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ACCEPTANCE

This thesis, THE EFFECTIVENESS OF A SHORT FOOD FREQUENCY QUESTIONNAIRE IN DETERMINING THE ADEQUACY OF VITAMIN D INTAKE IN CHILDREN, by Caitlin S. Russell was prepared under the direction of the Master's Thesis Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Master of Science in the Byrdine F. Lewis College of Nursing and Health Professions, Georgia State University. The Master's Thesis Advisory Committee, as representatives of the faculty, certify that this thesis has met all standards of excellence and scholarship as determined by the faculty.

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ABSTRACT

THE IMPACT OF BREASTFEEDING EDUCATION ON INFANT FEEDING OUTCOME

By:
Dashia Antunes

Background: Breastfeeding (BF) is widely recognized as the ideal infant feeding method with a multitude of well-known infant and maternal benefits. However, current BF rates, particularly in the southeastern United States, fail to meet current BF recommendations. BF education interventions have shown to be successful at improving BF outcomes, as well as maternal knowledge and self-efficacy. The purpose of this study was to examine the association between BF education and infant BF outcomes based upon World Health Organization recommendations, with a secondary aim of determining the impact of BF education on maternal BF knowledge and self-efficacy.

Methods: Sixty adult female clients of PeaPod Nutrition and Lactation Support in the Atlanta, Georgia area, being the primary caregiver of an infant (12 months of age or younger) completed a short, anonymous, electronic questionnaire about any BF education they received and infant feeding outcomes. Outcome measures include BF rates and exclusivity. Secondary outcome measures include maternal BF knowledge and self-efficacy. The chi-square statistic was used to evaluate any associations between BF education and outcome measures.

Results: Study participants had a median age of 34 years, 70% self-reported as Caucasian with a median income between \$100,000 - \$150,000, and all participants held a college

degree. Fifty-five of the 60 participants that completed the survey received BF education either during their pregnancy or in the postnatal period. The education received occurred in a variety of settings and topics, and mainly consisted of in-person/hands-on instruction, with limited virtual/telephone education. Twenty-three of the 60 respondents (38.3%) are currently BF, of which, 65.2% are exclusively BF and 52.2% have been BF for more than 6 months. No statistically significant association was found between those that received BF education and BF duration ($p = .838$) nor rate of exclusive BF (Fisher's Exact Test $p = .350$). Of participants that are currently exclusively BF, 50% reported receiving some form of BF education. Of individuals that previously breastfed for 6 months or more, approximately 74% reported receiving some form of BF education. All 55 participants that received BF education agreed that the BF education that they received increased their knowledge of BF, with 60% strongly agreeing and most participants (90.9%) agreed that their confidence in BF improved because of their BF education, 52.7% of which strongly agreed.

Conclusion: Overall, high rates of BF and exclusive BF of infants 6 months of age and older were observed among study participants. All participants agreed that BF education improved their BF knowledge and the majority agreed that their self-efficacy improved as a result of the education that they received.

THE IMPACT OF BREASTFEEDING EDUCATION ON INFANT FEEDING OUTCOMES

by

Dashia Antunes

A Thesis

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ABBREVIATIONS

| | |
|------|-----------------------------------|
| AAP | American Academy of Pediatrics |
| AOM | Acute otitis media |
| ARA | Arachidonic acid |
| BF | Breastfeeding |
| BFHI | Baby Friendly Hospital Initiative |
| DHA | Docosahexaenoic acid |
| DNA | Deoxyribonucleic acid |
| EBF | Exclusive breastfeeding |
| GA | Georgia |
| GI | Gastrointestinal |
| HM | Human milk |
| HMO | Human milk oligosaccharides |
| IRB | International Review Board |
| LD | Licensed Dietitian |
| LLL | La Leche League |
| LRTI | Lower respiratory tract infection |
| OM | Otitis media |
| PC | Peer Counselor |
| PI | Principal Investigator |
| RCT | Randomized controlled trial |

| | |
|--------|-----------------------------------|
| RD | Registered Dietitian |
| RSV | Respiratory syncytial virus |
| RTI | Respiratory tract infection |
| sIgA | Secretory immunoglobulin A |
| sIgM | Secretory immunoglobulin M |
| SIDS | Sudden Infant Death Syndrome |
| UNICEF | United Nations Children's Fund |
| URTI | Upper respiratory tract infection |
| U.S. | United States of America |
| WHO | World Health Organization |
| WIC | Women, Infant, and Children |

CHAPTER I

THE EFFECTIVENESS OF A SHORT FOOD FREQUENCY QUESTIONNAIRE IN
DETERMINING THE ADEQUACY OF VITAMIN D INTAKE IN CHILDREN

Introduction

Human milk (HM) is considered optimal nutrition for infant feeding and breastfeeding (BF) is recommended by several health organizations. The American Academy of Pediatrics (AAP) recommends exclusive breastfeeding for the first six months of life, with the continuation of breastfeeding for at least one year, or longer, along with the addition of nutritious complementary foods beginning around six months of age.¹ The Academy of Nutrition and Dietetics also holds this position as the ideal feeding pattern.² The World Health Organization (WHO) extends these recommendations to at least age two or beyond, as the first two years are critical for child growth and development.^{3,4} HM offers nutritive and non-nutritive benefits and confers a multitude of health benefits for the infant and mother, providing the basis for these recommendations.

Infant and maternal benefits of BF have been well established in the literature. However, current BF rates fail to meet expert recommendations. In the U.S., rates of ever BF in 1997 were 64%, were approximately 80% in 2014,⁵ and are currently at 83.8%,⁶ exceeding the Healthy People 2020 goal of 81.9%.⁷ The rate of any BF at 6 months of age was 29% in 1998, 51.8% in 2013,⁵ and currently at 57.3%⁶, slightly below the Healthy People 2020 goal of 60.6%.⁷ However, rates of exclusive breastfeeding (EBF) at 6 months of age are not meeting the Healthy People 2020 goal of 25.5%,⁷ with current

rates at 25.4%.⁶ EBF rates at 6 months of age have trended upwards however, with 13.8% EBF in 2007¹ increasing to 18.8% EBF in 2011.² BF trends vary regionally with the southeastern U.S. being less likely to breastfeed at 6 months of age compared to other areas, and rural areas are less likely to breastfeed compared to urban areas.⁶ Racial and sociodemographic disparities exist as evidenced by varying rates among ethnicities, races, ages and incomes. The rate of ever BF for non-Hispanic blacks, Hispanics, and non-Hispanic whites is 74%, 82.9%, and 86.6%, respectively.⁶ The rate of ever BF among lower income women is currently 75.5%, compared to 92.7% for higher incomes.⁶ Also, rates for women under 30 years of age are currently at 80%, with older women ever BF rates at 86.3%.⁶

BF education is designed to provide women with the knowledge necessary to achieve BF success by including the tools needed to overcome many of the observed BF barriers, as well as addressing many of the concerns, fears, or misconceptions often experienced. Breastfeeding education or counseling interventions have been reported to increase first day EBF rates by 43%, up to 1 month of age rates by 30%, and between 1-6 months of age by 90%, with reductions of 32%, 30%, and 18% of those not BF, respectively.⁸ Kornides and colleagues (2013) evaluated the effect of knowledge related to BF benefits on BF within the first two months. Women with an increased knowledge of the benefits associated with BF were 11 times more likely to initiate BF and more than 5 times more likely to continue BF at 2 months of age.⁹ Approximately 98% and 82% of women who agreed with the benefits of BF initiated BF and were breastfeeding exclusively at 2 months, respectively; compared to 61% and 62%, respectively, of those that disagreed with BF benefits. Although a minimum baseline knowledge of BF skills

and techniques are needed for BF success, women often lack the confidence in their ability to successfully breastfeed which can affect BF outcomes. BF self-efficacy is the women's belief in her ability to successfully breastfeed, influencing her BF efforts, motivation, and thoughts, ultimately impacting outcomes.¹⁰ A recent review of the literature¹⁰ reported outcomes related to education and support-based interventions aimed at enhancing BF self-efficacy and their effect on BF outcomes. The researchers stated that interventions incorporating BF self-efficacy social theories, delivered in a combination of community and hospital settings, over multiple encounters are the most effective at improving BF self-efficacy and BF exclusivity at 1 and 2 months postpartum.

