were identified. One outlier outside the critical value was examined and, again, found to be within naturalistic possibilities. Removing outliers in this model did little to affect the overall variance, and all outliers were ultimately retained in the main effects model.

Table 20: Main effects model summary[e] of multiple linear regression of postpartum weight retention

Final Model[d]	R	R^2	Adj. R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
Age	.06	.003	-.001	1.00	.003	.722	1	237	.396
GWG[a]	.33	.111	.103	.947	.108	28.578	1	236	.000
Work for pay[c]	.38	.141	.130	.933	.030	8.245	1	235	.004
Exclusive BF[b]	.42	.177	.163	.915	.036	10.340	1	234	.001

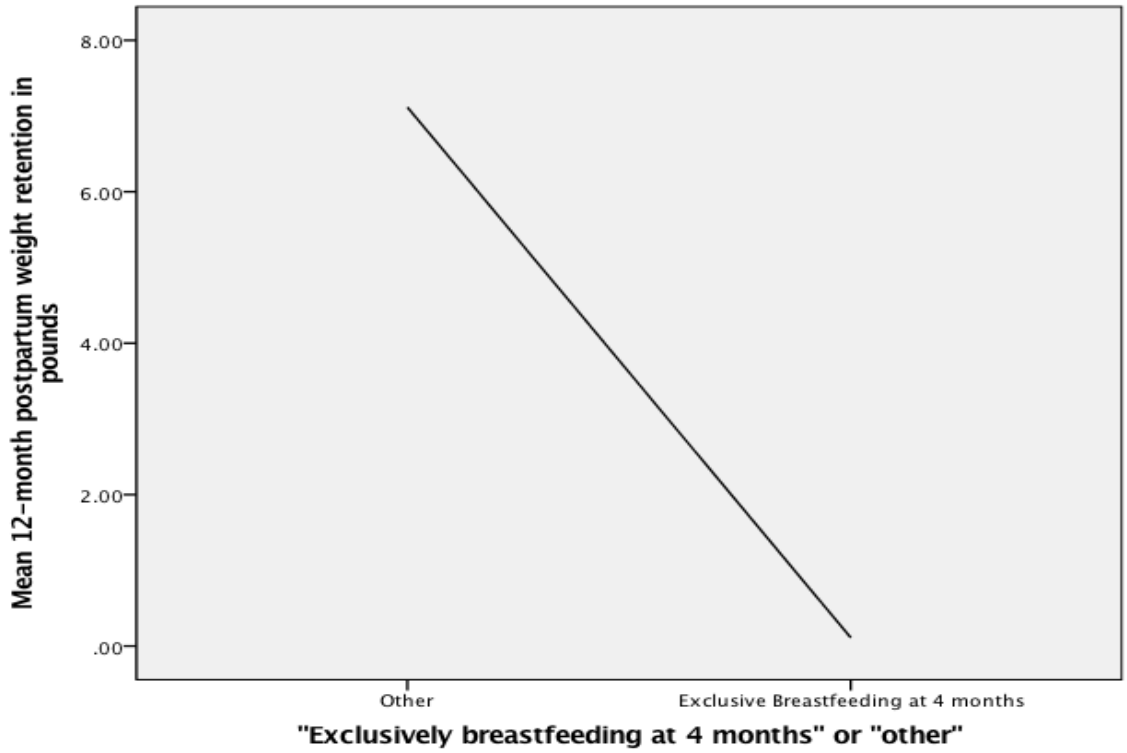
a. GWG, gestational weight gain
b. BF, breastfeeding
c. Work for pay, work for pay (prenatal)
d. Predictors: (Constant), Age, gestational weight gain, work for pay (prenatal), exclusive breastfeeding at 4m
e. Dependent Variable: postpartum weight retention

Table 21: Main effects model coefficients of multiple linear regression of postpartun weight

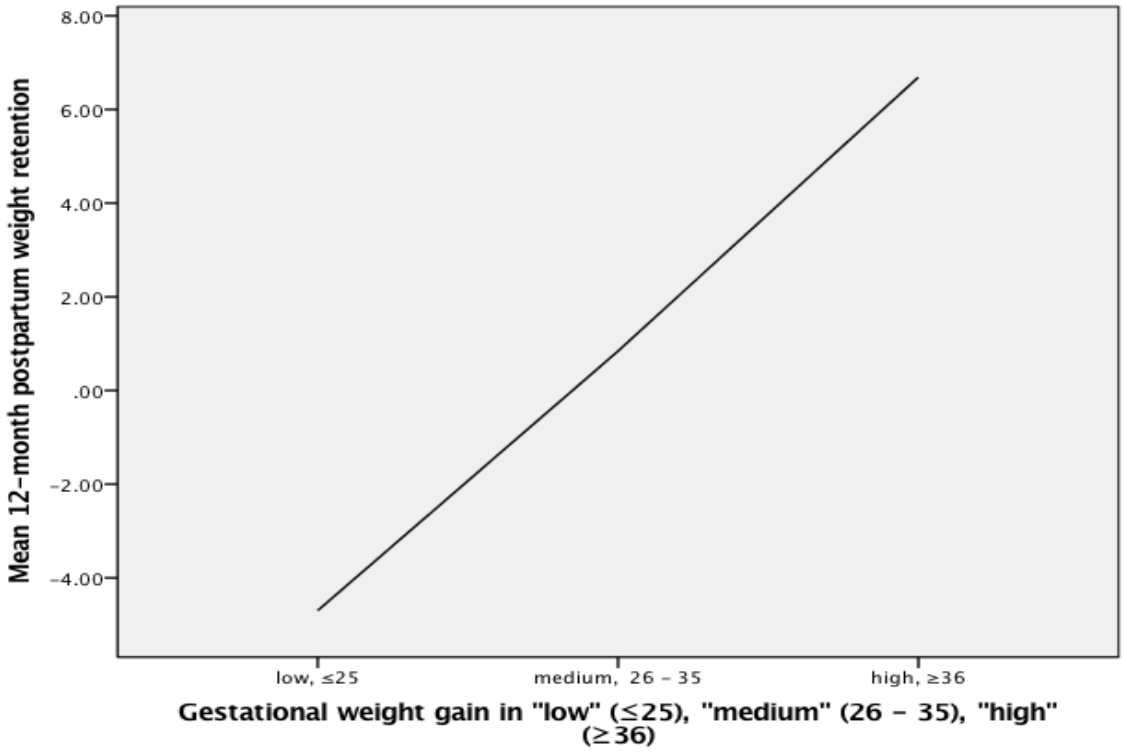
Model		Unstandardized Coefficients		Std Coefs			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	.805	.195		4.13	.000	.421	1.190
	Age	.003	.063	.003	.056	.956	-.120	.127
	GWG[a]	.362	.060	.362	6.01	.000	.243	.481
	Work for pay[c]	-.381	.147	-.162	-2.60	.010	-.670	-.092
	Exclusive BF[b] at 4m	-.587	.183	-.195	-3.22	.001	-.947	-.227

a. Gestational weight gain
b. BF, Breastfeeding
c. Work for pay, work for pay (prenatal)
d. Dependent Variable: postpartum weight retention

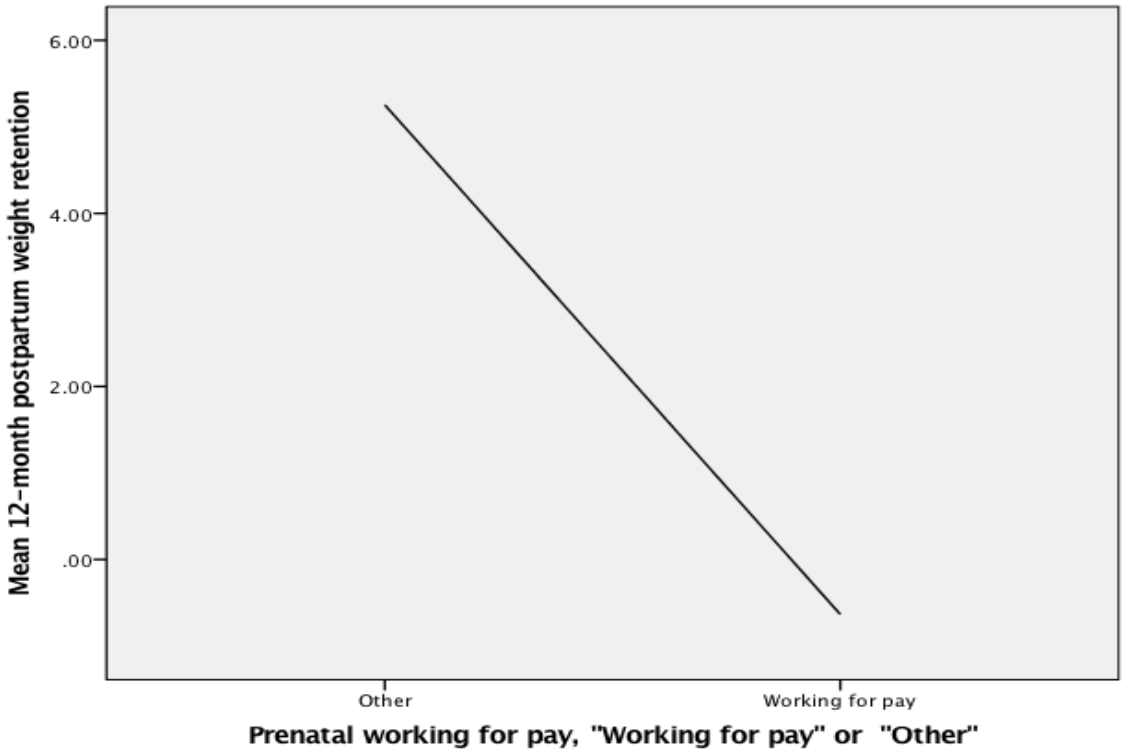
Graph 1: Means of postpartum weight retention in pounds for women who were exclusively breastfeeding or other at 4 months



