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Association between Breastfeeding Self-Efficacy and Human Milk Feeding in Mothers of Moderate and Late Preterm Infants in a Level II NICU

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Association between Breastfeeding Self-Efficacy and Human Milk Feeding in Mothers of Moderate and Late Preterm Infants in a Level II NICU

by

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Abstract

Introduction: There is a positive association between breastfeeding self-efficacy (BSE) and breastmilk feeding duration in mothers of healthy, full-term infants. BSE refers to a mother's perceived ability to successfully breastfeed her infant and is associated with four main factors: (a) performance accomplishments, (b) vicarious experience, (c) verbal persuasion, and (d) physiological and affective states. Limited research explores the relationship between BSE and breastmilk feeding duration for mothers of preterm infants. **Aim:** The aim of this research was to explore the association between BSE and human milk feeding at discharge in mothers of moderate and late preterm infants in a level II NICU. **Methods:** This study was part of a larger study known as the Family Integrated Care (FICare) study, a cluster randomized controlled trial conducted in 10 level II neonatal intensive care units (NICUs) in Alberta. BSE and breastmilk feeding rates were secondary outcomes of the trial. I conducted an observational study that involved secondary data analysis. Participants in this study included 221 maternal-infant dyads from the five control sites. BSE was collected using the modified breastfeeding self-efficacy scale – short form and human milk feeding outcomes were collected using categories recommended by Labbok and Krasovec. I aimed to look at predictors of human milk feeding at discharge and how previous breastfeeding experience may affect feeding outcomes. The primary hypothesis for this study was that mothers with higher modified BSES-SF scores at admission would be more likely to be providing human milk at discharge, compared to mothers with lower modified BSES-SF scores at admission. The secondary hypothesis for this study was that the mothers with previous breastfeeding experience (multiparous) were more likely to be providing human milk at discharge, compared to mothers with no previous breastfeeding experience (primiparous). **Results:** The primary hypothesis for this study was supported and with all models (multivariable, crude, and stratified by parity analyses), BSE at admission was significantly associated with human milk feeding at discharge. That is, mothers with higher modified BSES-SF scores at admission were more likely to be human milk feeding at discharge. Bivariate: For the crude analysis (full sample), and primiparous and multiparous sub-groups, modified BSES-SF scores at admission were significantly associated with type of feeding at discharge ($p < 0.05$). Multivariable: for each unit increase on the modified BSES-SF, the odds of using human milk at discharge increased by a factor of 1.06 (95% CI [1.03, 1.09], $p < 0.001$). In the primiparous sub-group, for each unit increase on the modified BSES-SF, the odds of using human milk at discharge increased by a factor of 1.08 (95% CI [1.03, 1.14], $p = 0.001$). In the multiparous sub-group, for each unit increase on the modified BSES-SF, the odds of using human milk at discharge increased by a factor of 1.05 (95% CI [1.00, 1.10], $p = 0.034$). The secondary hypothesis was not supported since there was no important difference in the association between higher modified BSES-SF scores at admission and providing human milk at discharge when stratified by parity. Only for mothers in the primiparous sub-group, education in the multivariable model and was significantly associated with human milk feeding at discharge. Mothers with a high school diploma or less were 11.30 (95% CI [1.11, 115.38], $p = 0.041$) times more likely to be combination feeding at discharge, compared to mothers with a college diploma/certificate and higher. C**onclusion:** using the modified BSES-SF at admission in level II NICUs has potential as a clinical tool to support healthcare providers in identifying mothers of moderate and late preterm infants at risk of early discontinuation of human milk feeding at discharge. Further research is needed to support the association between higher modified BSES-SF scores at admission and type of feeding at discharge with this maternal-infant dyad.

Keywords: preterm infant, human milk feeding, breastfeeding self-efficacy, family integrated care, neonatal intensive care unit

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Dedication

I dedicate this thesis to my baby boy, Coen, who at only 38 weeks gestation has already brought so much love and joy to my life. Thanks for surviving the bumpy ride and not making an early appearance. You were my motivation to finish. We did it!