Although the benefits of BF education on BF outcomes have been reported, the effect of education provided through a family-based nutrition center in the Southeast U.S. is unknown. The purpose of this study is to investigate the association between BF education and infant feeding outcomes, as well as maternal outcomes in a diverse population of mothers from the Southeastern U.S. Existing and new clients of *Pea Pod Nutrition and Lactation Support*, in the Atlanta, Georgia area were surveyed regarding their current and past BF practices, as well as future BF intentions; *Pea Pod* serves a highly diverse population with a multitude of BF educational opportunities.

Specific Aim 1: Examine the association between breastfeeding education and infant breastfeeding outcomes based upon WHO recommendations.

Research Hypothesis 1: Compared to no maternal BF education, BF education will result in increased rates of BF and exclusive BF as well as BF duration.

Null Hypothesis 1: There will be no association between BF education status and BF outcomes.

Specific Aim 2: Determine the impact of BF education on maternal breastfeeding knowledge and self-efficacy.

Research Hypothesis 2: Compared to no maternal BF education, BF education will result in increased maternal breastfeeding knowledge and self-efficacy.

Null Hypothesis 2: There will be no association between BF education status and maternal BF knowledge and self-efficacy.

CHAPTER II

Literature Review

Properties of Human Milk

Nutritive Properties

During infancy, growth and development occur at a rapid pace and HM provides the ideal balance of macronutrients, water, vitamins, and minerals to meet energy and nutritional needs, supporting optimal growth and development. HM contains approximately 3.5 g of lipids per 100 mL, contributing about half of the energy content.⁴

Lipids represent an important energy source and consist of triacylglycerides, free fatty acids, phospholipids, and cholesterol.¹¹ Unique to HM and critical for central nervous system development is the presence of long-chain polyunsaturated fatty acids docosahexaenoic acid (DHA) and arachidonic acid (ARA).⁴ Carbohydrates, mainly lactose, provides another important source of energy especially for the brain and HM provides 7 g of carbohydrates per 100 ml.⁴ Human milk oligosaccharides (HMO) nourish the gastrointestinal (GI) microbiota and act as prebiotics for beneficial GI bacteria.¹¹ With a low protein content (0.9 g per 100 ml), HM provides adequate easily digested protein without stressing the immature urinary system.⁴ Not only do HM proteins provide nutrition, they also aid in the digestion and absorption of other micronutrients and macronutrients.¹¹ Bile salt-stimulated lipase and amylase are HM proteins that facilitate lipid and starch digestion.¹² Beta-casein, a byproduct of casein digestion, aids the absorption of calcium. Additionally, lactoferrin and haptocorrin are HM proteins that aid in the absorption on iron and vitamin B12.¹² With the exception of vitamin D, HM

typically contains adequate vitamins and minerals to meet infant needs for the first six months of life, provided adequate maternal nutrition.⁴

Nonnutritive Properties

The nonnutritive health benefits associated with BF are well known and documented. A great deal of the health benefits stem from the immunological protective factors found in HM. Many of the proteins and HMOs present in HM contribute to the immunologic characteristics and confer protection from a wide variety of infections, as well as short and long-term protection from acute and chronic disorders.⁴ HM contains white blood cells,⁴ such as macrophages, neutrophils, T and B-lymphocytes, which phagocytose fungi and bacteria and kill harmful microorganisms, offering immune protection to the infant.¹³ Immunoglobulin proteins, predominantly secretory Immunoglobulin A (sIgA) but also secretory Immunoglobulin M (sIgM), provide immune protection until the infant's immune system is fully mature.¹¹ The mechanism by which sIgA and sIgM provide protection to the infant is by preventing (or reducing) pathogens from binding to (and crossing) the intestinal mucosal layer of the infants' GI tract.^{11,13} Additionally, sIgA and sIgM transfer protective properties of the maternal immune system through HM and onto the infant.¹² Lysozymes, a component of the whey protein found in HM, with the assistance of lactoferrin, also contribute to the power of the infant's immune system by killing bacteria and viruses.^{4,12} HMOs also prevent the adherence of pathogens to the mucosal lining of the GI tract, thereby protecting the infant from diarrheal and respiratory tract infections.¹¹ In addition to the unique components of HM preventing direct pathogenic binding, Bifidus factor, a growth factor present in HM,

indirectly inhibits the growth of pathogenic bacteria by acting as a prebiotic and supporting the growth of beneficial intestinal bacteria, thereby working to establish a healthy gut microbiota.^{12,13} In the case that an infection does develop, the severity and/or duration of the infection may be lessened by the presence of immunomodulatory cytokines in HM, that act by reducing inflammation.¹³ HM also contains growth factors such as IGF and epidermal growth factor, and hormones such as insulin, that not only protect against pathogens,¹³ but also assist in the maturation of the infant GI tract by stimulating its' growth and DNA synthesis.¹² All of these unique components of HM work in tandem establishing the GI tract and immune system of the infant, offering protection against a variety of infections and illnesses.

Breastfeeding and Outcomes

Infant Outcomes

The protective effects of BF against RTIs and GI infections have been well studied and documented, especially given the fact that they are significant causes of infant morbidity and mortality.¹⁴⁻²¹ Optimal BF practices are predicted to prevent roughly one-third of all RTIs and approximately 50% of diarrheal infections,¹⁹ and reducing associated hospital admissions by 57% and 72%, respectively.²⁰ Researchers in Japan¹⁸ examined respiratory syncytial virus (RSV), a common bronchiolitis and pneumonia-causing virus, and the protective effects of EBF compared to other feeding patterns on the severity of illness and infant hospitalizations. Although no statistically significant differences were found in the rate of infant hospitalizations, BF appeared to decrease the severity of RSV, indicated by shorter duration of hospital stay and decreased need of

oxygen therapy treatments of BF infants. A large systematic review and meta-analysis conducted by WHO researchers¹⁶ investigating the effects of BF on incidence and hospital admissions related to RTIs and diarrhea on children in both low and high income settings, found BF to be protective against respiratory infections, reducing the incidence and severity with a 50% reduction in hospital admissions. Similarly, BF was found to be protective against diarrheal related infant morbidity and mortality with reduced hospital admissions, particularly with EBF ≥ 6 months.¹⁶

Additionally, the duration of BF appears to impact the risk of infections as Duijts et al. (2010) found that during the first 6 months of life a lower risk of upper respiratory infections (URTI), lower respiratory tract infections (LRTI), and GI infections were associated with EBF for ≥ 6 months, compared to those never BF, with a lower risk of LRTIs from 7 – 12 months of age ($P < .01$).¹⁵ These findings conclude that EBF for ≥ 6 months offers more respiratory and diarrheal protection than EBF for 4 months with partial BF thereafter. In addition, Chanty and associates¹⁴ investigated the differences in respiratory outcomes (including pneumonia, wheezing, otitis media (OM), and URIs) among ≥ 6 months EBF (or almost EBF) infants to those BF between 4 and < 6 months. Statistically significant differences were found for RTIs (including pneumonia and recurrent OM), with an increased risk among infants EBF for 4 to < 6 months as compared to ≥ 6 months.

Acute OM (AOM), common among infants and young children due to their developing ear and changes in anatomy, is a typical complication of viral URTIs. A review of the research in the U.S. and Europe²² reported a dose-dependent response among children up to 2 years of age in the incidence of AOM and EBF. EBF for the first

6 months provided the best protection with a 43% reduction in the risk of AOM as compared to those infants EBF for shorter durations as well as those never BF.²² In addition to the immunological properties of HM discussed above, it has been suggested that reduced incidences of AOM in BF infants is potentially attributed to the anatomical mechanics during BF compared to bottle feeding.²² A more recent review²³ also concluded that EBF for ≥ 6 months exhibited a greater protective effect than shorter BF durations, and that early introductions of HM substitutes increased the risk of OM.