Graph 2: Means of postpartum weight retention in pounds for low, medium or high levels of gestational weight gain in pounds



Graph 3: Means of postpartum weight retention in pounds for women working for pay or other (prenatal)



5. Discussion

The first objective of this study was to develop methodologies from a critical study analysis. The methodologies developed were based on an analysis preformed on a diverse, even chaotic, body of literature. The validity of this study's results and conclusions are closely tied to the initial methodological decisions that were based on this analysis. For example, in order to improve upon existing methodologies, the sample included only women who qualified for IFPSII at the 12-month point and who breastfed for at least 12 months. However, ultimately the nature of the study sample is a key constraint. Differences sampling choices, for example choosing women who breastfed for shorter or longer durations, or using a sample of women whose breastfeeding durations vary, may affect study results. Throughout the study, alterative conclusions may have been drawn with other methodological choices. The generalizability of possible conclusions from this research is therefore open to question.

5.1 Evaluation of research question

What is the relationship between an optimal breastfeeding pattern (timing of initiation within one hour of birth, and duration of exclusive breastfeeding of at least four months) and postpartum weight retention in women breastfeeding at least 12 months?

5.1.1 Early breastfeeding

Breastfeeding time of initiation was not a significant correlate of postpartum weight retention in women breastfeeding for at least 12 months any of the models in which it was included. The variable early breastfeeding was based on the WHO and UNICEF's recommendations for breastfeeding within one hour of birth (93), and, operationalized as WHO and UNICEF recommended, it had no effect in this sample.

This study sought to examine the effect of an optimal breastfeeding pattern that includes early breastfeeding on postpartum weight retention. Specifically, the study hoped to uncover any direct

relationship between early breastfeeding and postpartum weight retention. It was thought that benefits of early breastfeeding, whether from skin-to-skin contact (68), or from breastfeeding itself (67), may effect exclusive breastfeeding and therefore postpartum weight retention in the sample. The lack of effect in this sample may indicate that early breastfeeding does not influence postpartum weight retention in women who breastfeed at least 12 months. If this is the case, early breastfeeding may still be beneficial for women who do not share the characteristics of this sample. Women in the study sample were more likely to breastfeed within one hour of birth (69.8%) compared to the original sample (54.3%). If early breastfeeding is correlated with increased breastfeeding duration (2) and in-hospital exclusivity (67), it may be more influential for women who are at risk of less successful breastfeeding than for women who breastfeed at least 12 months.

Additionally, the lack of a clear and consistent "best practices" for operationalization of definitions (see section 2.5.1 Variable definitions and terms) may play a role in this study in the case of early breastfeeding. The literature used a range of different operationalized definitions for the commonly used term, 'early breastfeeding'. These include definitions of 'early breastfeeding' as short as within 10 minutes of life (92), within one hour (2, 5), or even as much as within 4 hours of birth (91). These do not necessarily reflect the WHO and UNICEF's recommendation of breastfeeding within one hour of birth for establishment and maintenance of sufficient duration and exclusivity of breastfeeding (93). Early breastfeeding has been observed to provide benefits not only if breastfeeding was initiated within one hour, but also at other time points. Therefore, it may be that operationalizing early breastfeeding as within one hour in this study was not most appropriate choice with which to reveal any such a relationship.

The IFPSII dataset offered a number of other categories for time of initiation of breastfeeding. It may be that more of the categories from which the variable was created apart from just "*< 30 minutes"* combined with *"30 - 60 minutes"* confer benefits. Other categories within a reasonable time of birth such as, *"1-2 hours"* and *"3-6 hours"* could potentially show benefits, if not the other available categories, *"7-12 hours", "13-24 hours", "1 day", "2 days",* and *"More than 2 days"* (109). Or, it may be that benefits are most dramatically conferred in the shortest of

timeframes for early breastfeeding. Perhaps "*< 30 minutes"* would be the timeframe in which the most benefits are conferred.

5.1.2 Breastfeeding exclusivity

Breastfeeding exclusivity, as indicated by the variable exclusive breastfeeding at 4 months, showed a statistically significant reduction of postpartum weight retention in the study sample. The effect persisted in the face of possible modifiers and other main effects variables. In the recent (2013) Brazilian study discussed in the literature review (66), the studies authors noted that the negative association found between breastfeeding and postpartum weight retention in their sample may be explained by a greater exclusivity of breastfeeding (larger milk production by the mothers) and longer duration. The combination of duration and exclusivity may create a greater maternal energy expenditure and therefore less weight retention (66). The large difference in postpartum weight retention in the "exclusive breastfeeding at 4 months" participants in this study, compared to those that did not breastfeed exclusively at 4 months supports the importance not only of the long duration inherent in this sample, but also high levels of exclusive breastfeeding. This combination appears protective against postpartum weight retention.

The average postpartum weight retention for women from the study sample who did not breastfeed exclusively at 4 months was 7.12 pounds. There was a statistically significant average retention of 7.01 more pounds for this group. The women who did breastfeed exclusively at 4 months had a .11 pounds average retention. The inverse relationship between exclusive breastfeeding at 4 months and postpartum weight retention remained even after adjusting for possible confounders. And, while this sample is not generalizable to the population at large, it may be generalizable to women who breastfeed at least 12 months. For these women, an average retention of ~7 pounds less could motivate breastfeeding exclusively for 4 months in addition to breastfeeding for ≥ 12 months.

In this study breastfeeding exclusivity was measured using an indicator variable of those women still exclusively breastfeeding at 4 months. The WHO and UNICEF actually recommend a minimum of 6 months of exclusive breastfeeding (69). Running analyses with an indicator variable for women who were still exclusively breastfeeding at 6 months may have helped

determine if this guideline is beneficial as recommended in this sample. However, an insufficient number of women in the IFPSII dataset breastfed exclusively for ≥ 6 months. Therefore, a meaningful analysis of women who breastfed ≥ 12 months and exclusively breastfed for ≥ 6 months was not possible in this data. In the study sample, 4 months exclusive breastfeeding was sufficient for protection against postpartum weight retention. It remains unknown if ≥ 6 months exclusive breastfeeding would offer a dose-response relationship of increased protection. Additionally, the IFPSII's small sample of women breastfeeding exclusively at 6 months may support the opinion that women in the US do not breastfeed with sufficient exclusivity and duration to obtain an accurate picture of the relationship between breastfeeding and postpartum weight retention (10), at least at the time of IFPSII data collection (2005-2007) (63).

5.1.3 Other main effects variables

5.1.3.1 Work for pay

Other main effects variables evident in this data were work for pay (prenatal), and gestational weight gain. Work for pay showed a consistent significant main effect within the study sample. However, work for pay as operationalized in this sample was a prenatal measure. Therefore, it is not a modifiable behavior for women who are pregnant and concerned about postpartum weight retention. Unlike, for example, studies that examined the time at which women chose to return to work (those who returned sooner were significantly more likely to retain less weight at 6 months postpartum) (29, 32). However, generally work related variables were seldom explored in terms of their relationship to postpartum weight retention in the literature reviewed for this thesis. Even when they were explored, they were not always significant correlates of weight retention (22). There may be more appropriate variables to study that represent modifiable behaviors related to work. Additionally, the mechanism for how prenatal work for pay is protective against postpartum weight retention in this thesis is unclear. And, while this variable is protective in this study's select sample, it is not known if it would be correlated with less postpartum weight retention in a more representative sample.