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List of Terms/Abbreviations and Definitions

Terms/Abbreviation	Definition
Bottle feeding	Feeding via bottle with a nipple, which may contain breastmilk or formula
BSE	Breastfeeding Self-Efficacy
BSES-SF	Breastfeeding Self-Efficacy Scale – Short Form
Combination feeding	Feeding that includes a combination of breastmilk and formula
Direct breastfeeding	Nutritive and non-nutritive suckling directly on a mother's breast
FICare	Family Integrated Care
Gavage feeding	Feeding that occurs through a tube (e.g., nasogastric or orogastric)
Higher modified BSES-SF scores	The theoretical range of scores on the modified BSES-SF is 18 to 90 with higher scores indicating higher levels of breastfeeding self-efficacy
Human donor milk	Breastmilk that comes from a donor (e.g., a breastfeeding mother who is screened and her donated milk aggregated with that of other donors and pasteurized by a human milk bank)
Human milk feeding	Breastmilk offered to the infant directly from the mother's breast; mother's pumped breastmilk given by bottle, nasogastric or orogastric tube; and human donor milk. The breastmilk may have included human milk fortifiers
Human milk fortifier	Fortifier (e.g., powder) that is added to human milk in the NICU to increase the nutritional content
Late preterm	34^0 to 36^6 weeks gestation
Moderate preterm	32^0 to 33^6 weeks gestation
Modified BSES-SF	Breastfeeding Self-Efficacy Scale – Short Form that was adapted for mothers of preterm infants given their unique breastmilk feeding issues
NICU	Neonatal Intensive Care Unit

Epigraph

"You can choose courage, or you can choose comfort. You cannot have both." – Brene Brown

Chapter 1: Introduction

In this chapter, I will introduce topics relevant to this study including a discussion on preterm birth rates, followed by a definition of preterm birth, moderate and late preterm birth, costs associated with moderate and late preterm birth, neonatal intensive care unit and benefits of breastfeeding, cost of low breastmilk feeding rates, and breastfeeding self-efficacy theory. This chapter will conclude with an overview of the aim of this study.

Preterm Birth Rates

Preterm birth and its complications contribute significantly to infant death globally (March of Dimes, 2017). In the United States, preterm birth rates are on the rise (March of Dimes, 2017) and every year the birth of premature infants exceeds half a million (National Center for Health Statistics, 2012). At present, the preterm birth rate in the United States (11.5%) is above the March of Dimes international goal for 2020 (9.6%) and approximately 6% away from the March of Dimes goal for 2030 (5.5%) (Hall & Greenberg, 2016). In Canada from 2016-2017, the average preterm birth rate among all provinces and territories was 7.9%. The Northwest Territories had the highest preterm birth rate (8.9%), followed by the Yukon Territory (8.8%), and Alberta (8.7%). Quebec had the lowest preterm birth rate (7.1%). Within Alberta, Edmonton has the highest preterm birth rate (9.0%), which is similar to Calgary (8.9%) (Canadian Institute for Health Information, 2018). Delayed childbearing (Newburn-Cook & Onyskiw, 2005; Joseph, Allen, Dodds, Turner, Scott, & Liston, 2005) and assisted reproductive technology (McGovern, Llorens, Skurnick, Weiss, & Goldsmith, 2004) may be contributing factors to Alberta's high preterm birth rates.

Defining Preterm Birth

Preterm birth is defined as birth prior to 37 weeks gestation (World Health Organization, 2017). Over the years, the definitions relating to preterm subcategories (e.g., extremely preterm, very preterm, moderately preterm, and post term) differ throughout the literature (Rose & Engle, 2017). Common definitions relating to preterm subcategories are as follows: extremely preterm (< 28 weeks and 0 days; 28^0); very preterm (28 weeks and 0 days; 28^0 to 31 weeks and 6 days; 31^6) (Rose & Engle, 2017; World Health Organization, 2017); moderate (32 weeks and 0 days; 32^0 to 33 weeks and 6 days; 33^6); and late preterm (34 weeks and 0 days; 34^6 to 36 weeks and 6 days; 36^6) (Engle, Tomashek, & Wallman, 2007). In 2005, the National Institute of Child Health and Human Development sponsored a workshop and compiled a team of experts who made the decision to replace 'near term' with 'late preterm' (Raju, Higgins, Stark, & Lenovo, 2006). Given that there is overlap in the way gestational age is defined for preterm infants (World Health Organization, 2017), this study used the definitions reported by Engle et al. (2007), which defined moderate preterm infants as those born between 32^0 to 33^6 weeks gestation and late preterm infants as those born between 34^0 to 36^6 weeks gestation.