Other potential benefits of BF for the infant include a reduced risk of asthma (especially for the first two years),²⁴ type 1 diabetes mellitus,²⁵ childhood leukemia,²⁶ and atopic dermatitis.²² Breastfed infants also have a lower risk of post neonatal mortality²⁸ and BF ≥ 2 months cut the risk of sudden infant death syndrome (a leading cause of infant mortality) in half, with longer durations associated with further reduced risk.²⁹ Even longer-term health benefits may be associated with BF as there appears to be a reduced risk obesity^{30,31} and type 2 diabetes mellitus,³⁰ two risk factors for cardiovascular disease, a leading cause of morbidity and mortality in the U.S. Although there is conflicting research on associations between BF and blood pressure and cholesterol levels later in life, potential risk factors for cardiovascular disease, a meta-analysis³² found slight reductions in systolic and diastolic pressure in breastfed infants. However, Parikh et al.³³ (2009) and a larger, more recent review³⁰ found no significant association between BF and blood pressure. Additionally, both studies^{30,33} found no association between total cholesterol level and BF; however other studies^{34,35} found both lower total cholesterol and low-density lipoprotein cholesterol associated with breastfeeding. Also,

Parikh et al. (2009) found higher high-density lipoprotein cholesterol levels and lower adult body mass index associated with being breastfed as an infant.³³

Maternal Outcomes

Although not as well studied or known, BF also confers maternal health benefits. A variety of short and long-term beneficial maternal outcomes are associated with BF, some of which may offer greater benefit with increased BF duration. Immediate physical effects, as a result of the release of the hormone oxytocin during the let-down phase of BF include the stimulation of uterine contraction which aid in uterine shrinkage back to pre-pregnancy size and a decreased risk of postpartum hemorrhage.^{1,2,13,36} Weight loss and faster return to pre-pregnancy size are often cited as benefits of BF^{2,36} however other research reports mixed findings^{1,13,27} clearly indicating more research needed.

Hormonal changes associated with lactation typically delay the return of the menstrual cycle, possibly 6 months or more if EBF, serving as a natural form of contraceptive (although not completely reliable), resulting in longer pregnancy intervals allowing for adequate time for the body to recover and return to optimal pre-pregnancy status.^{1,2,13,36} Reported psychological beneficial effects include; improved maternal confidence,¹³ infant bonding,^{2,13,36} reduced stress^{2,36} and decreased risk of postpartum depression.^{1,2,27}

Well known beneficial long-term maternal outcomes associated with BF such as reduced risk of breast and ovarian cancers appears to be inversely related to BF duration,^{1,2,13,27,36} likely due to reduced lifetime exposure to the hormone estrogen.³⁶ Longer BF durations also appear to reduce the risk of development of type II diabetes

mellitus, likely due to improved insulin sensitivity during lactation.³⁶ Research also shows a reduced risk of rheumatoid arthritis.^{1,13} An overall reduction in chronic disease risk, due to favorable metabolic changes³⁶ has been found to be associated with BF, with reduced risk of hyperlipidemia, cardiovascular disease,^{1,36} and hypertension.^{1,2,36}

Breastfeeding Rates and Goals

Historically, BF rates in developed countries declined in the 1970s, especially with the manufacturing and intense marketing of HM substitutes. Initiation and duration of BF rates have since increased, however are highly variable depending on location and sociodemographic factors. In the U.S., rates of ever BF in 1997 were 64%, hovered around 80% in 2014,⁵ and are currently at 83.8%⁶, exceeding the Healthy People 2020 goal of 81.9%.⁷ The rate of any BF at 6 months of age was 29% in 1998, 51.8% in 2013,⁵ and currently at 57.3%⁶, also above the Healthy People 2020 goal of 60.6%.⁷ Rates of EBF at 6 months of age however are not meeting the Healthy People 2020 goal of 25.5%,⁷ with current rates at 25.4%.⁶ EBF rates at 6 months of age have trended upwards however, with only 13.8% EBF in 2007¹ and increasing to 18.8% EBF in 2011.² Additionally, U.S. BF rates (although not EBF) in other age groups (4 – 11.9 months) appear to be on the rise as well, as shown in the results of the Feeding Infants and Toddlers Study³⁷ comparing rates from 2002 to 2008. BF trends vary regionally with the southeastern U.S. being less likely to breastfeed at 6 months of age compared to other areas; rural areas also less likely to breastfeed compared to urban areas.⁶ Racial and sociodemographic disparities exist as evidenced by varying rates among ethnicities, races, ages and incomes. For example; the rate of ever BF for non-Hispanic blacks,

Hispanics, and non-Hispanic whites is 74%, 82.9%, and 86.6%, respectively.⁶ The rate of ever BF among lower income women is currently 75.5%, compared to 92.7% for higher incomes.⁶ Also, rates for women under 30 years of age are currently at 80%, with older women ever BF at 86.3%.⁶

Worldwide, the 2017 rate of EBF <6 months of age is 41%, with 70% breastfed for at least one year and only 45% at two years old.³⁸ A large international study³⁹ of 2,159 infants in 12 countries throughout the U.S., Europe, Canada, and Australia reported just 4% EBF at 6 months old, indicating high variability by region. The study also found that mothers with type 1 diabetes were less likely to EBF, indicating maternal health status as a potential factor. One target from the WHO's "*Comprehensive implementation plan on maternal, infant, and young child nutrition*" is to increase the global rate of EBF to at least 50% by 2025.³ Additionally, the WHO and the United Nations Children's Fund (UNICEF) goals from the "*Global Breastfeeding Collective*" indicate improving rates of EBF at 6 months to 70%, BF rates of 80% at one year old, and 60% at two years of age by 2030.³⁸

Economics of Breastfeeding

The economic impact of suboptimal BF practices is substantial, with direct and indirect costs associated with infant and maternal outcomes. Direct costs include the cost of infant formula (approximately \$1,200 - \$1,500 for the first year),⁴⁰ increased health care costs associated treatment and hospitalizations as a result of infant infections, and increased health insurance claims. Indirect costs include missed work days for parents, reduced employee productivity, and premature death/adult mortality.⁴⁰ Worldwide,

optimal BF practices for the first 0 – 23 months of life, are predicted to save the lives of over 820,000 children per year.^{3,15,38} Approximately \$302 billion/year is lost as a result of suboptimal BF rates and for every \$1 invested in BF promotion, \$35 in economic returns are generated.^{15,38}

It is estimated that if 90% of U.S. mothers EBF their infants for at least 6 months, \$13 billion would be saved annually, with 911 infant deaths prevented.^{15,38,41} A cost-analysis of the potential economic impact in Louisiana alone, considering just 4 infant diseases (RTIs, sudden infant death syndrome, gastroenteritis, and necrotizing enterocolitis), estimated over \$216 million/year saved and 18 infant deaths prevented, if 90% of infants were EBF for at least 6 months.⁴² The annual projected savings of \$13 billion are based on Bartick and Reinhold's (2010) pediatric cost analysis of 10 health outcomes; OM (over \$908M), gastroenteritis (over \$186M), necrotizing enterocolitis (almost \$290M), LRTIs (over \$2.27B), atopic dermatitis (over \$600M), SIDS (over \$4.72B), asthma (over \$552M), leukemia (over \$135M), type 1 diabetes (over \$103M), and obesity (over \$592M).⁴¹

Given the large impact of BF on women's health, maternal health outcomes cost analyses indicate greater economic impacts. When taking into account costs associated with maternal health outcomes, in addition to pediatric outcomes, a 2016 analysis predicted direct and indirect medical costs and nonmedical related costs at \$4.3 billion annually with 3,340 infant and maternal premature deaths contributing an additional annual cost of \$14.2 billion.⁴³ Furthermore, almost 80% of the costs and premature deaths were associated with maternal outcomes such as; type 2 diabetes, hypertension, myocardial infarction, breast and pre-menopausal ovarian cancers.