5.1.3.2 Gestational weight gain

Gestational weight gain showed the largest significant impact on study sample participants. This supports the consistent high correlation between increased gestational weight gain and increased postpartum weight retention throughout past literature (37, 96). However, it may be, as Dujmović et al. (37) found in their sample of Croatian women, that a high exclusivity of breastfeeding in addition to a long breastfeeding duration mitigated, somewhat, the strong effect ($\beta = .362$) of high gestational weight gain. Gestational weight gain accounted for 10.8% of the 17.7% of variance explained by the final model. This supports gestational weight gain as a primary focus for women concerned about avoidance of postpartum weight retention. Even women in unique subgroups such as this study's sample are impacted by its effect. Given gestational weight gain's observed correlation with postpartum weight retention in both the short and long term (19), the importance of avoiding excessive gestational weight gain to protect against future overweight or obesity is paramount.

5.1.3.3 Other potential predictors

Some variables that were expected to potentially affect postpartum weight retention showed inconsistent or no association in this sample. One notable example is age, a variable for which analyses are often adjusted (16, 38, 95, 102). Age may sometimes be associated with postpartum weight retention (15, 21, 56). But it is not always found to be associated (7). Age in this data had no effect on postpartum weight retention, nor did any of the other socio-demographic variables.

Pre-pregnancy weight or pre-pregnancy body mass index is often considered a moderator of postpartum weight retention (14, 24, 35, 100). In this study, as in Haiek et al. (14), pre-pregnancy weight was not retained for final analyses. Pre-pregnancy weight did show a significant effect in one model. However, that effect disappeared after the addition of gestational weight gain to the model. As gestational weight gain has consistently been observed as strong influence on postpartum weight retention, it may be that its contribution is more important than other weight-related data. The other component of body mass index, height, showed no effect in the study sample. This may support the importance of separating height and weight in order to

avoid misleading conclusions in the analysis, instead of combining them into one body mass index variable (101).

In this study, there was no correlation between parity and postpartum weight retention. This disagreed with prior findings indicating that parity was somehow correlated with weight retention. In several examples of past literature having a first child was correlated with substantial postpartum weight retention (22, 79), whereas having more children was negatively associated with weight retention (16, 18).

5.2 Limitations

5.2.1 The sample

The main source for this section is Fein et al. (63). Fein et al. identify the principle limitation of the IFPSII as being non-representative of the socioeconomic demographics of the United States. It therefore may not generalized to the population at large. Further, the IFPSII sample was drawn from a consumer panel. This technique helps identify participants across the US more likely to continue to complete repeated questionnaires than a random population sample. However, it may create a biased sample. Women in IFPSII were older, more educated, of higher socioeconomic status, more likely to be white, English-literate, and employed than the general population. Women who were more likely to be non-smokers, have lower parity, and initiate and have longer duration breastfeeding were also overrepresented in the IFPSII sample. Prohibitive costs of randomly sampling pregnant women was a barrier to accessing a comparably large but more representative sample. All of these limitations are also true of this study's sample. These limitations may be amplified in the study sample.

5.2.2 Issues with the dependent variable

This study's dependent variable was postpartum weight retention. Weight was self-reported in the IFPSII (63). As in any study where weight is self-reported, there is possibility for bias (110). The reported weight measurements used to calculate postpartum weight retention as well as reported pre-pregnancy weights may be subject to participant error or misrepresentation. Self-reported weight bias may especially happen in overweight and obese individuals. Women in Rowland's

1990 study who would be classified as obese (under current classifications) reported weights that were on average 3.4 kg under their actual weight. Some researchers consider the potential to underreport weights problematic, "[a]n underestimate of 5 kg may overestimate gestational weight gain by almost 50%, and an error of 1 kg may overestimate postpartum weight change by more than 100% to 200%" (79 p. 3 author's manuscript). Others do not consider the differences that may occur due to self-reporting to be of concern. These researchers assume that the underreporting would apply relatively equally to each individual's weight data at each data collection point in a longitudinal study (22).

Weight changes during the study period may also have been influenced by variables identified in other research that were not accounted for within the IFPSII dataset. Levels of exercise/physical activity, dieting, smoking, and other factors may play a role in postpartum weight retention (7). Physical activity has been considered in the literature for its potential to aid fat loss (111). Additionally, failure to account for dieters has been raised as a criticism of past studies (7). Without a complete picture of sample participants' lives it is not possible to draw thorough conclusions about complex systems. As illustrated in Figure I the factors involved in postpartum weight retention are many and the interactions may be complex.

5.2.3 Terms and operationalization

Terminology and operationalization was as much of an issue in this study as in its predecessors. The problems of operationalization stem not only from the terms themselves, but also from the dataset. The IFPSII dataset's variables often contained specific categories for participants to choose from describing aspects of their infant feeding behaviors. These categories did not always correspond precisely to operationalized definitions elsewhere. Sometimes the IFPSII's questionnaires offered more choices than other commonly used operationalized definitions. When creating variables based on operationalized definitions from past literature, information was discarded that may have been useful for analysis.

5.2.3.1 Early breastfeeding

Section 2.3.1 Timing of initiation, notes a number of different initiation times that have been considered in the past when looking at early breastfeeding. This study examined a variable operationalized based on WHO and UNICEF's recommended timeframe of initiation within 1 hour of birth alone. However, as IFPSII had categories ranging from "*< 30 minutes"* to *"More than 2 days"*, a wide variety of other operationalizations could have been explored. Due to this study's narrow sample, however, exploring these categories within the study sample may not have offered a clear picture of how or if different operationalizations affected research outcomes. A more generalizable sample may have been more appropriate in order to have the variability necessary to truly explore early breastfeeding's possible operationalizations.

5.2.3.2 Breastfeeding exclusivity

Breastfeeding exclusivity could also have been measured in a number of different ways. Several studies used lactation scores in order to measure breastfeeding exclusivity (20, 21, 24). The majority of articles cited by Neville et al. (7) finding a significant relationship between breastfeeding and postpartum weight retention used a lactation scale or similar methods. An argument could be made that in order to incorporate methodological improvements by creating a high quality variable, a lactation scale of some kind would be necessary. Many of the scales used were designed to account for both exclusivity and duration of breastfeeding, as in Østbye et al. (25). As this study constrained for duration initially, designing a lactation scale in this way would be redundant. Lactation scales that account for only exclusivity were not regularly modeled in past studies. Therefore, as in Sharma et al. (80), breastfeeding exclusivity was based on the 2005 AAP breastfeeding guidelines (the guidelines in effect at the time of data collection). The 2005 AAP guidelines indicated that some infants may need complimentary foods as early as 4 months despite the exclusivity recommendation of 6 months. Therefore this study used a conservative measure modeled after Sharma et al. when creating the variable of exclusive breastfeeding for 4 months (80). However, other operationalizations could have generated different results.

The IFPSII does not have a specific definition of exclusive breastfeeding readily accessible in their description of practices (63). Questionnaires asked detailed questions about what and how much mothers feed infants in the past 7 days (see Appendix II for the month 2 questionnaire as an example). It is assumed that the IFPSII authors created exclusive breastfeeding variables from these details. However, their codebook does not indicate the parameters they used to define the term exclusive (109). Therefore, this study is also subject to limitations regarding term definitions.

5.2.3.3 Gestational weight gain

Gestational weight gain was self-reported. Again, self-reported weights may be subject to bias and have the potential to skew analysis results (110). However, gestational weight in this case had a predictable effect in line with other literature (37, 96) regardless if that literature used self-reported or measured weights. It may be, therefore, that gestational weight gain self-report was not overly affected by bias in this sample.

5.2.3.4 Work for pay

It is unclear how prenatal working for pay is protective against postpartum weight retention. An argument could be made that prenatal work for pay as operationalized in this study may be a marker of a specific lifestyle. Working prenatally could be indicative of an individual with more activity and engagement outside the home. Such a lifestyle could be associated with reduced postpartum weight retention. Potentially those women who are more active outside the home engage in more physical activity in general. Greater physical activity could affect postpartum weight retention, as exercise (58) may influence weight retention. Or, perhaps psychosocial factors are at play. It is possible that women who feel more fulfilled and happy practice self-care that leads to lower weight retention. Alternately, the reverse argument could be made. If breastfeeding duration and exclusivity is important to reducing postpartum weight retention, an active work-life outside the home may interfere with breastfeeding. In which case, it would be expected to interfere with loss of gestational weight.