Moderate and Late Preterm Birth

Within the last decades, research has focused on the morbidities related to the highest risk preterm population (< 32 weeks), even though moderate and late preterm infants comprise approximately 80% of the preterm population (Gouyon, Iacobelli, Ferdynus, & Bonsante, 2012). Compared to full-term infants, moderate and late preterm infants experience substantial neonatal and post-discharge morbidity and mortality (Vohr, 2013). Due to premature development, moderate and late preterm infants are at an increased risk for respiratory distress, apnea, infection, hypoglycemia, immunological compromise, jaundice, temperature instability, and poor oral feeding (Vohr, 2013). Post discharge, late preterm infants are 2 to 3 times more likely to be readmitted to the hospital or visit an emergency room, compared to full-term infants (Vohr, 2013). In addition, there are health consequences that extend beyond the immediate postnatal period. Compared to term infants, moderate and late preterm infants are also at increased risk of "development disability, school failure, behaviour problems, social and medical disabilities, and death" (Vohr, 2013, p. 741).

Costs Associated with Moderate and Late Preterm Birth

The short-term and long-term costs associated with moderate and late preterm birth are noteworthy (Gouyon et al., 2012). In a study looking at the economic burden of prematurity in Canada, it was determined that costs for moderate and late preterm infants were substantial (Johnston et al., 2014). In the first 10 years of life, total national costs (determined by costs in Canada associated with healthcare resources, medical expenses, and death) for moderate preterms (defined for this study as 28^0 to 32^6 weeks gestation) was $255.6 million, late preterms (33^0-36^6 weeks gestation) was $208.2 million, and early preterms (< 28 weeks gestation) was $123.3 million (Johnston et al., 2014).

Johnston et al. (2014) reported that all moderate and late preterm infants contributed almost $500 million of the total national costs (as described above) of preterm births, approximately 3.8 times more than costs associated with early preterm infants. In addition to the economic costs related to preterm birth, there are human costs, which include loss of parental productivity, as well as financial and emotional stressors associated with the NICU environment (Johnston et al., 2014; Rose & Engle, 2017).

Neonatal Intensive Care Unit and Benefits of Breastfeeding

Preterm infants < 32 weeks gestation are usually admitted to a level III NICU (Committee on Fetus and Newborn, 2012), whereas moderate and late preterm infants are usually admitted to a level II NICU. The birth of a preterm infant is often unexpected and adapting to the challenges of caring for a preterm infant in a fast-paced and highly technical NICU environment can create separation between the infant and their family (Briere et al., 2014). Given the increased risk of health complications and morbidities, preterm infants may benefit from the protective properties of breastmilk (Briere et al., 2014).

Throughout the literature, breastfeeding definitions differ. For example, Labbok and Krasovec (1990) defined 'exclusive breastfeeding' as only breastmilk, which does not include any other solid or liquid. In comparison, the WHO (2008) defined exclusive breastfeeding as breastmilk directly from a mother's breast, pumped breastmilk, and breastmilk from a wet nurse. The WHO (2008) definition also extends to include oral rehydration solutions, vitamins, minerals, as well as medicines. For this study, I defined 'human milk feeding' as breastmilk offered to the infant directly from the mother's breast; mother's pumped breastmilk given by bottle, nasogastric or orogastric tube; and human donor milk. Except for feeding offered directly from the mother's breast, the breastmilk may have included human milk fortifiers.

Cost of Low Breastmilk Feeding Rates

Low rates of breastmilk feeding may be detrimental to the health of preterm infants and their families, and have economic implications (Bartick, 2011; Rollins et al., 2016; Victora et al., 2016). In the United States, low rates of breastmilk feeding were estimated to contribute $3.9 billion in medical costs, $1.3 billion in non-medical costs, and $14.2 billion in mortality (Johnston et al., 2014). To my knowledge, similar studies have not been conducted in Canada.

Breastfeeding Self-Efficacy Theory

Breastfeeding duration is associated with maternal self-efficacy. Self-efficacy theory is constructed within a broader social cognitive theory (Bandura, 2012) and has been used as a foundation for many studies related to breastfeeding (Tuthill, McGrath, Graber, Cusson, & Young, 2016). According to Bandura (1977), self-efficacy is a complex cognitive process that influences how an individual makes decisions regarding their abilities to perform a specific behaviour. Self-efficacy reflects an individual's perceived (vs. true) abilities and influences an individual's choice of specific behaviours, as well as the persistence of those chosen behaviours (Bandura, 1977). At its core, self-efficacy refers to an individual's confidence in their ability to accomplish a specific skill or behaviour (Bandura, 1977). Highly efficacious individuals are more likely to be successful in mastering a specific behaviour, compared to individuals with low self-efficacy (Bandura, 1977).