Barriers to Breastfeeding

Lack of Knowledge

A significant barrier to BF initiation, duration, and exclusivity is a lack of knowledge related to how to successfully breastfeed, BF practices, the associated benefits, potential problems that may arise and solutions, where to seek help and information when needed, and education regarding accurately assessing insufficient milk supply; as perceived insufficient supply is the leading determinant of BF cessation^{2,13,44} The lack of prenatal education is particularly concerning as the majority of women make their decision regarding feeding method before conception and during pregnancy.⁴⁵ Low-income minority women in particular, report a lack of access to information that supports and promotes BF.⁴⁶

Poor Familial Support

Inadequate support, particularly from fathers, maternal grandmothers, and significant others can pose barriers to successful BF initiation and duration, as they may play a significant role in infant feeding decisions, influencing a mother's decision to breastfed.^{13,44-46} The knowledge, attitude, and support of BF by the father and maternal grandmother has been associated with longer BF duration.⁴⁴ This is especially the case in some cultures in which the feeding decision may not be made by the mother.⁴⁵ There is a lack of knowledge and experience among influential family members with regard to understanding how to best provide support to BF mothers and understanding the importance of BF, indicating a great need to include them in BF education programs as

fathers that receive education from health professionals are more likely to promote and support BF.⁴⁶

Lactation Problems

A wide variety of lactation related issues such as; nipple pain due to improper positioning or latching, difficulty latching, flat or inverted nipples, ankglossia, engorgement, plugged ducts, mastitis, and insufficient milk supply can also pose a barrier to BF.^{13,44,46} Experiencing lactation issues can be frustrating and affect maternal confidence in her ability to successfully breastfeed, leading to lower self-efficacy and earlier than desired cessation. Perceived insufficient milk supply is an issue experienced by about 50% of BF women (even though <5% of women have insufficient supplies) contributing further to suboptimal BF practices.^{2,13,44}

Sociodemographic, Cultural and Lifestyle Determinants

As indicated by the BF rates mentioned above, significant BF disparities exist among various demographics. Younger, less educated low income minority women typically do not meet their BF goals and are less likely to initiate BF and do not breastfeed as long as their counterparts.⁴⁴⁻⁴⁶ For low income minority women in particular, acculturation, a lack of cultural acceptance, and language/literacy barriers may influence BF.⁴⁶ The lack of adequate maternity leave in the U.S., lack of accommodation to BF or pump at work pose a significant barrier to all working women.^{13,38,44,45} In fact, length of maternity leave appears to be associated with BF duration and the return to full-time work outside of the home is associated with reduced BF duration.⁴⁴ Low income

women working low paying jobs however, may be even more disadvantaged because of needing to return to work sooner for financial reasons.⁴⁶ The WHO reports that providing access to adequate maternity leave increases EBF rates by an astounding 52% and their joint publication with UNICEF, the *Global Breastfeeding Collective* calls for paid maternity leave with employer policies that allow for adequate pumping and nursing breaks with acceptable pumping and milk storage areas.¹⁹

The U.S. society has normalized bottle feeding and BF is often viewed as an alternative feeding method.¹³ Influence from media and the marketing industry display bottle feeding as the norm therefore BF is not as socially accepted,⁴⁵ leading to the sexualization of breasts, further contributing to maternal embarrassment and concerns with BF in public.^{13,45,46} HM substitutes are heavily marketed in parenting magazines, physician offices, on television, and by direct mail, further discouraging BF.⁴⁵

Maternal attitudes, lifestyle choices, and maternal obesity are additional factors affecting BF practices. Improved maternal self-efficacy is associated with greater BF duration and women that view BF as healthier, easier, and more convenient appear to breastfeed longer.⁴⁴ Inadequate opportunities to communicate with and get support from other BF mothers is another barrier.³⁸ Maternal lifestyle choices such as alcohol use⁴⁶ and smoking (possibly due to the associated decrease in milk supply, decreasing maternal motivation) negatively impact BF practices as well.⁴⁴ Maternal obesity is also negatively associated with successful BF initiation and duration.^{44,46}

Hospital Practices and Medical Services

There is a need for training and education of all healthcare professionals to ensure BF support,¹³ as many have inadequate BF training and education.⁴⁵ Providers,

particularly pediatricians, have the potential to greatly impact BF rates through the education on national BF goals,⁴⁴ unfortunately many providers report not feeling comfortable instructing a woman how to feed her infant and some feel that it is not their responsibility.⁴⁵ The *Global Breastfeeding Collective* also calls for improving access to BF counseling in health care facilities.¹⁹

In addition, typical hospital interventions; including mandatory newborn interventions, epidurals, sedation, intravenous fluids, etc., during childbirth are not conducive to promoting optimal BF conditions.⁴⁵ Improved BF rates are observed with hospitals using evidence-based best practices⁴⁵ and those implementing the Baby Friendly Hospital Initiative (BFHI) recommendations (such as early initiation, rooming-in, not offering HMS, etc.).⁴⁴ Unfortunately few hospitals in the U.S. maintain certification,⁴⁵ only 7.15% of U.S. births are at baby friendly hospitals,⁴⁴ and hospitals not implementing baby friendly practices can contribute to differences in the establishment of successful BF.⁴⁰

Breastfeeding Education

Adequately timed and culturally appropriate BF education interventions are effective at improving BF practices (rate, initiation, and duration);⁴⁷ especially considering that some of the main barriers to BF include lack of knowledge, lactation problems, and sociodemographic/cultural barriers. Formal BF education goes above and beyond traditional routine, standard antenatal care and may involve a variety of types, settings, and delivery methods. Intervention strategies may include health education, counseling, peer support, and skills training with content focused on (but not limited to):

practical BF skills training (mechanics such as proper latch and positioning), health education (benefits of BF, health outcomes), prevention and management of lactation problems or issues, and BF expectations.⁴⁸ Individual or group, formal or informal, clinic or home-based sessions led by physicians, nurses, lactation consultants, peer counselors (trained or untrained), midwives, dietitians, and other health care professionals, provided before pregnancy, during, or postpartum may include telephone, video, oral, and/or printed materials.^{47,48} According to a 2013 Lancet review,⁸ BF education or counseling interventions increase first day EBF rates by 43%, up to 1 month of age rates by 30%, and between 1-6 months of age by 90%, with reductions of 32%, 30%, and 18% of those not BF, respectively. Additionally, combined individual and group sessions tended to be more successful than individual and group sessions alone.

Simply improving BF knowledge, particularly during the antenatal period (typically the time when infant feeding decisions are being made),⁴⁷ is associated with positive BF outcomes such as improved BF initiation, duration, and achievement of maternal BF goals.⁹ Kornides and colleagues (2013) evaluated the effect of knowledge related to BF benefits on BF within the first two months. Women with an increased knowledge of the benefits associated with BF were 11 times more likely to initiate BF and more than 5 times more likely to continue BF at 2 months of age.⁹ Approximately 98% and 82% of women who agreed with the benefits of BF initiated BF and were breastfeeding exclusively at 2 months, respectively; compared to 61% and 62%, respectively, of those that disagreed with BF benefits.

Improving Self-Efficacy through Education Interventions

Although a minimum baseline knowledge of BF skills and techniques are needed for BF success, women are often lacking the confidence in their ability to successfully breastfeed which can affect BF outcomes. BF self-efficacy is the women's belief in her ability to successfully breastfeed, influencing her BF efforts, motivation, and thoughts, and ultimately impacting outcomes.¹⁰ Brockway, Benzies, and Hayden (2017) examined the literature regarding education (providing information, discussions, and demonstrations) and support-based interventions aimed at enhancing BF self-efficacy and their effect on BF outcomes. Their findings indicate that interventions incorporating BF self-efficacy social theories, delivered in a combination of community and hospital settings and, over multiple encounters are the most effective at improving BF self-efficacy and BF exclusivity at 1 and 2 months postpartum. Following a pilot study in which BF self-efficacy was assessed among those that attended an educational workshop, researchers⁴⁹ in Canada conducted a RCT including 110 pregnant women to examine the impact of a 2.5 hour prenatal workshop, incorporating self-efficacy social theories and adult learning principles on BF self-efficacy and BF outcomes at 4 and 8 weeks postpartum. At both 4 and 8 weeks, BF self-efficacy was lower in the control group, although only reached statistical significance at 4 weeks. At 8 weeks postpartum, participants in the control group had reduced rates of EBF as well as higher rates of weaning. Of the participants that attended the workshop, 78% were EBF and only 5% had weaned at 8 weeks postpartum, leading researchers to conclude that the workshop reduced incidence of weaning, increased rates of EBF, and increased maternal BF self-efficacy. A more recent experimental trial⁵⁰ carried out in Brazil sought to increase BF

self-efficacy through educational interventions utilizing a flip chart titled “I Can Breastfeed My Child”, reviewing the content via a predetermined script at hospital bedside (shortly following birth) for approximately 20 minutes, while also answering questions and providing information and encouragement. At 2 months postpartum, 100% of the women in the intervention group were EBF compared to just 41% of women in the control, with increased BF self-efficacy observed among those EBF.