5.2.3.5 Other variables and terms

The health promotion orientation variable as it was created may be a poor indicator of health promotion orientation. It measured one behavior, that of prenatal vitamin consumption. A more accurate indicator may be available in the IFPSII dataset, or may be able to be developed for future studies. Ideally a health promotion orientation variable would account for health-promoting tendencies over multiple time points.

Additionally, the depression scale may not be the most accurate reflection of participant's depression levels. The Edinburgh Postnatal Depression Scale as a 10-item scale has been called into question in its original form (112). It has been suggested that an 8-item version may be more robust (112).

Finally, the term "postpartum weight retention" is used ubiquitously throughout breastfeeding literature. In breastfeeding literature it generally refers to any weight in excess of pre-pregnancy weight that is still retained at 12 months after giving birth. This term was used and defined in the same way in this study in order to be comparable to other studies. However, the biomedical definition of the postpartum period specifies postpartum as being 6-8 weeks after giving birth (113). The term 'postpartum weight retention' operationalized as it was in this study is imprecise compared to the biomedical definition. Postpartum here is referring to a significantly larger time period. The time period encompasses but also surpasses the biomedical 6-8 week definition. Therefore, using the term postpartum weight retention to mean weight retained after one year may cause unnecessary confusion. Breastfeeding and postpartum weight retention research may be of interest not only to social scientists, but also medical professionals. Refining the definition of postpartum weight retention may aid cross-disciplinary utility.

5.2.3.6 Insufficient exploration

Some variables that may have had an effect on postpartum weight retention could not be examined. For example, the sociodemographic variable for race/ethnicity. Race/ethnicity was explored in descriptive analyses. It was also run in the initial model. But, it was not statistically significant. Additionally, an imbalance in the races and ethnicities was present in the study sample. Therefore, it was not retained as a modifier. It was considered far too imbalanced to offer meaningful conclusions.

Also, it would have been helpful to explore diet as a potential modifier in the study sample. Two assessments of maternal diet were sent to participants as part of IFPSII (63). One was sent late in pregnancy and one at ~4 months postpartum (63). For comparative purposes, the study also included a separate assessment of the diet of a sample of non-pregnant, non-postpartum women of childbearing age (63). The dietary assessment tool during IFPSII used was National Cancer Institute (NCI)'s Diet History Questionnaire (63). A total of 2 070 of 3 361 Diet History Questionnaires that were returned on time by potential participants who met the comparison group criteria and were retained. However, the Diet History Questionnaire data were not included as a part of the IFPSII dataset. Diet therefore, was not analyzed in this study.

Additionally, available measures in the IFPSII dataset may not have been the best measures with which to determine breastfeeding's relationship with postpartum weight retention. IFPSII used weight measures in its data. It may be that measuring weight is not sufficient to observe the entire picture of the effect of breastfeeding on postpartum weight retention. Past literature has pointed to other possible measures. For example, total energy expenditure, basal metabolic rate, sleeping metabolic rate, and minimal sleeping metabolic rate have been observed to be elevated in pregnant or lactating women (114). These are measures of increased energy and carbohydrate-specific expenditures (114). It may be that examining total energy expenditure and metabolic rates provides a richer indication of breastfeeding's effect on postpartum weight retention. Or, it may be that looking at weight alone is insufficient when considering women's health even when related to obesity. Other measures may need further exploration. For example, waist circumference has potential for specific importance for mortality compared to weight or body mass index (115).

6. Recommendations for future research

6.1 Early breastfeeding

More research on early breastfeeding may be valuable in order to verify that the WHO's and UNICEF's recommended 1 hour timeframe is most highly correlated with the benefit of increased breastfeeding success noted in past studies (2, 5). When the optimal timeframe is confirmed or refined, further study into the relationship between optimal early breastfeeding and postpartum weight retention would be helpful. Further research can determine if a relationship exists when appropriate measures and methods are employed. One such methodological consideration would be using a sample that includes women for whom breastfeeding behavior varies in the initiation time, duration, and exclusivity, but who have sufficient long-term (at least 6 – 12 months) follow-up weight data. This would allow for a more nuanced comparison between time of initiation, duration and exclusivity of breastfeeding, and ultimately postpartum weight retention.

6.2 Breastfeeding exclusivity

It is important to flesh out the relationship between breastfeeding exclusivity and postpartum weight retention. In order to determine if the WHO recommendations for exclusive breastfeeding of at least 6 months (69) is also beneficial for reducing postpartum weight retention, studies must be able to compare women who exclusively breastfed ≥ 6 months with those who breastfed exclusively for < 6 months. A shorter duration of exclusive breastfeeding may be sufficient, as it was in this sample. In order to determine if a dose-response relationship between exclusive breastfeeding and postpartum weight retention exists, larger samples may be necessary. The same is true in order to determine if exclusive breastfeeding for ≥ 6 months is more protective than exclusively breastfeeding for ≥ 4 months. Sample sizes of women exclusively breastfeeding ≥ 6 months must be increased to make meaningful analyses possible.

Generally more research looking at the role of exclusive breastfeeding is necessary. In light of other studies that found exclusive breastfeeding for several (3) months to be significantly associated at 12 months with lack of weight retention, but who did not find that the number of weeks of exclusive breastfeeding predictive of weight retention in all women (19), more research is needed to determine the nature of the relationship between breastfeeding exclusivity and weight retention.

Data from the IFPSII were collected 2005 – 2007 (63). Breastfeeding habits could have improved in subsequent years. Although, there is some indication that US breastfeeding rates are still subpar despite recent increases (71). If there are still insufficient numbers of women breastfeeding for long durations at high intensities, extremely large samples may be necessary. Future US studies may consider collecting data in samples as large or even larger sample than the IFPSII in order to gather enough participants with characteristics that allow for meaningful analyses of the WHO recommendations in a US sample.

6.3 Work for pay

There is lack of clarity around the mechanism by which work for pay prenatally protects against postpartum weight retention. Therefore further research is needed to determine how prenatal work for pay protects against weight retention and if this variable has practical value for women. Additionally, further quantitative analyses into the main effects and potential moderating effects of lifestyle factors on postpartum weight retention are of value. Factors such as working for pay or time of return to work after giving birth may be indicative of broader lifestyle patterns that influence health behaviors. These factors may also affect weight as well as overall life satisfaction. Qualitative analyses may also be of use to determine how broader lifestyle patterns or lifestyle satisfaction affect women's breastfeeding behaviors, or postpartum weight retention directly. For example, it may be helpful to determine any effects of spending significant amounts of time outside the house. Does it interfere with or promote breastfeeding success including

exclusivity? Further, does it affect postpartum weight retention? Additionally, if the woman feels engaged meaningfully outside the house, or not, could be a worthwhile component of study.

6.4 Gestational weight gain

Because gestational weight gain is consistently the most influential variable in postpartum weight retention, it is vital to retain this variable in future analyses. It is also necessary to search for any behavioral factors that mitigate its effects, as breastfeeding and prenatal work for pay did in this sample. While it is important for women to be informed and encouraged to reduce their gestational weight gain, there are some women who will still have higher than recommended gestational weight gains. These women are a target sub-population. It is perhaps they, more than any other group, who need to know the best options for reducing postpartum weight retention.

6.5 Other recommendations

Weight retention for women after giving birth is an extremely complex and multi-faceted topic. The amount of variance explained from this study was only 17.7%. While certainly biophysical and genetic factors account for some of postpartum weight retention patterns and may not be modifiable, behaviors may be. Identifying other major protectors against postpartum weight retention is vital. It is especially important to pinpoint those representing modifiable behaviors. This can only be achieved through continued exploration of variables and how they interact with each other. Continuing to examine the breastfeeding behaviors above as well as looking broadly at work-related variables, diet, exercise, and other lifestyle factors is still necessary.

In the context of one such lifestyle factor, depression, it may be beneficial refine measurement techniques. Exploring the Edinburgh Postnatal Depression Scale as a modified 8-point scale may be considered. The 8-item version may be more effective (112) in obtaining a clearer picture of any role depression plays in breastfeeding and in postpartum weight retention. Alternately, comparing the 8-point with the standard 10-point scale may be helpful in order to determine if one scale is indeed superior for weight retention studies.

Additionally, it would be worthwhile to develop and explore more involved indicators of health promotion orientation. Identifying these indicators would enable researchers to better determine if women's health promotion orientation affects breastfeeding behaviors and if women with health promotion orientations retain less postpartum weight. It may also enable researchers to identify positive deviants. The study of positive deviants could help identify other personal resources empowered women may be using, especially protective modifiable behaviors.