In mothers of healthy, full-term infants, maternal BSE has gained popularity as a potential theory that may help to improve breastmilk feeding rates (Dennis, 1999; Dennis, 2003; Wheeler & Dennis, 2013); yet, limited research explores this relationship for mothers of moderate and late preterm infants. Further research is required to investigate BSE with the moderate and late preterm population. Given the complex nature of breastfeeding and the important implications for premature infant health outcomes, BSE was a concept that I explored in this study.

The **aim of this study** was to explore the factors that predicted human milk feeding in mothers of moderate and late preterm infants in a level II NICU. Although a cause and effect relationship cannot be determined given the observational design of this study, understanding the factors that contribute to human milk feeding in this population may produce valuable knowledge about an identified gap in the literature and generate hypotheses for further study. Understanding the predictors of human milk feeding may ultimately lead to the development of research and clinical practices that may improve rates for this preterm population.

Chapter 2: Literature Review

In this chapter, I will present a review of the literature including a discussion about the benefits of breastmilk feeding for preterm infants, predictors of breastmilk feeding, breastfeeding self-efficacy, the neonatal intensive care unit, and maternal mood disorders. This chapter will conclude with a methodological critique of the literature, identification of knowledge gaps in the literature, and review of research questions.

Search Strategy

I searched the following electronic databases: Cumulative Index Nursing and Allied Health Literature (CINAHL), PubMed, and Google Scholar. I used the following keywords: [infants, ill infant, newborn, preterm infant*, “infant, premature”, “infant, very low birth weight”], [“breastfeeding self-efficacy”, “breastfeeding self efficacy”, breastfeeding self-efficacy scale, maternal confidence, breastfeeding confidence], [mother, maternal], [breastfeeding, breast-feeding, “breastmilk feeding”, breast milk feeding, expressed breast milk, expressed breast-milk], and [infant feed*, feeding outcomes, feeding rates]. I then combined similar terms using “or” with a final grouping using “and”. I set the following limiters: scholarly peer reviewed journals; English language; and set a timeframe of 2001 to present. The final search yielded 312 articles. I briefly reviewed these articles and included literature in my thesis that was high-level evidence (e.g., randomized controlled trials), current, and related to my research question and population of interest.

Benefits of Breastmilk Feeding for Preterm Infants

Breastmilk is considered the ideal source of nutrition for infants and provides many nutritional, immunological, and emotional benefits (Victora et al., 2016). The American Academy of Pediatrics and Canadian Pediatric Society recommend exclusive breastfeeding for at least the first 6 months of life with continued breastfeeding beyond 1 year (American Academy of Pediatrics, 2012; Canadian Pediatric Society, 2009). In the United States, 79.2% of all women initiate breastfeeding, but only 18.8% of infants are exclusively breastfed at 6 months (Centers for Disease Control, 2014). Few mothers met the Canadian Paediatric Society recommendations as only 50% provided any breastmilk to their infants at 6 months, while only one in five mothers exclusively breastfed (McQueen et al., 2011).

Due to immature development, preterm infants who are at an increased risk for health complications and morbidities may receive important benefits from the immunological and neurological properties of breastmilk (Wheeler & Dennis, 2013). In comparison to full-term infants, however, preterm infants received less breastmilk (Wheeler & Dennis, 2013). Buller and colleagues (2008) found that breastfeeding initiation rates (receiving any breastmilk at discharge) for preterm infants born between 30 and 35 weeks gestation in Toronto, Canada was 82.4% (61.8% exclusively); breastfeeding rates decreased around 6 months post-hospital discharge to a range of approximately 49% (31.2% exclusively). As a result of immaturity and health complications, preterm infants were often unable to feed directly from the breast and mothers needed to frequently pump their breastmilk, which can be time consuming, stressful, and exhausting (Briere et al., 2014).

Predictors of Breastmilk Feeding

According to the research, there are several predictors of breastmilk feeding. Women who were married, non-smokers, older, and from a higher socioeconomic status were more likely to breastfeed for longer durations (Niela-Vilén et al., 2016). Dennis (2002) found that women of a young maternal age, ethnic minority, low-income, and who were unsupported were least likely to breastfeed (Dennis, 2002). These factors were similar in mothers of healthy, full-term infants, as well as preterm infants (Niela-Vilén et al., 2016). Many of the known predictors of breastfeeding (e.g., maternal age and socioeconomic status) are non-modifiable demographic factors (Dennis, 2002; Dennis & Faux, 1999). To positively impact breastfeeding outcomes, health care professionals need to investigate modifiable factors (Dennis & Faux, 1999), such as breastfeeding self-efficacy (Dennis, 2006; Wheeler & Dennis, 2013). As a result, the following review will focus on potentially modifiable factors (e.g., NICU care, maternal mood disorders, and BSE), as these may prove to be clinically relevant.