Education Interventions in Different Environments

According to the 2017 WHO guidelines⁵¹ on protecting, promoting, and supporting BF, facilities that provide prenatal care should educate women and their families about the benefits and management of BF. It is their view that BF education delivered prenatally will assist mothers to practically prepare, foster discussions, and promote the initiation of BF after delivery. Specifically, antenatal BF education should be tailored to individual needs, considering each unique social and cultural situation and sensitively delivering information in a culturally appropriate manner. The BFHI, utilized in some hospital facilities, includes practices that promote, protect, and support BF and consists of 10 steps that form the foundation for the initiative. Implementation of the BFHI has a dose dependent effect on BF outcomes such as initiation, duration, and exclusivity. Wouk, Tully, and Labbok (2017) conducted a systematic review⁵² of the evidence for the third step of the BFHI, which involves prenatal BF education, by providing knowledge of BF benefits, the importance of EBF, BF management, and skills to pregnant women. Thirty-eight randomized controlled trials and quasi-experimental studies including over 15,000 participants in developing and developed countries,

conducted during various timeframes, were included to determine if clinic or hospital-based BF education positively impacts BF outcomes (initiation, duration, and exclusivity). Many of the included studies assessed at least one or more variables regarding BF plans: prior intent of BF initiation, duration, exclusivity, prior experience, confidence, self-efficacy, and knowledge, attitudes, and beliefs. Prenatal education interventions only, were evaluated in 17 of the studies and included a wide variety of formats including: web-based; self-efficacy and adult based learning theories; workshops with various tools (dolls, videos, group discussions, etc.); a combination program including videos, educational booklets, and two telephone follow-ups; another combination consisting of a video, booklet, and a short session with a lactation consultant; interpersonal support and education provided by health care professionals. Many of the studies reported significant increases in at least one measured BF outcome and six of the studies reported significance in all three BF outcome measures. Twenty-one of the included studies assessed prenatal education interventions combined with either intrapartum or postpartum support, some of which consisted of: International Board of lactation Consultant Examiners support via visits; telephone calls or sessions; electronic-based guidance from health care providers; a three hour knowledge sharing and empowering program in addition to routine education with telephone and home visits; or telephone support combined with either one-on-one or group education sessions using various theories. Two-thirds of the studies found significant positive impact on one or more BF outcome measure. All studies included in the review that examined the impact of including partners or other familial support in the prenatal educational intervention found significant differences in at least one measured BF outcome between

intervention and comparison groups. Researchers conclude that a variety of individual or group educational interventions combined with interpersonal support from healthcare professionals, peer counselors, lactation consultants or others, has a positive impact on BF outcomes. Additionally, involving the mother's family or partner in the educational intervention improves BF outcomes.

The updated (2016) evidence report and systematic review for the U.S. Preventative Services Task Force⁵³ analyzed 52 highly variable studies in terms of geographic location, population, intervention format, controls, outcomes, timing, and methods to investigate the effects BF education, support from health care professionals or peer counselors (PC), and system-level policies such as the BFHI on BF practices. Findings show that individual support and education positively impact any BF and EBF, however found no relationship with BF initiation. Although, the overall initiation rate was high (53% – 98%) and many women already intended to breastfeed. Also, of note, for the <3-month age group, the timing of the intervention made a difference in the outcomes and interventions that were delivered at more than one time period were significantly associated with reports of any BF. The system-wide level of support, including those implementing the BFHI, improved BF initiation rates and EBF at four weeks of age in women with lower education levels much more than those women with higher education levels. Researchers conclude that individual BF support and education increases BF duration and exclusivity, compared to routine, standard care, however there was no statistically significant relationship on BF initiation or the rate of any BF at six months of age.

The large 2015 systematic review and meta-analyses conducted by Sinha and colleagues (2015) investigated the effects of BF educational interventions on early BF initiation, exclusivity, continued and any BF rates.⁵⁴ In particular the focus was on the delivery of interventions within various settings including health systems and services, the home and family environment, community environment, work environment, and policy environment. Of the 195 studies included, 73 took place in health systems and services; results indicate that education delivered in this setting type had the most prominent effect on any BF, increasing early initiation by 11% and EBF by 45%. The home and family environment was the second largest setting, observed in 57 of the included studies and although early initiation rates were not statistically significant, rates of EBF increased by 45%. Interventions implemented in the community environment showed an 86% increase in early BF initiation rates, indicating the importance of raising community awareness. Interventions implemented in the work environment increased the rate of EBF, although not by a statistical significance, however rates of any BF improved by 30%. No statistically significant effects were reported for the policy environment setting, likely due to the small number of studies. Overall, educational interventions improved early BF initiation by 25% and EBF by 44%, with the greatest effects observed in lower-middle income and rural areas compared to higher income and urban areas. Additionally, 53 studies included interventions delivered in a combination of settings and found a 57% increase in the rate of early BF initiation, 79% increase in EBF, and a 30% increase in the rate of any BF. Therefore, interventions delivered concurrently in a combination of settings has a greater beneficial impact on BF outcomes than single

settings, highlighting the need for multiple synchronized sectors interacting to promote and support BF.

Paternal Education Interventions

Given that the lack of partner/familial support is cited as a major barrier to positive BF outcomes, educational interventions targeting partners and other family members could attempt to address this barrier; however, BF education programs typically fail to include partners or are not specifically designed for this population. Social support is important for successful BF practices and paternal preference regarding infant the feeding method is typically valued and relevant⁵⁵ as well as positively impacting maternal feeding decision and BF maintenance.⁵⁶ In addition to support via actively participating in feeding decisions, paternal BF attitudes and knowledge regarding benefits strongly influences BF outcomes such as initiation and duration.⁵⁷ Also, paternal support may influence BF outcomes more than support from health care providers.⁵⁸ Since paternal beliefs potentially play such a crucial role in feeding methods, it is imperative that in addition to providing basic BF education and ways to offer support, partner-focused interventions should address common paternal concerns that may negatively impact BF outcomes such as feeling left out, helpless, jealous, inadequate, or fear of reduced attention and negative effects on the sexual relationship with the mother.^{55,57}

Wolfberg and associates⁵⁵ conducted a RCT investigating the effect of a BF educational intervention designed to educate fathers on how to advocate for BF, assist partners with BF, and how to work with their partner to ensure success, with an aim of eliminating common misconceptions. Both the control and intervention group

participated in a 2-hour educational session with a different focus for each group and were given \$25 gift cards as incentive. The intervention took place in an informal, nonthreatening setting with an easy-going and engaging peer-father instructor. BF education regarding benefits, nutrition, support and facilitation as well as counter arguments against not BF was delivered via video, presentation, open discussion, and role-play. The control intervention was led by the same facilitator, using the same methods and similar media, however with a focus on basic infant care and safety. Participants in the intervention group were significantly more likely to initiate BF (74 versus 41%) and although there was a lack of statistical significance of BF duration at 4, 6, and 8 weeks postpartum, rates were higher than observed among the control group (38, 35, and 35% compared to 35, 19, and 19%, respectively). Interestingly, researchers also found that maternal intention to breastfeed as well as maternal grandmother and paternal belief that the infant should be breastfed, was associated with higher rates of BF in both groups.

Another controlled trial⁵⁷ assessing paternal role in BF promotion investigated the effects of paternal education focused on the prevention and management of BF problems on the duration of BF. The intervention group received a 40-minute, midwife led, in-person education session on infant feeding, potential BF difficulties, and the prevention and management of said difficulties which also addressed paternal concerns and helped fathers recognize and accept their role. The control group had a similar session however the focus was on basic childcare with only information on the health benefit of BF, not problem management. At 6 months postpartum, the intervention group had statistically significant higher rates of EBF (25% versus 15%; $P < .05$) with a higher prevalence of

any BF at 12 months (19% compared to 16%), though not reaching statistical significance. While both groups reported a variety of BF difficulties, the control group was more likely to give up because of problems (18% compared to 4% among the intervention group). The majority (91%) receiving the intervention, compared to 48% of those not, reported receiving support and relevant assistance from their partners.