Not only is determining those modifiable behaviors that are most protective against postpartum weight retention necessary, but the operationalizations for variables representing common beneficial behaviors should also be optimized. Research testing different operationalizations within the same dataset to determine if different operationalizations change analysis results could be of use. The definitions most likely to provide valid and reliable measurement and analysis may be identified in this way.

The importance of determining the best ways to operationalize dimensions of breastfeeding cannot be underestimated. Breastfeeding's effect on postpartum weight retention will continue to be uncertain unless high quality operationalizations of the dimensions of breastfeeding are consistently used. There is room for improving how concepts and variables are defined and measured. Coming to a consensus on which terms to emphasize and which terms to retire could collapse the redundancies in such commonly used vocabulary as 'mixed' (25) , 'partial', (36), 'or 'combination' (35) and reduce confusion. Also, standardized operationalizations and refined commonly used terms used consistently across studies would enhance the coherence of the literature. For example, the commonly used term postpartum weight retention could potentially be replaced with a term that more appropriately describes the weight retained in the 12-month period after giving birth. This would reduce confusion and increase cross-discipline readability. If a set of standardized definitions cannot be agreed upon, the operationalization of terms should be clearly stated in the methodology. If neither of these occurs, future researchers' abilities to attempt to replicate results will remain impeded.

Additionally, larger sample sizes would help gather enough participants who are breastfeeding exclusively for sufficient lengths of time to make meaningful comparisons. Moreover, larger

samples are beneficial for gathering information from different races, ethnicities, education levels and socioeconomic statuses. Ultimately, larger, more inclusive samples would allow any findings to be more generalizable to the population as a whole.

Current breastfeeding recommendations naturally focus on the best-case scenario for the infant. For example, in addition to WHO's and UNICEF's recommended initiation of breastfeeding within 1 hour of birth, the WHO's current recommendation for duration of breastfeeding is continued breastfeeding along with other appropriate foods for two years or more (69). While this guideline may be best for the infant, it may not the best goal for US women. Overly ambitious goals may be ultimately demotivating to women who could otherwise be invested in breastfeeding for a considerable length of time. Ultimately as much breastfeeding as possible may benefit both the mother and the infant. Woman, therefore, should be encouraged with manageable goals.

Furthermore, while the importance of best practices for infant care is paramount, some mothers may also be motivated by practices that promote their own health. It could be that maternal health promoting practices overlap with or are different from those practices best for the infant. Offering information specific to each may be helpful to motive women differently, potentially encouraging better breastfeeding practices regardless of what motivates an individual.

6.7 Practical implications

While this study cannot be generalized to the population at large, it can potentially be generalized to other women who breastfeed at least 12 months. This study's results reinforce the importance of minimizing gestational weight gain for reducing postpartum weight retention. Additionally, this study also supports the possibility of a contribution of breastfeeding to reduce postpartum weight retention. Specifically this study indicates women who breastfeed for at least 12 months may experience a modest but statistically significant reduction in postpartum weight when they

breastfeed exclusively for at least 4 months. This study also points to the possibility of other lifestyle factors influencing postpartum weight retention. Prenatal work for pay may also be correlated with weight retention in other women who breastfeed for long periods, as it was in these data. It may be indicative of broader lifestyle patterns that can be studied in similar samples.

If future studies within samples that are generalizable to the population at large were to have similar findings, the implication for exclusive breastfeeding of 4 months making a difference in postpartum weight retained might offer a specific and more achievable goal than the WHO's recommendation of ≥ 6 months of exclusive breastfeeding F (69). Breastfeeding exclusively for 4 months may be perceived as more manageable than doing so for 6 months. Educating women with information that allows them to make realistic goals for their health is inherently health promoting. The potential for reworking recommendations for women to make them more realistic is vital for encouraging women's empowerment within the context of their health. Not all women are motivated to breastfeed by health benefits to their child and themselves. Some women may instead be motivated to breastfeed in order to avoid possible negative consequences associated with postpartum weight retention, including increased risk of obesity.

6.8 Conclusions

This study aimed to determine if is there a significant relationship between breastfeeding and postpartum weight retention. It explored the relationship between an optimal breastfeeding pattern (timing of initiation within one hour of birth, and duration of exclusive breastfeeding of at least four months) and postpartum weight retention in women breastfeeding at least 12 months.

This study suggests that among American women who breastfed a minimum of 12 months, minimizing the amount of gestational weight gained and breastfeeding exclusively for four months or more may protect against postpartum weight retention.

Despite numerous health benefits associated with early initiation of breastfeeding in the literature, this study failed to find a protective effect of early breastfeeding in this sample. However,

breastfeeding was not immaterial in this sample. Women who were still exclusively breastfeeding at 4 months retained less postpartum weight. Women who worked for pay during the prenatal period (rather than those who were on leave or unemployed) also had lower postpartum weight retention. Breastfeeding exclusively at 4 months and prenatal work for pay both had modest effects but clearly reduced postpartum weight retention in the study sample. Gestational weight gain was the single most influential variable. Increased gestational weight gain was associated with increased postpartum weight retention.

This thesis supports results from prior literature that indicated breastfeeding of sufficient duration and exclusivity reduced postpartum weight retention. It also supports literature that indicates minimizing gestational weight gain is important for lower postpartum weight retention.

Future research may expand upon the findings of this study. Future breastfeeding and postpartum weight retention researchers may wish to focus on improving methodologies including terminology and operationalizations for this discipline. They may desire to tease out the optimal breastfeeding patterns for protection against postpartum weight retention, including how long it is necessary to breastfeed exclusively, and if early breastfeeding impacts women's weight retention in samples that have a greater variety of durations of breastfeeding. They may want to explore the effect of women's working habits outside the home on breastfeeding and on postpartum weight retention. Additionally, they may wish to seek out other modifiable behaviors that mitigate the impact of gestational weight gain on women's postpartum weight retention.

This study supports breastfeeding as a health promoting action, not only for the infant, but also for the mother. Health promoters may wish to proffer conclusions based on high quality breastfeeding and postpartum weight retention studies to women considering breastfeeding. Using information from high quality studies, women can educate themselves by understanding the nuances and complexity of breastfeeding. This will empower them to make realistic goals for durations of breastfeeding and exclusive breastfeeding and to have realistic expectations of breastfeeding's affect on postpartum weight retention.

Appendices

Appendix I. Informed consent: Synovate Consumer Opinion Panel

To access all IFPSII materials, see (39).

What ***if*** ***I can't finish every survey on time?***

We understand that occasionally life just gets too hectic. It will be important for you to complete the surveys when you receive them so that your baby will be the right age. But if you are late with a survey, it's best to go ahead and send it when you can. You will receive a gift for every survey we receive from you.

What if I lose one of the surveys?

If you lose one of the surveys, call us at 1-800-745-4267 and we will send you a replacement right away.

Are there rewards/incentives?

Becoming a part of Project FIRST, you will receive a gift each time you return a questionnaire to us.

How do I know that you'll protect my privacy?

Project FIRST has been approved by the FDA, which has found that our privacy protections are strong enough to assure that you will not be identified in any results. We are required by both our rules and the FDA privacy protections to keep all identifying information strictly here at Synovate and not to give out to any one any information that could allow you to be identified.

Our pledge to you and to all of our panelists is that:

- You will never be asked to buy anything or contribute to any organization.
- We will never sell or send your name (or any other information) to another party that might want to sell you anything.
- Any information you provide will be combined with responses given by others. Individual information will always be kept strictly confidential.
- Should you decide not to participate in a particular study or discontinue your Panel membership, we will respect your decision to do so.

Enrollment is FREE. To ensure that you are involved at every step of Project FIRST, we need your current telephone number, which we have asked for on the questionnaire.

Feeding
Infants
Research
STudy

First

Are you…

…willing to be a part of a special group of expecting women?

…willing to share your experiences as an expecting and new mother?

…willing to participate in an important research study that will really make a difference in the lives of future new mothers and babies?

If you answered 'yes' to the questions above, then complete the enclosed questionnaire to become a member of **Project FIRST!**

synovate
Consumer Opinion Panel

What is Project FIRST?

Project FIRST (Feeding Infants Research STudy) is a 15 month research study of mothers-to-be and mothers of babies. The study will ask about your pregnancy and how you are feeding and caring for your baby during the baby's first year. The information you provide will be used to help the Food and Drug Administration (FDA) understand the real-life experience of feeding and caring for a baby and to help them develop programs for other new mothers. By becoming a member of Project FIRST, you'll be part of a very special community of women throughout the United States, and we'll send you a gift for every questionnaire we receive from you.