Neonatal intensive care unit.

There were many barriers to breastfeeding for preterm infants, including hospital and clinical practices (Gerhardsson et al., 2018). For example, when premature infants were admitted to a NICU and separated from their mothers at birth, it took longer to initiate breastfeeding, while frequent skin-to-skin contact and rooming in were positively associated with breastfeeding (Maastrup et al., 2014). Limited research in this area suggests that only a small percentage of preterm infants were permitted to engage in skin-to-skin contact with their mothers in the delivery room (Maastrup et al., 2014). Researchers have identified that healthcare staff may not have the time or appropriate training to provide breastfeeding support to mothers of preterm infants (Renfrew et al., 2009).

The NICU is a fast-paced, highly technical, stressful, and challenging environment that can compromise breastmilk feeding (Swanson et al., 2012; Wheeler & Dennis, 2013) and further isolate the mother, who may be perceived as an outsider within a complex medical environment (Swanson et al., 2012). Mothers of preterm infants face unique breastmilk feeding challenges, including milk supply issues, which often require an exhaustive pumping regimen of at least every 2 to 3 hours (Swanson et al., 2012; Wheeler & Dennis, 2013). Preterm infants typically begin receiving breastmilk via gavage and bottle feeding before transitioning to direct breastfeeding, further complicating an already challenging and overwhelming experience for mothers of preterm infants (Swanson et al., 2012). Dosani et al. (2017) found that mothers of late preterm infants experienced a high-level of difficulty with breastfeeding, including difficulty with latching, identifying hunger cues, and struggling to keep their infants awake at the breast. In addition, mothers of preterm infants may be unwell themselves and suffering from chronic diseases (e.g., hypertension, diabetes), which may have led to the preterm delivery (Wheeler & Dennis, 2013).

Maternal mood disorders.

Maternal mental health may be an important factor affecting breastfeeding outcomes. In a systematic review, Dennis and McQueen (2009) demonstrated that maternal mood disorders may negatively impact breastfeeding, finding an inverse relationship between depressive symptomology and BSE in mothers of healthy, full-term infants. Limited research, however, has explored the relationship between maternal mood disorders (e.g., anxiety, stress, depression, and/or postpartum depression) and infant feeding outcomes for mothers of moderate and late preterm infants.

Breastfeeding self-efficacy.

Self-efficacy has emerged in the research as an important indicator for breastfeeding success. Self-efficacy is defined as the belief in an individual's abilities to accomplish a goal or complete a task and is believed to impact personal motivation and success (Bandura, 1977). Health-related behaviours are impacted by self-efficacy, due to its ability to influence behaviour (Weinberg & Gould, 2011). For example, mothers often wean or discontinue breastfeeding because of perceived difficulty, rather than choice (Hill, 1991). Maternal perceptions of insufficient milk supply have also led to early discontinuation of breastfeeding (Hill &

Humenick, 1996). Given the influential role that self-efficacy can play in improving breastfeeding rates, Dennis (1999) adapted Bandura's self-efficacy theory (Bandura, 1977) to develop a BSE theory to explain the valuable role self-efficacy plays in breastfeeding success.

BSE refers to a mother's perceived ability to successfully breastfeed her infant (Dennis & Faux, 1999). Breastfeeding initiation and duration are influenced by a mother's confidence in her ability to breastfeed (Dennis, 1999). For example, women with high maternal breastfeeding confidence were less likely to discontinue breastfeeding in the early postpartum period (Tuthill et al., 2016). The concept of BSE places priority on the mother's breastfeeding confidence and recognizes the importance of empowering and supporting a mother's breastmilk feeding efforts, rather than diminishing her efforts (Dennis, 2003). Dennis (1999) described BSE as being influenced by four main factors: (a) performance accomplishments (e.g., previous breastfeeding experiences), (b) vicarious experience (e.g., observing other women breastfeeding), (c) verbal persuasion (e.g., encouragement from influential others, such as: lactations consultants, family, and friends), and (d) physiological and affective states (e.g., pain, stress, exhaustion, anxiety).