A controlled trial including 547 families at a BFH in Brazil⁵⁶ of 547 primarily low-income families set out to assess the impact of paternal inclusion in BF educational programs compared to no intervention and maternal only intervention on BF outcomes for the first 6 months postpartum. The pediatrician led intervention consisted of video, open-discussion, and an informational handout addressing BF recommendations, the prevention and management of BF problems, and the impact of paternal participation, including emphasizing how to assist the BF mother by helping with childcare duties or household chores. Most mothers (~93%) indicated the desire for paternal assistance, however ~21% were not sure in what capacity. Likewise, most fathers (~99%) indicated a desire to help their partners with BF however, 21.5% were not sure how to accomplish that. The results show that paternal inclusion in BF education interventions positively impacts BF outcomes, with rates of EBF at 4 months of age among the control, mother only, and mother/father intervention groups of 5.7%, 11%, and 16.5% ($P = .003$), respectively. Any BF at 6 months postpartum however was 46.4%, 60.3%, and 50%, respectively with the mother only intervention group at a significantly reduced risk of weaning within the first 6 months. Researchers hypothesize that the decreased rate of any BF at 6 months in the mother/father group could be a result of the lack of cultural relevance in the education video for lower socioeconomic status fathers. Due to the heavy

emphasis on assisting with household chores and childcare duties; however, in this population traditional patriarchal roles are still the norm so it may have been difficult for the fathers to relate to the content.

An incentive-based educational program targeting partner support among a low-income WIC population in the U.S. set out to increase knowledge regarding the importance of partner support and the resulting effect on BF rates and duration.⁵⁹ Both the control and intervention groups received the usual BF education provided by WIC. The intervention group also received an additional 2-hour session focused on BF basics, positioning, fears and concerns, problems and solutions, benefits, and myths, as well as an assortment of incentives such as gift bags, gift cards, samples, free haircut and/or lunch coupons, tickets to a sporting event, etc. Drastic differences were observed in rates of EBF at hospital discharge (55.2 and 88.5%; $P = .003$), 2 weeks (34.5 and 80.8%; $P = .000$), 6 weeks (24.1 and 50%; $P = .023$), and 3 months postpartum (17.2% and 42.3%; $P = .021$) among the control versus intervention group, respectively. This study further supports the need for paternal inclusion, concluding that providing incentives considerably affects BF motivation in the first 3 months.

With review of these trials, researchers⁵⁸ conclude that partner targeted BF educational interventions are an effective method to improve BF initiation and EBF, however cite the need for more RCTs and consistent definitions of various BF outcome measures. They also suggest incorporating male-focused education program at places of employment, home-based education programs, more programs delivered by peer-fathers, more follow-up telephone calls, and incentives.

Technology Based Breastfeeding Education

The rapid development of electronic technologies since the 1990s and increased access worldwide has brought significant new opportunities for disseminating information and gaining health related knowledge. It is estimated that over 40% of the world's population has internet access and over 95% have access to mobile services.⁶⁰ Tele-health is a growing field offering numerous advantages compared to face-to-face sessions including convenience, cost-efficiency, and accessibility. In addition to videoconferencing and telephone-based methods, other electronic technologies such as web-based, mobile text messaging and apps, and social networking sites provide even more options, reach, and advantages.^{60,61} E-technologies overcome barriers of cost and geographical isolation, particularly for low-income individuals, those in rural areas, those that may lack adequate transportation, and other hard to reach populations.⁶⁰ In recent years, as more individuals seek out health information from the internet, there has been a rise in the use of electronic technologies and mobile health for health promotion interventions, prompting the investigation of the effectiveness of such resources in the delivery of BF education and the resulting effects on BF outcomes.

Lau et al. (2016) conducted a meta-analysis including 16 studies with 5505 participants from 6 different countries (U.S., Finland, Iran, China, Spain, and France) examining the effect of various e-technologies on BF outcomes.⁶⁰ A variety of BF outcomes were investigated such as intention, initiation, exclusivity, intensity, and duration as well as BF awareness, attitudes, confidence, and knowledge. Compared to typical forms of usual care delivered by nurses, midwives, pediatricians, dietitians, PCs and university staff aimed to educate, promote, and support BF, various forms of e-

technology interventions including web-based, virtual, CD-ROM, e-prompt, or mobile text messaging are becoming increasingly utilized. Some of which focus on BF benefits, management, problems, physiology, mechanism, and techniques. In general, the use of e-technology interventions significantly improved BF initiation, duration of EBF, BF knowledge and attitudes. No significant effects were found on BF intention, intensity, awareness or confidence.

Researchers in Australia examined the effectiveness of a web-based BF intervention on BF initiation and duration using a website that provided best practice feeding information.⁶² Participants could post discussions, privately correspond with other participants via email, and contact a health care professional at any time through webcam. Statistically significant higher rates of EBF at 6 months postpartum were found among the intervention group, leading to the conclusion that web-based intervention may aid in closing the gap in maternal health services, as well as supporting beneficial BF outcomes.

Web-based BF education targeted towards physicians could also potentially improve BF outcomes. Analysis of the web-based education titled *BreastfeedingBasics* used by over 15,000 physicians, indicates that the free course covers a broad scope including BF knowledge competencies such as: anatomy and physiology, benefits, barriers, BF worldwide, problems, maternal medication use, and development of the breastfed infant.⁶³ As time is typically a barrier cited by physicians, this program offers the advantage of completing it on their own time.

Text4Baby was the first free mobile-based health service in the U.S. targeting low-income, young or minority mothers at risk for poor health outcomes and potentially

limited ability accessing accurate health information with the goal of reducing barriers to accessing health information, resources, and improving health knowledge and behaviors.⁶⁴ Clear, understandable, and relevant text messages in English or Spanish consist of a maximum of 160 characters at a 6th grade reading level. This program provides a cost-effective method of delivering educational content on a variety of BF topics such as BF benefits, weight gain, feeding frequency, hunger cues, videos, and more, as well as phone numbers for additional resources.⁶⁵ The LATCH trial⁶⁶ among WIC participants in a BF PC program at four Connecticut locations tested the effectiveness of a two-way mobile text messaging intervention combined with in-person pre/postnatal BF education, to promote EBF from 2014 – 2016. PCs had support from International Board-Certified Lactation Consultants in delivering message content related to BF positioning, benefits, myths, how to tell if the infant is receiving enough BM, and other relevant topics. EBF rates at 2 weeks postpartum were higher for the intervention group, although not statistically significant; no association was observed at 3 months. The trial did, however, facilitate early contact (within the first 48 hours) with PCs among participants in the intervention group, 60% compared to 34.6% in the control group. Researchers suggested that perhaps some participants could not receive as much support as was needed, due to the part-time nature of the PCs, limited ability to help, or the large number of participants that were lost to follow-up.

Researchers in other countries have conducted interventions incorporating the use of mobile text messaging aimed at improving BF practices. A community-based study in China delivered relevant and practical weekly text messages about BF and infant feeding practices, based on WHO guidelines, input from health care professionals, and peer-

reviewed literature.⁶⁷ Findings indicate a significant increase in the rate of EBF at 6 months among those receiving the weekly messages (15.1%) compared to those in the control group receiving standard pre/postnatal care only (6.3%). Researchers conducting a pilot study in India utilized daily text messaging to supplement weekly cellular phone calls with a lactation counselor as a way to provide BF education and counseling and improve BF practices.⁶⁸ Appropriate timing of BF initiation as well as rates of EBF at 6, 10, and 14 weeks and 6 months were significantly ($P < .001$) higher among the intervention group. A unique intervention among Nigerian women incorporated BF education and voice/text mobile phone messaging reinforcing the lessons, into monthly microcredit program meetings, ultimately increasing the likelihood of EBF at 6 months of age.⁶⁹ In a pilot study, *MumBubConnect*, a two-way text messaging service in Australia providing weekly BF information, witnessed increased EBF rates although not any or predominately BF rates.⁷⁰

As mothers and fathers using e-technologies such as social media networking sites and mobile applications increases, these platforms prove to be prime outlets for disseminating BF information. Aware of the fact that many women look to Facebook for BF information and support as well as other parenting information, Bridges et al.⁷¹ examined BF related posts and comments of members in 15 Australian Breastfeeding Association closed Facebook groups to determine how BF women experience these online support groups. Of all queries posted, 44% were specifically related to BF with the most common questions related to BF management, BF and health, and BF and work. The Australian-based mobile app *Milk Man*, developed as part of a larger infant feeding initiative designed to improve BF outcomes is based on social cognitive theory and

targets fathers by providing them with relevant BF information and ways that they can support their partners with BF using engaging features such as push notifications and gamification.⁷²

CHAPTER III

Methodology

Study Design and Population

This study is an observational cross-sectional cohort study. The study population will include current and new female clients ≥ 18 years of age who sought counseling at *Pea Pod Nutrition and Lactation Support*, a non-profit family nutrition organization serving the city of Atlanta, Georgia and the surrounding areas. In addition to family nutrition services, *Pea Pod* offers breastfeeding support, office based and in-home lactation consultations, and a variety of in-person and web-based breastfeeding education classes. *Pea Pod* is unique in that they serve a varied population with demographics consisting of various ages, races, ethnicities, education, and income levels. Only female *Pea Pod* clients who are the primary caregiver of an infant ≤ 1 year of age will be included in the study. Mothers who are not clients at *Pea Pod* or clients who are < 18 years of age, not primary caretakers, or who have a child > 1 year of age will be excluded.