Why is the FDA collecting this information?

The people who work at the FDA are dedicated to safeguarding and improving the health and well being of mothers and children. The FDA ensures the safety of all types of baby foods and most other foods, and it regulates breast pumps. The FDA also educates the public about healthy habits. Learning as much as they can about how today's moms care for their babies helps FDA understand how their policies affect mothers and babies and helps them develop programs that will meet the needs of future moms and babies.

Who uses this information?

Information about the mom's real-life experiences of caring for and feeding their babies helps FDA understand what foods mothers are feeding their babies, when they make feeding changes, why they make feeding choices, and where they go to learn more about feeding babies. And, because Project FIRST collected this same kind of information about 10 years ago, FDA can compare the experiences of a new generation of mothers with those of mothers in the past.

Why am I being asked to participate?

The FDA selected Synovate to conduct this study because of the many different kinds of women who make up the Synovate Consumer Panel. One of the major goals of Project FIRST is to collect information from all kinds of moms across the United States, including those who work and those who stay home after their baby has been born, those who have other children and first-time moms, and those who formula feed and those who breastfeed their baby. The more moms that join Project FIRST, the better the results will show the experiences of all types of mothers.

What kind of commitment is involved?

The last months of pregnancy and the first months of a baby's life can be one of the most hectic times women face, and we promise to make participating in Project FIRST during your baby's first year as easy as possible for you.

We will need to know when your baby is born, so we will call you about the time you expect to deliver. After that, all surveys will be by mail. Because we want detailed information, we will ask you to update us nearly every month until your baby is a year old. After the first few surveys, filling them out should not take much time because many of the questions are the same. It will take most people between 10 and 30 minutes to fill out each survey, depending on how many of the questions apply to your situation. You will also have an opportunity to answer a survey about the foods you eat while you are pregnant and a few months after your baby's birth.

Appendix II. Example of questionnaire, month 2

To access all additional questionnaires, see (39).

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.

	NEVER	ONLY RARELY	EVERY FEW DAYS	ABOUT ONCE A DAY	AT MOST FEEDINGS	EVERY FEEDING
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.

7. How often does your baby drink all of his or her bottle of formula?

Never ☐ Rarely ☐ Sometimes ☐ Most of the time ☐ Always ☐

8. 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 ☐

9. 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 ☐

10. 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
☐	☐	☐	☐	☐	☐

P.O. Box 5030 Chicago, IL 60680 ✦ Toll Free: 1-800-745-4267 ✦ Email: marie@synovate.net ✦ www.GlobalOpinionPanels.com

11. 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 ☐

12. 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.

13. Does your baby usually feed from both breasts at each feeding?

Yes ☐ No ☐ Baby is only fed pumped milk ☐ **➔(GO TO QUESTION 16)**

14. Does your baby usually let go of the breast him or herself?

Yes, both breasts ☐ Yes, first breast only ☐ Yes, second breast only ☐ No ☐

15. 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 ☐

16. In an average 24-hour period, what is the LONGEST time for you, the mother, between breastfeedings 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

17. 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)**

18. 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 ☐

19. 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

20. 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 a cold or other respiratory symptoms ☐
To ease colic ☐ To ease an illness other than a cold or
To ease digestion ☐ respiratory symptoms ☐
To ease fussiness ☐ To stimulate the baby's immune system ☐
To help the baby relax ☐ 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 ☐ ➔**(CONTINUE)** No ☐ ➔**(GO TO SECTION E ON PAGE 7)**

2. Have you completely stopped breastfeeding and pumping milk for your baby?
Yes ☐ ➔**(CONTINUE)** No ☐ ➔**(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 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 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
☐	☐	☐	☐	☐

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
☐	☐	☐	☐	☐

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 ABOUT BREASTFEEDING	INFORMATION ABOUT MY DIET WHILE BREASTFEEDING	INFORMATION ABOUT BREAST PUMPS	NO INFORMATION FROM THIS SOURCE
Doctor or physician assistant	☐	☐	☐	☐
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 www.4woman.gov	☐	☐	☐	☐
The web site www.womenshealth.gov	☐	☐	☐	☐
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?

	VERY UNCOMFORTABLE (1)	(2)	(3)	(4)	VERY COMFORTABLE (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 ..... ☐➔ **(CONTINUE)** No..... ☐➔ **(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?

NOT AT ALL CONFIDENT (1)	(2)	(3)	(4)	VERY CONFIDENT (5)
☐	☐	☐	☐	☐

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."

	EAT MORE	EAT LESS	EAT ABOUT THE SAME	DID NOT EAT BEFORE OR NOW
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.

	THE FOOD IS NOT HEALTHY FOR MY BABY	TO PREVENT FOOD ALLERGY IN MY BABY	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	☐	☐	☐	☐	☐
Any herbal or botanical supplement	☐	☐	☐	☐	☐

9. 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 any 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	☐	☐	☐	☐	☐	☐
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 go to my baby and breastfeed him or her during my work day ..... ☐
My baby is brought to me to breastfeed during my work day ..... ☐
I pump milk during my work day and save it for my baby to drink later ..... ☐
I pump milk during my work day, but I do not save it for my baby to drink later ..... ☐
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	☐	☐	☐	☐
I thought that my baby was not gaining enough weight	☐	☐	☐	☐
A health professional said my baby was not gaining enough weight	☐	☐	☐	☐
I didn't have enough milk	☐	☐	☐	☐
My nipples were sore, cracked, or bleeding	☐	☐	☐	☐
My breasts were infected or abscessed	☐	☐	☐	☐
Breastfeeding was too painful	☐	☐	☐	☐
Breastfeeding was too tiring	☐	☐	☐	☐
I was sick or had to take medicine	☐	☐	☐	☐
Breastfeeding was too inconvenient	☐	☐	☐	☐
I wanted to be able to leave my baby for several hours at a time	☐	☐	☐	☐
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	☐	☐	☐	☐

Section D-2: Breast Pumps

14. Since your baby was born, have you ever pumped or tried to pump milk? (Include expressing breast milk in any way as pumping milk.)

Yes, but I did not get any milk... ☐ Yes, and I got milk ... ☐ No..... ☐ ➔ **(GO TO SECTION E ON PAGE 7)**

15. How old was your baby the first time you pumped or tried to pump milk?

_____ DAYS **OR** _____ WEEKS

16. How have you pumped or expressed milk since this baby was born? **(PLEASE "X" ALL THAT APPLY)**

Electric breast pump ..... ☐
Combination electric and battery operated breast pump ..... ☐
Battery operated pump ..... ☐
Manual breast pump (no batteries, no cord to plug in) ..... ☐
By hand (without using a pump) ..... ☐

IF YOU HAVE USED A BREAST PUMP SINCE THIS BABY WAS BORN, PLEASE CONTINUE. ALL OTHERS GO TO SECTION D-3 ON PAGE 6.

17. How many breast pumps have you used since this baby was born? Count all the pumps you have used even if they are the same type and style.

1..... ☐ 2..... ☐ 3..... ☐ 4 or more..... ☐

18. What type of breast pump do you use most often?

Electric breast pump ..... ☐
Combination electric and battery operated breast pump ..... ☐
Battery operated pump ..... ☐
Manual breast pump ..... ☐

19. How did you get the breast pump that you use most often?

I bought it ..... ☐
It was given to me as a gift ..... ☐
I rented it ..... ☐
I got it from WIC ..... ☐
I borrowed it from a friend or relative ..... ☐
I borrowed it from my place of work ..... ☐
I use one provided by a hospital, my place of work, or another place ..... ☐

20. Was the breast pump you use most often new or used when you got it or began using it?

New ..... ☐ Used ..... ☐ Not sure ..... ☐

21. How did you learn to use the breast pump you use most often? (**PLEASE "X" ALL THAT APPLY)**

- I read the printed directions that came with the pump ☐
- I got instructions for the pump from the internet ☐
- I watched a video about how to use the pump ☐
- A lactation consultant, WIC staff, nurse, or doctor showed me how to use it ☐
- A friend, relative, sales clerk, or other person showed me how to use it ☐
- I figured it out without directions or being shown how ☐

22. Using 1 to mean "Very Dissatisfied" and 5 to mean "Very Satisfied," how satisfied are you with the performance of the breast pump that you use most often?