In mothers of healthy full-term infants, the importance of maternal confidence in relation to breastfeeding consequences has been well established (Blyth, Creedy, Dennis, Moyle, Pratt, & De Vries, 2002). Multiple studies utilized the Breastfeeding Self-Efficacy Scale – Short Form (BSES-SF) and demonstrated a positive relationship between BSE and breastmilk feeding rates in mothers with healthy, full-term infants (Chan Man, Wan, & Choi Kai, 2016; Loke & Chan, 2013; McCarter-Spaulding & Gore, 2009; McQueen et al., 2011; Otsuka et al., 2014; Otsuka et al., 2008; Noel-Weiss et al., 2006; Wilhelm et al., 2006). Brockway, Benzies, and Hayden (2017) conducted a systematic review and meta-analysis and found that interventions to improve

BSE among mothers of full-term infants were effective at increasing breastfeeding rates at 1 and 2 months postpartum.

Limited research explores the relationship between BSE and breastfeeding duration in the moderate and late preterm population. In mothers of late preterm infants, low self-efficacy scores may identify mothers at risk of early discontinuation of breastfeeding (Gerhardsson et al., 2018). Previous breastfeeding experience and university education were related to higher self-efficacy, while age and mode of delivery (e.g., vaginal vs. caesarean) were unrelated to self-efficacy (Gerhardsson et al., 2018).

Methodological Critique of Breastfeeding and Self-Efficacy Literature

Much of the qualitative and quantitative literature that explored breastfeeding in mothers of preterm infants lacked methodological rigor. Small sample sizes, homogenous samples, sampling biases (e.g., convenience sampling), selection bias from a lack of blinding, treatment fidelity, and high attrition rates may have impacted these results. The majority of breastfeeding researchers (Chan Man et al., 2016; Jackson & Dennis, 2016; McQueen et al., 2011; Noel-Weiss et al., 2006; Otsuka et al., 2014; Otsuka et al., 2008; Wheeler & Dennis, 2013; Wilhelm et al., 2006) studied homogenous populations (e.g., English-speaking, well-educated, high income, full-term infants, healthy maternal-infant dyads), and utilized convenience sampling (Chan Man et al., 2016; Jackson & Dennis, 2016; McQueen et al., 2011; Noel-Weiss et al., 2006; Otsuka et al., 2014; Otsuka et al., 2008; Pinelli et al., 2001; Wheeler & Dennis, 2013; Wilhelm et al., 2006; Wolfberg et al., 2004), which may have introduced sampling bias. To reduce biases, a few researchers utilized single-blinding of a research assistant who completed data collection to minimize expectation bias (Chan Man et al., 2016; Jackson & Dennis, 2016; McQueen et al, 2011; Noel-Weiss et al., 2006). Some researchers conducted randomized controlled trials, which enhanced the scientific rigor of their results (Chan Man et al., 2016; Jackson & Dennis, 2016; McQueen et al., 2011; Noel-Weiss et al., 2006; Pinelli, Atkinson, & Saigal, 2001; Wolfberg et al., 2004).

In two studies, researchers found statistically significant increases in BSES-SF scores between intervention (exposed to a breastfeeding education program) and control (received standard nursing care) groups (Chan Man et al., 2006; Noel-Weiss et al., 2006). Interventions were similar in both studies: researchers implemented breastfeeding education programs ranging from the prenatal to early postpartum period (4 weeks). Failure to find group differences occurred in other studies (Jackson & Dennis, 2016; Otsuka et al., 2014; Pinelli et al., 2001; Wilhelm et al., 2006; Wolfberg et al., 2004) exploring BSE. For instance, using lanolin cream did not affect BSE, and no significant differences were found between the study groups when looking at the mean BSES-SF scores at baseline and 4 days post-randomization (Jackson, 2016). A self-efficacy intervention increased the total BSES-SF score in hospitals with 'baby-friendly' certification but had no effect on BSE in hospitals without the baby-friendly certification (Otsuka et al., 2014). Together, these studies suggest that interventions that focus specifically on increasing BSE (e.g., breastfeeding education programs) may be more effective than the use of topical creams.

Wheeler and Dennis (2013) were some of the first researchers to include mothers of ill or preterm infants (<37 weeks) in a study that aimed to psychometrically test the modified BSES-SF. Their results were consistent with the original BSES-SF study (Dennis, 2003), which suggests that the modified BSES-SF is a valid and reliable measure of BSE with the preterm population. The generalizability of these results is limited because the small sample from this study was mainly representative of Caucasian, married, and educated women. Further research is needed with larger sample sizes and diverse populations, including moderate and late preterm infants.