Study Variables

Demographic characteristics and breastfeeding duration, education, knowledge, and self-efficacy data will be obtained via survey (Table 1). Existing and new clients will be invited to participate in the survey via email. Breastfeeding education will be the independent variable and the primary outcome variables include breastfeeding rates, exclusivity of breastfeeding (only breast milk, water, and supplements), and duration of breastfeeding in weeks. Maternal breastfeeding knowledge and self-efficacy are

secondary outcome variables that will be assessed via voluntary survey responses.

Survey questions will assess the type, timing, and setting of education received, topics addressed in the education, current and previous breastfeeding duration and exclusivity, maternal BF knowledge and self-efficacy regarding breastfeeding (Appendix I). Eligible mothers will receive an email from Alicia Simpson, Executive Director of *Pea Pod Nutrition and Lactation Support*, that includes the following statement: “You are being asked to take part in a research study looking at the link between breastfeeding education and feeding choice in infants. Please read the attached consent form. If you wish to take part in the study after reading the consent form, please click the link below to fill in the survey. The survey should take no more than 10 minutes to do and all answers will be kept private. Thank you! Anita Nucci, PhD, RD, LD, Associate Professor and Dashia Antunes, graduate student, Georgia State University, Department of Nutrition.”

Additionally, attached to the email consent form, and a link to the electronic survey. The electronic survey will be created in Google Forms. All responses will be anonymous. The electronic survey responses will be available only to the study PI and Student-PI and accessed via password protected computer. Survey responses will be entered onto a Microsoft Excel spreadsheet that will be stored on a shared Drop Box created by the study PI and accessible to the Student-PI. This study was given expedited approval from Georgia State University IRB.

Statistical Analysis

Frequency statistics were used for analysis of all participant demographic variables as well as breastfeeding rate, education, self-efficacy, and knowledge.

Normality testing will be conducted on the continuous age variable. Chi-square statistics will be used to analyze the association between breastfeeding education and infant breastfeeding outcomes (exclusivity and duration) as well as secondary maternal outcomes (breastfeeding knowledge and self-efficacy). All statistical analysis will be conducted using SPSS (version 25.0, SPSS Inc. Chicago, IL). A P-value of <0.05 will be considered statistically significant.

CHAPTER IV

Results

Participant Characteristics

Study participants had a median age of 34 years (range; 25 – 44), 70% self-reported as Caucasian and an income between \$100,000 - \$150,000. All participants hold a higher education degree, with 46.7% have a master's degree. Detailed demographics are further summarized in Table 1. Sixty participants completed the anonymous online survey and 55 individuals (91.7%) reported receiving some type of breastfeeding education at some point in time, with about half receiving the education postnatally (Table 2).

BF Education

Of the 55 that reported receiving BF education, many respondents received their BF education at more than one location/setting, commonly including a healthcare provider's office, a hospital or birthing center, a La Leche League meeting, and/or within the participant's private home (81.5%, 50%, 35.2%, and 33.3%; respectively) (Table 3). Most participants reported receiving education in multiple settings. The vast majority of participants received their BF education in-person (81.8%) or "hands-on" education with a lactation consultant, doctor, midwife, or other healthcare provider (80%). Few reported receiving BF education virtually (14.5%) or via telephone/text messaging (7.3%) (Table 4). A variety of topics were included in the BF education received by study participants (Table 5). Commonly reported topics of concern relevant to BF include: BF positions

(92.7%), proper latching (89.1%), benefits of BF (85.5%), maternal benefits of BF (78.2%), BF problems (78.2%), and BF timing/frequency (74.5%).

BF Knowledge and Self-Efficacy

BF knowledge and self-efficacy was assessed using a 5-point Likert scale ranging from strongly agree to strongly disagree. Of the 55 participants that received BF education, 100% agreed that the BF education that they received increased their knowledge of BF, with 60% strongly agreeing. Most participants (90.9%) agreed that their confidence in BF improved because of their BF education, 52.7% of which strongly agreed. Two participants disagreed that their BF education increased BF confidence and three others neither agreed nor disagreed.

Twenty-three of the 60 respondents (38.3%) are currently BF. Of which, 65.2% are exclusively BF and 52.2% have been BF for more than 6 months. Chi-square analyses were performed to determine if associations exist between BF education and BF outcomes (duration and exclusivity), as well as maternal BF knowledge and self-efficacy (confidence). No statistically significant association was found between those that received BF education and BF duration ($p = .838$) nor rate of exclusive BF (Fisher's Exact Test $p = .350$). Of participants that are currently exclusively BF, 50% reported receiving some form of BF education. Of individuals that previously breastfed for 6 months or more, approximately 74% reported receiving some form of BF education. All participants that reported an increase in BF knowledge and self-efficacy (confidence) received BF education; therefore, we are unable to assess the association between the two variables

Table 1. Demographic Characteristics of Study Participants

| Characteristics | Participant Responses (N = 60) |
|---------------------------|---------------------------------------|
| | n (%) |
| Age* (in years) | 34 (31, 35) |
| Race | |
| Caucasian | 42 (70.0) |
| African American | 13 (21.7) |
| Hispanic | 3 (5.0) |
| Asian | 2 (3.3) |
| Maternal Education | |
| Some High School or Less | 0 (0) |
| High School Diploma | 0 (0) |
| Associate Degree | 0 (0) |
| Bachelor's Degree | 24 (40.0) |
| Master's Degree | 28 (46.7) |
| Doctoral Degree or Beyond | 8 (13.3) |
| Household Income | |
| \$0 - \$9,999 | 0 (0) |
| \$10,000 - \$24,999 | 0 (0) |
| \$25,000 - \$49,999 | 3 (5) |
| \$50,000 - \$74,999 | 8 (13.3) |
| \$75,000 - \$99,999 | 19 (31.7) |
| \$100,000 - \$149,999 | 24 (40) |
| \$150,000 and Greater | 1 (1.7) |

*Median (Interquartile range; 25%, 75%)

Table 2. Time Period Breastfeeding Education Occurred

| Breastfeeding Education Timeframe | Participant Responses (N = 55) n (%) |
|--|---|
| Preconception | 4 (7.3) |
| Prenatal | 23 (41.8) |
| Postnatal | 28 (50.9) |

Table 3. Location of Breastfeeding Education

| Breastfeeding Education Location | Participant Responses (N = 54) n (%) |
|---|---|
| Participant's Home | 18 (33.3) |
| Healthcare Provider's Office | 44 (81.5) |
| Community Health Department | 0 (0) |
| WIC Clinic | 2 (3.7) |
| LLL Meeting | 19 (35.2) |
| Hospital or Birthing Center | 27 (50.0) |
| Other | 8 (14.8) |

WIC – Women, Infants, and Children, LLL – La Leche League

Table 4. Type of Breastfeeding Education Received

| Type of Breastfeeding Education | Participant Responses (N = 55) n (%) |
|--|---|
| In-person | 45 (81.8) |
| Online (Webinar, Class, Video, etc.) | 8 (14.5) |
| Telephone/Text Messaging with a Healthcare Provider | 4 (7.3) |
| Presentation (Lecture, Tutorial, Pictures, Demonstrations, etc.) | 22 (40) |
| Hands-on (with a Lactation Consultant, Doctor, Midwife, etc.) | 44 (80) |
| Peer Counseling | 5 (9.1) |