VERY DISSATISFIED				VERY SATISFIED
1	2	3	4	5
☐	☐	☐	☐	☐

23. Have you been hurt by any breast pump that you used or tried to use to express milk since this baby was born?

Yes ..... ☐ No ..... ☐ **➔(GO TO QUESTION 27 ON THIS PAGE)**

24. What type of pump hurt you? (**PLEASE "X" ALL THAT APPLY)**

- Electric breast pump ☐
- Battery operated pump ☐
- Combination electric and battery operated breast pump ☐
- Manual breast pump ☐

25. In what way were you hurt? (**PLEASE "X" ALL THAT APPLY)**

- Nipple injury from the pump ☐
- Sore nipples from the pump ☐
- Infection from a pump injury ☐
- Pressure bruise ☐
- Other **(SPECIFY)** ☐ _____

26. Did you go to a medical doctor, lactation consultant, or other health professional because of the injury?

Yes ..... ☐ No ..... ☐

27. Have you had any of the following problems with a breast pump that you used to express milk since this baby was born?

	YES	NO
Pressure or suction from the pump was hard to release	☐	☐
Pump was uncomfortable or painful to use even though it did not cause injury	☐	☐
Pump had a bad seal or milk got into the motor or other place it should not be	☐	☐
Could not get pump to work or to express any milk	☐	☐
Pump worked, but did not get enough/much milk	☐	☐
Pump worked, but it took too long to get enough milk	☐	☐
Pump worked for a while but then quit working	☐	☐
Pump had another problem (SPECIFY) _____	☐	☐

IF YOU HAVE NOT BEEN HURT BY A PUMP AND ANSWERED NO TO ALL PROBLEMS LISTED IN QUESTION 27, GO TO SECTION D-3 ON THIS PAGE.

28. Did you call the pump manufacturer to get help with the problem or to report the injury or problem? Yes ... ☐ No..... ☐

29. After you had a problem or injury from using the pump, did you stop breastfeeding?

No, not at all ..... ☐ Yes, for a short time..... ☐ Yes, I stopped breastfeeding completely ..... ☐

30. Did you stop using the pump that injured you or that you had trouble with?

- Yes, I completely stopped using the pump ☐
- Yes, except I used the pump sometimes for special situations ☐
- No, I continued to use the pump ☐ **➔ (GO TO SECTION D-3 ON THIS PAGE)**

31. What did you do about expressing milk after you stopped using the pump?

- I changed to a different type of pump (for example, from manual to battery operated) ☐
- I changed to a different style of pump of the same type (for example, from one brand or style of electric pump to a different electric pump) ☐
- I changed to a new pump that was just like the one that hurt me or that I had trouble with ☐
- I stopped using a pump to express milk ☐
- I stopped expressing milk ☐

Section D-3: Pumping or Expressing Milk

32. During the past 2 weeks, how many times did you pump milk? (Include expressing breast milk in any way as pumping milk.)

_____ 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 ☐
- 2 ounces ☐
- 3 to 4 ounces ☐
- 5 to 6 ounces ☐
- 7 to 8 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 ☐
- Because my nipples were too sore to nurse ☐
- To increase my milk supply ☐
- To get milk for someone else to feed to my baby ☐
- For me to feed to my baby when I do not want to breastfeed or when baby cannot breastfeed ☐
- 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) ☐
- To mix with cereal or other food ☐
- To have an emergency supply of milk ☐
- 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 ☐
- 2 to 3 days ☐
- 4 to 5 days ☐
- 6 to 8 days ☐
- More than 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
3 to 4 hours..... ☐ | 12 to 16 hours..... ☐ | temperature..... ☐

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 USE	ONCE A DAY	EVERY 2 TO 6 DAYS	ABOUT ONCE A WEEK	ABOUT ONCE IN 2 WEEKS	NEVER	ITEM IS 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 formula concentrate to breast milk..... ☐
Added prepared (mixed up) formula or 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?

	NOT AT ALL LIKELY	SOMEWHAT UNLIKELY	SOMEWHAT LIKELY	VERY LIKELY
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..... ☐➔ **(CONTINUE)** | No..... ☐ ➔ **(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..... ☐
How to store the package after opening it..... ☐
How to store formula after it is prepared..... ☐
What to do with formula left over in the bottle after feeding the baby..... ☐
Have not read any of this information..... ☐ ➔ **(GO TO QUESTION 9)**

4. Were any of the directions and statements you read hard to understand?

Yes..... ☐ | No..... ☐ ➔ **(GO TO QUESTION 6)**

5. Which were hard to understand? **(PLEASE "X" ALL THAT APPLY)**

Written directions for preparing the formula..... ☐
How to store the package after opening it..... ☐
How to store formula after it is prepared..... ☐
What to do with formula left over in the bottle after feeding the baby..... ☐

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... ☐ ➔ **(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..... ☐
How to store the package after opening it..... ☐
How to store formula after it is prepared..... ☐
What to do with formula left over in the bottle after feeding the baby..... ☐

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..... ☐➔ **(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..... ☐➔**(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..... ☐➔**(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.

INGREDIENT OR CHARACTERISTIC	AVOID	INCLUDE
_____	☐	☐
_____	☐	☐
_____	☐	☐

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	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 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
3 to 4 hours ..... ☐ 12 to 16 hours ..... ☐ formula at room temperature ..... ☐

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)**

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
☐	☐	☐	☐	☐	☐

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 _____

Appendix III. Infant Feeding Practices Study Survey Timeline

To access all IFPSII materials, see (39).

Infant Feeding Practices Study: Survey Timeline

	7th/8th month of pregnancy	8th/9th month of pregnancy	Shortly after delivery (telephone)	Age of the Infant									
				~3 weeks	2 months	3 months	4 months	5 months	6 months	7 months	9 months	10 months	12 months
Mother's health and health care	✓												
Baby's family medical history	✓												
Dietary change because of pregnancy	✓												
Mother's employment status	✓												
Breastfeeding attitudes and experiences	✓												
Intended feeding plans and confidence in breastfeeding	✓												
Information sources for diet and infant feeding	✓												
WIC participation	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Breastfeeding Awareness Campaign Evaluation	✓					✓				✓			
Maternal diet history questionnaire (subsample)		✓					✓						
Single or multiple birth			✓										
Use of antibiotics, other prescription, and non-prescription medicines					✓	✓	✓	✓	✓	✓	✓	✓	✓
Stool characteristics					✓	✓	✓	✓	✓	✓	✓	✓	✓
If no longer breastfeeding: infant's age at stop, reasons for stop, and attitudes toward breastfeeding					✓	✓	✓	✓	✓	✓	✓	✓	✓
Infant formula feeding details					✓			✓		✓	✓		
Breastfeeding and breast pumping details					✓			✓		✓			
Dietary changes because of breastfeeding and reasons					✓			✓		✓			
Infant length and weight						✓		✓		✓			✓
Sleeping arrangements						✓			✓		✓		✓
Employment status and characteristics						✓			✓		✓		✓
Child care						✓			✓		✓		✓
Mother's current health and weight						✓			✓		✓		✓
Mother's tobacco use						✓			✓		✓		✓
Food allergy							✓				✓		✓
Information sources about herbal products and general infant feeding							✓					✓	
Solid food feeding details								✓	✓	✓	✓	✓	✓
Sunlight exposure											✓		
Birth weight			✓										
Medical problems of mother and infant			✓										
Birth experience				✓									
Breastfeeding practice and problems, and support in the hospital and after discharge				✓									
Mother's knowledge, attitudes, confidence, and planned duration of breastfeeding				✓									
Reasons for not trying breastfeeding				✓									
Formula feeding practices				✓									
Jaundice and treatment				✓									
Food frequency checklist				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dietary supplement and herbal intake				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Edinburgh Postpartum Depression Scale					✓								
Information sources about breastfeeding, diet while breastfeeding, and breast pumps					✓								
Breastfeeding and infant formula feeding practices					✓	✓	✓	✓	✓	✓	✓	✓	✓
Health problems of the infant					✓	✓	✓	✓	✓	✓	✓	✓	✓

Appendix IV. Edinburgh depression scale

Edinburgh Postnatal Depression Scale[1] (EPDS)

Postpartum depression is the most common complication of childbearing.[2] The 10-question Edinburgh Postnatal Depression Scale (EPDS) is a valuable and efficient way of identifying patients at risk for "perinatal" depression. The EPDS is easy to administer and has proven to be an effective screening tool.

Mothers who score above 13 are likely to be suffering from a depressive illness of varying severity. The EPDS score should not override clinical judgment. A careful clinical assessment should be carried out to confirm the diagnosis. The scale indicates how the mother has felt ***during the previous week***. In doubtful cases it may be useful to repeat the tool after 2 weeks. The scale will not detect mothers with anxiety neuroses, phobias or personality disorders.