Summary

Moderate and late preterm infants represent the largest proportion (80%) of the preterm population and incurred the largest economic costs of all preterm infants. Over the last two decades, literature has highlighted health issues faced by this specific population of preterm infants, with little information about how to address them. Given the personal, emotional, social, and financial consequences associated with the care of moderate and late preterm infants, it is crucial to identify strategies that can be used to improve health outcomes for this population. By identifying predictors of human milk feeding at discharge for the moderate and late preterm maternal-infant dyad, mothers may be identified earlier for additional support to improve rates of human milk feeding in NICU. With human milk feeding well-established in the NICU, mothers may have the confidence to continue breastfeeding at home, and their infants may benefit from a reduction in health complications and comorbidities in infancy.

The **purpose** of this study was to examine the association between BSE and human milk feeding at discharge in moderate and late preterm infants. The research question was, "In mothers of moderate and late preterm infants, does BSE at admission to NICU predict human milk feeding at discharge?" It was hypothesized that mothers with higher modified BSES-SF scores at admission would be more likely to breastfeed human milk at discharge. The aim was to explore sociodemographic and psychosocial predictors of breastmilk feeding. It was assumed that multiparous mothers were more likely to have previous experience with breastmilk feeding and be providing human milk at discharge, compared to primiparous mothers who would be less likely to have previous experience with breastmilk feeding.

Chapter 3: Methods

Study Design

My research design was an observational study. I conducted a secondary analysis of data from the control group in the larger Family Integrated Care (FICare) study, a cluster randomized controlled trial (cRCT) examining whether FICare, compared to standard care, shortened the average length of stay for moderate (32^0 to 33^6 weeks gestation) and late (34^0 to 36^6 weeks gestation) preterm infants in a level II NICU.

Setting

The larger FICare cRCT was implemented in 10 level II NICUs (five control sites and five intervention sites) throughout Alberta, a province in Western Canada (Benzies et al., 2017). Alberta has a population of approximately 4 million with a high proportion of women in their childbearing years (Government of Alberta, 2011). Among the Canadian provinces, Alberta has the highest rate of preterm births (Canadian Institute for Health Information, 2018).

Participants

Participants for the larger study were recruited between January 2016 and August 2018. Inclusion criteria for the FICare cRCT were as follows: mothers and their moderate or late preterm infants ($32^{0/7}$ to $34^{6/7}$ gestational age) admitted to one of the level II NICUs or transferred to a level II NICUs from a level III NICU within 72 hours of birth (Benzies et al., 2017). Gestational age was defined by first trimester ultrasound or date of the last menstrual cycle (Benzies et al., 2017). Setting a maximum gestational age of $34^{6/7}$ weeks for recruitment ensured that participants in the intervention group received a minimum exposure of 1 week to the intervention (Benzies et al., 2017). Only data from twin A were included in my dataset. Mothers of infants with severe health complications (e.g., requiring palliative care or born with serious congenital abnormalities), and those unable to participate in FICare (e.g., language barriers or social issues) were excluded (Benzies et al., 2017).

Measurement

The following infant health data were collected: gestational age, sex, length of stay, and birth weight. Maternal socio-demographic (age, ethnicity, education, and marital status) and other health variables (parity, mode of delivery, singleton/twins, and substance use) were collected (refer to Appendix A).

Breastmilk feeding rates.

The World Health Organization breastfeeding categories (Labbok & Krasovec, 1990) were used to collect information on breastmilk feeding rates. Labbok and Krasovec (1990) developed commonly used categories of breastfeeding (e.g., exclusive, partial, token, or none), which the World Health Organization (2008) adapted for their breastfeeding definition. For the purposes of this study, which was looking at the outcome of human milk feeding at discharge, I collapsed relevant feeding categories into either 'only human milk feeding' (i.e., mothers who reported providing their own breastmilk or donor human milk) or 'combination' (e.g., mothers who reported providing both a combination of formula and their own breastmilk at discharge). I used the term 'breastmilk,' except when referring to the dependent variable (e.g., human milk). See definitions.

Breastfeeding self-efficacy scale – short form (BSES-SF).

The Breastfeeding Self-Efficacy Scale – Short Form (BSES-SF) was used to measure BSE. The BSES has been adapted over time. Originally, a 33-item tool was developed to measure BSE, which was termed the Breastfeeding Self-Efficacy Scale (BSES) (Dennis & Faux, 1999). Due to redundancies within the scale and results of further psychometric testing, the scale was shortened to a 14-item scale and termed the Breastfeeding Self-Efficacy Scale – Short Form (BSES-SF) (Dennis, 2003).