Table 5. Topic of Breastfeeding Education

| Breastfeeding Education Topics | Participant Responses (N = 55) n (%) |
|---|---|
| Benefits of Breastfeeding | 47 (85.5) |
| Maternal Benefits of Breastfeeding | 43(78.2) |
| How to Determine If Baby is Getting Enough Milk | 34 (61.8) |
| Typical Infant Growth and Development | 30 (54.5) |
| Breastfeeding Timing and Frequency | 41 (74.5) |
| Breastfeeding Myths | 30 (54.5) |
| Breastfeeding Problems | 43 (78.2) |
| Proper Latching | 49 (89.1) |
| Breastfeeding Positions | 51 (92.7) |
| Pumping Breastmilk | 34 (61.8) |
| Breastfeeding and Returning to Work/School | 22 (40.0) |
| Resources for Help If Needed | 17 (30.9) |

CHAPTER V

Discussion

In this study participants were primarily high-income, educated, Caucasian women. Most participants received BF education either during their pregnancy or in the postnatal period. The education received occurred in a variety of settings, included a variety of topics, and mainly consisted of in-person/hands-on instruction, with limited virtual/telephone education. Although the data show positive trends towards a relation between BF education and BF outcomes, no significant associations were found. Therefore, we fail to reject null hypothesis 1 (there will be no association between BF education status and BF outcomes), given the extremely small sample of participants that either did not receive BF education or did not breastfeed and the lack of significant association. Results regarding BF knowledge and self-efficacy are inconclusive therefore we are unable to assess whether we reject or fail to reject null hypothesis 2 (there will be no association between BF education status and maternal BF knowledge and self-efficacy).

Despite our findings not reaching statistical significance, the trends observed in this study are consistent with previous similar studies investigating the effects of BF education on infant feeding outcomes. Based on survey responses, participants in this study reported a wide variety of educational topics, settings, and professional support. The large systematic review conducted in 2017 by Wouk and others⁵² also found that a variety of BF educational interventions combined with interpersonal professional support improved BF outcomes. Our results show a trend towards high EBF rates among

participants that reported receiving education. This is also consistent with the findings resulting from the 2013 Lancet review⁸ which concluded that BF education improved overall rates of EBF among participants. Although Sinha et al. (2015)⁵⁴ found the greatest effects of BF education interventions to be on lower-middle income women, and participants in this study were mainly middle-upper income, the researchers found that BF education improved rates of EBF, again consistent with the trend observed in this study. Specifically, Sinha et al.⁵⁴ concluded that a combination of BF education settings had the greatest beneficial impact on BF outcomes, which was also consistent among our participants.

In this study, participants were in agreement that BF education improved their knowledge of BF and over 85% of participants report “benefits of BF” as one of the topics addressed in their education, which is consistent with Kornides and associates⁹, who found an association between education on the benefits of BF and improved BF outcomes. In this study, more than 90% of participants agreed that their BF education improved their self-efficacy, also consistent with the findings of other researchers. In particular, Brockway, Benzies, and Hayden¹⁰ found that BF education and support delivered through a combination of settings over multiple encounters improved rates of EBF and maternal self-efficacy. This is consistent with the current survey responses as all responses indicated participants received their BF education in more than one setting and likely during multiple different encounters. In addition, researchers in Canada⁴⁹ and Brazil⁵⁰ have also found higher rates of EBF and improved maternal self-efficacy among women that received BF education.

Utilizing an online platform and email invitation for collection of survey responses is a strength of this study as it allows for efficient distribution, minimal cost, and convenience of survey completion. Despite the ease of the data collection design, this study has several limitations. The online nature of the data collection presents as a limitation as it is impossible to ask participants about any questionable or unclear responses, nor were participants able to ask the researchers for clarification. Another limitation with respect to the survey itself, is that several of the survey questions were poorly written and therefore could have been misinterpreted by some participants. Also, the survey form was neither piloted beforehand nor were the questions validated. Additional limitations include the small sample size and lack of diversity among the study participants. The demographic characteristics of the study population were not consistent with the target population as most were Caucasian, wealthy, and educated. Additionally, there were very few participants that did not breastfeed and very few that did not receive BF education, making the study population not representative of the wider population.

Future studies using a questionnaire method should consider conducting a pilot study to determine any potential issues with the questions or contents. Moreover, researchers may want to consider individually collecting survey responses via the telephone or in-person to immediately clarify any questions/responses as it was unclear how some of the questions used in this study may have been interpreted by participants. Future studies with the intent of studying demographics consistent with the southeastern U.S., should aim for a representative sample population with greater ethnic and social diversity, perhaps recruiting from a greater mixture of settings such as WIC, public health

departments, local hospitals, or other community settings. Incentives and partnerships with local physicians could be considered to attract more diverse participation. An anonymous online survey may not be the best manner to engage a wide variety of individuals possibly due to inadequate internet access, time constraints, work conflicts, or lack of interest in online surveys. Lastly, as the use of telehealth and virtual learning modalities takes off future studies should compare virtual education effectiveness with traditional hands-on and in-person types of BF education.

In conclusion, although current results did not reach statistical significance, we observed high reported rates of BF among our population with a trend towards high rates of EBF for infants 6 months of age and older. All participants agreed that BF education improved their BF knowledge and the majority agreed that their self-efficacy improved as a result of the education that they received.

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APPENDIX A

Breastfeeding Characteristics of the PeaPod Nutrition and Lactation Support Population

Please place a check mark in the box next to your answer.

1. Race
 - White
 - Black
 - Asian
 - Mixed race

2. What is your age (years): _____

3. What is your highest level of education?
 - Some high school or less
 - High school diploma
 - Associate degree
 - Bachelor's degree
 - Master's degree
 - Doctoral degree or beyond
 - Prefer not to answer

4. What is your total annual household income?
 - \$0 to \$9,999
 - \$10,000 to \$24,999
 - \$25,000 to \$49,999
 - \$50,000 to \$74,999
 - \$75,000 to \$99,999
 - \$100,000 to \$149,999
 - \$150,000 or greater
 - Prefer not to answer

5. Have you received any type breastfeeding education? If no, skip to question #12.
 - Yes
 - No

6. If so, when did you receive the education:
 - Pre-conception (before the pregnancy)
 - Prenatal (during pregnancy)
 - Postnatal (after birth)

7. If so, where did the education take place? Select all that apply.
 - At home
 - Health care provider's office (doctor, midwife, lactation consultant etc.)
 - Community Health Department

- WIC clinic
 - La Leche League meeting
 - Hospital or birthing center
 - Other (please describe) _____
8. Which best describes the type of education?
- In-person
 - Online (webinar, class, videos, etc.)
 - Telephone or mobile text messaging with a health care provider
 - Presentation (lecture, tutorial videos, pictures, demonstrations, etc.)
 - Hands-on (with a lactation consultant, doctor, midwife, or other provider)
 - Peer-counseling
 - Other (please describe) _____
9. Which topics were covered during the education? Select all that apply.
- Benefits of breastfeeding
 - Maternal benefits of breastfeeding
 - How to determine if your baby is getting enough milk
 - Typical infant growth and development
 - Timing and frequency of breastfeeding
 - Breastfeeding myths
 - Breastfeeding problems
 - Proper latching
 - Breastfeeding positions
 - Pumping breastmilk
 - Breastfeeding and returning to work/school
 - Resources for help if needed
 - Others (please list) _____
10. The breastfeeding education that I received increased my knowledge of breastfeeding.
- Strongly Agree
 - Agree
 - Neither agree nor disagree
 - Disagree
 - Strongly disagree
11. The breastfeeding education that I received increased my confidence in my ability to breastfeed.
- Strongly agree
 - Agree
 - Neither agree nor disagree
 - Disagree
 - Strongly Disagree
12. Are you currently breastfeeding? If no, skip to question #15.
- Yes

- No
13. Are you exclusively breastfeeding? (Baby receives no other formula or nonhuman milk substitutes).
- Yes
 No
14. How long have you been currently breastfeeding your child?
- < 1 month
 1 month to < 3 months
 3 months to < 6 months
 6 months or more
15. If no longer breastfeeding, was your child exclusively breastfed (Baby receives no other formula or nonhuman milk substitutes). If no or does not apply, skip to question #16.
- Yes
 No
 Does not apply
16. If no longer breastfeeding, how long did you previously breastfeed your child?
- < 1 month
 1 month to < 3 months
 3 months to < 6 months
 6 months or more
 Does not apply (I am still breastfeeding)