Women with postpartum depression need not feel alone. They may find useful information on the web sites of the National Women's Health Information Center <www.4women.gov> and from groups such as Postpartum Support International <www.chss.iup.edu/postpartum> and Depression after Delivery <www.depressionafterdelivery.com>.

SCORING

QUESTIONS 1, 2, & 4 (without an *)
Are scored 0, 1, 2 or 3 with top box scored as 0 and the bottom box scored as 3.

QUESTIONS 3, 5-10 (marked with an *)
Are reverse scored, with the top box scored as a 3 and the bottom box scored as 0.

Maximum score: 30
Possible Depression: 10 or greater
Always look at item 10 (suicidal thoughts)

Instructions for using the Edinburgh Postnatal Depression Scale:

1. The mother is asked to check the response that comes closest to how she has been feeling in the previous 7 days.
2. All the items must be completed.
3. Care should be taken to avoid the possibility of the mother discussing her answers with others. (Answers come from the mother or pregnant woman.)
4. The mother should complete the scale herself, unless she has limited English or has difficulty with reading.

[1]Source: Cox, J.L., Holden, J.M., and Sagovsky, R. 1987. Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry* 150:782-786.

[2]Source: K. L. Wisner, B. L. Parry, C. M. Piontek, Postpartum Depression N Engl J Med vol. 347, No 3, July 18, 2002, 194-199

Edinburgh Postnatal Depression Scale[1] (EPDS)

Name: _____ Address: _____

Your Date of Birth: _____ _____

Baby's Date of Birth: _____ Phone: _____

As you are pregnant or have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt **IN THE PAST 7 DAYS**, not just how you feel today.

Here is an example, already completed.

I have felt happy:
- ☐ Yes, all the time
- ☒ Yes, most of the time
- ☐ No, not very often
- ☐ No, not at all

This would mean: "I have felt happy most of the time" during the past week. Please complete the other questions in the same way.

In the past 7 days:

1. 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

2. 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

*3. I have blamed myself unnecessarily when things went wrong
   - ☐ Yes, most of the time
   - ☐ Yes, some of the time
   - ☐ Not very often
   - ☐ No, never

4. I have been anxious or worried for no good reason
   - ☐ No, not at all
   - ☐ Hardly ever
   - ☐ Yes, sometimes
   - ☐ Yes, very often

*5 I have felt scared or panicky for no very good reason
   - ☐ Yes, quite a lot
   - ☐ Yes, sometimes
   - ☐ No, not much
   - ☐ No, not at all

*6. Things have been getting on top of me
   - ☐ Yes, most of the time I haven't been able to cope at all
   - ☐ Yes, sometimes I haven't been coping as well as usual
   - ☐ No, most of the time I have coped quite well
   - ☐ No, I have been coping as well as ever

*7 I have been so unhappy that I have had difficulty sleeping
   - ☐ Yes, most of the time
   - ☐ Yes, sometimes
   - ☐ Not very often
   - ☐ No, not at all

*8 I have felt sad or miserable
   - ☐ Yes, most of the time
   - ☐ Yes, quite often
   - ☐ Not very often
   - ☐ No, not at all

*9 I have been so unhappy that I have been crying
   - ☐ Yes, most of the time
   - ☐ Yes, quite often
   - ☐ Only occasionally
   - ☐ No, never

*10 The thought of harming myself has occurred to me
   - ☐ Yes, quite often
   - ☐ Sometimes
   - ☐ Hardly ever
   - ☐ Never

Administered/Reviewed by _____ Date _____

[1]Source: Cox, J.L., Holden, J.M., and Sagovsky, R. 1987. Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry* 150:782-786 .

[2]Source: K. L. Wisner, B. L. Parry, C. M. Piontek, Postpartum Depression N Engl J Med vol. 347, No 3, July 18, 2002, 194-199

Appendix V. Scoring for depression Scale

The depression scale was created as follows.

QUESTIONS 1, 2, & 4 were scored:

"1. I have been able to laugh and see the funny side of things" (104)/ *M2a29a. Mother has been able to laugh and see the funny side of things* (63) was coded as "Dep1" after being scored as follows.

- As much as I always could → scored 0
- Not quite so much now → scored 1
- Definitely not so much now → scored 2
- Not at all → scored 3

"2. I have looked forward with enjoyment to things" (104)/*M2a29b. Mother has looked forward with enjoyment to things* (63) was coded as "Dep2" after being scored as follows.

- As much as I ever did → scored 0
- Rather less than I used to → scored 1
- Definitely less than I used to → scored 2
- Hardly at all → scored 3

4. "I have been anxious or worried for no good reason" (104) /*M2a29d. Mother has felt worried and anxious for no real reason* (63) was coded as "Dep 4" after being scored as follows.

- No, not at all → scored 0
- Hardly ever → scored 1
- Yes, sometimes → scored 2
- Yes, very often → scored 3

QUESTIONS 3, 5-10 were reverse scored as instructed (104).

3. "I have blamed myself unnecessarily when things went wrong" (104) / *M2a29c. Mother has blamed herself unnecessarily when things went wrong* (63) was coded as "Dep 3" after being scored as follows.

- Yes, most of the time → scored 3
- Yes, some of the time → scored 2
- Not very often → scored 1
- No, never → scored 0

5. “I have felt scared or panicky for no very good reason” (104)/*M2a29e. Mother has felt scared or panicky for no real reason* (63) was coded as “Dep 5” after being scored as follows.

- Yes, quite a lot → scored 3
- Yes, sometimes → scored 2
- No, not much → scored 1
- No, not at all → scored 0

6. “Things have been getting on top of me” (104)/*M2a29f. Things have been too much for mother M2a29f* (63) was coded as “Dep 6” after being scored as follows.

- Yes, most of the time I haven’t been able cope at all → scored 3
- Yes, sometimes I haven’t been coping as well as usual → scored 2
- No, most of the time I have coped quite well → scored 1
- No, I have been coping as well as ever → scored 0

7. “I have been so unhappy that I have had difficulty sleeping” (104)/*M2a29g. Mother has been so unhappy that she has had trouble sleeping M2a29g* (63) was coded as “Dep 7” after being scored as follows.

- Yes, most of the time → scored 3
- Yes, sometimes → scored 2
- Not very often → scored 1
- No, not at all → scored 0

8. “I have felt sad or miserable” (104)/ *M2a29h. Mother has felt sad or miserable M2a29h* (63) was coded as “Dep 8” after being scored as follows.

- Yes, most of the time → scored 3
- Yes, sometimes → scored 2
- Not very often → scored 1
- No, not at all → scored 0

9. “I have been so unhappy that I have been crying” (104) /*M2a29i. Mother has felt so unhappy she has cried* (63) was coded as “Dep 9” after being scored as follows.

- Yes, most of the time → scored 3
- Yes, sometimes → scored 2
- Only occasionally → scored 1
- No, never → scored 0

10. “The thought of harming myself has occurred to me” (104)/*M2a29j. Mother has thought of hurting herself M2a29j* (63) was coded as “Dep 10” after being scored as follows.

- Yes, quite often → scored 3
- Sometimes → scored 2
- Hardly ever → scored 1
- Never → scored 0

Appendix VI. Glossary

AAP	American Academy of Pediatrics
CDC	U.S. Centers for Disease Control and Prevention
Complementary feeding	Providing the baby other foods and beverages in addition to breastfeeding.
Dimensions of breastfeeding	Aspects of breastfeeding behavior including time of initiation of breastfeeding, duration of breastfeeding and exclusivity of breastfeeding. Referred to in some sources as breastfeeding 'characteristics'
Early breastfeeding	In this study, early breastfeeding refers to initiation of breastfeeding within an hour of life. Other studies have considered initiation within other time periods to be 'early breastfeeding'.
Exclusive breastfeeding	Providing the baby no foods or beverages other than breast milk
Exclusivity	The amount of breastfeeding without complementary feeding. Also referred to in the literature as breastfeeding 'intensity'
FDA	U.S. Food and Drug Administration
FPL	Federal Poverty Level
Multiparous	Having given birth to more than one infant
Neonatal	Refers to newborns/the period relating to newborns
Normal weight	A body mass index ≥ 18.5 and < 25
Obesity	A body mass index ≥ 30

Overweight	A body mass index ≥ 25 and < 30
Parity	Refers to the number of times a woman has given birth
Postpartum weight retention	The average change in weight from pre-pregnancy to one year postpartum, generally focused on gestational weight retained in excess of prepregnancy weight
Prenatal	During pregnancy
Primiparity	Refers to having given birth to only one child
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

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