The BSES-SF is a valid tool that uses 5-point Likert response categories that range from 1 (*not at all confident*) to 5 (*always confident*); a central score of 3 refers to *neutral* (Dennis, 2003). The theoretical range of scores is 14 to 70 with higher scores indicating higher levels of BSE (Dennis, 2003). Reliability testing was completed and Cronbach's alpha for the BSES-SF was 0.94, which was slightly less than the original BSES Cronbach's alpha of 0.97 (Dennis, 2003). The BSES-SF scores were significantly correlated with the original BSES scores at 1 (r = 0.99) and 8 weeks postpartum (r = 0.99) (Dennis, 2003). Construct validity was demonstrated through a factor analysis and criterion-related validity analysis (Dennis, 2003). A uni-dimensional structure was confirmed through a scree test and factor analysis (Dennis, 2003). Predictive validity was determined by assessing the relationship between BSE and the method of infant feeding at 4 and 8 weeks postpartum (Dennis, 2003). In that validation study, BSES-SF scores at 1-week postpartum were correlated with breastfeeding at 4 and 8 weeks postpartum; mothers with higher BSES-SF scores at 1-week postpartum were more likely to be breastfeeding at 4 and 8 weeks postpartum (Dennis, 2003).

The BSES-SF was adapted for mothers of preterm infants given their unique breastmilk feeding challenges, which often includes milk supply issues or the complex task of transitioning a preterm infant from gavage feeding to feeding at the breast (Wheeler & Dennis, 2013). As a result, four items were added to address concerns related to pumping and the stem in the questions were adapted to better relate to this population (Wheeler & Dennis, 2013). For example, "I can always tell when my baby is finished breastfeeding" became "When my baby is ready to breastfeed, I will always be able to tell when my baby is finished breastfeeding." In addition, “I can always” became “I can” given that “always” was viewed as a discouraging term for mothers of preterm infants (Wheeler & Dennis, 2013, p. 73). The scale for mothers of ill or preterm infants is referred to as the modified BSES-SF (2013) and is an 18-item questionnaire that captures maternal confidence in a mothers’ breastfeeding abilities (Wheeler & Dennis, 2013). The 5-point Likert scale has response categories ranging from 1 (*not at all confident*) to 5 (*always confident*) (Wheeler & Dennis, 2013). The theoretical range of scores is 18 to 90 with higher scores indicating higher levels of BSE (Wheeler & Dennis, 2013). Wheeler and Dennis (2013) were the first to psychometrically test the modified BSES-SF with the preterm population. Cronbach’s alpha was 0.88 (Wheeler & Dennis, 2013). Criterion-related validity was determined by examining how the BSES-SF correlated with other measures of BSE (Wheeler & Dennis, 2013). In that validation study, the modified BSES-SF was negatively correlated with the Hill and Humenick Lactation Scale (Hill & Humenick, 1996) that measures maternal perceptions of insufficient milk supply ($r = -.84$, $p < .00$) (Wheeler & Dennis, 2013). Mothers with lower modified BSES-SF scores were more likely to show a perceived inadequate milk supply (Wheeler & Dennis, 2013). Predictive validity was demonstrated. In that validation study, modified BSES-SF scores at 1-week post discharge were correlated with infant feeding methods at 6 weeks post discharge ($t = 4.09$, $p < .001$) (Wheeler & Dennis, 2013). For this study, Cronbach’s alphas were .95 at admission and .93 at discharge. To my knowledge, Gerhardsson et al. (2018) were the only researchers to date to investigate BSE using the modified BSES-SF in mothers’ of late preterm infants. The modified BSES-SF takes approximately 5 to 10 minutes to complete.

Edinburgh postnatal depression scale (EPDS).

The EPDS is a 10-item scale used to capture maternal postnatal depressive symptoms within the past 7 days (Cox, Holden, & Sagovsky, 1987). The 4-point Likert response categories range from 0 (*as much as I always could*) to 3 (*not at all*). Items include, "I have been able to laugh and see the funny side of things," and "I have looked forward with enjoyment to things." The theoretical range of scores is 0 to 30, with scores $\geq$13 indicative of depression and the need for further assessment. The EPDS has a sensitivity of 0.86, a specificity of 0.78, and a positive predictive value of 73% (Shrestha, Pradhan, Tran, Gualano, & Fisher, 2016). The EPDS has been validated in mothers of term infants and is the most commonly used tool to screen for depression both pre- and postnatally (Kernot, Olds, Lewis, & Maher, 2015). For this study, Cronbach's alpha was .86 at admission and .85 at discharge. The EPDS takes approximately 10 minutes to complete.

Parental stressor scale: neonatal intensive care unit (PSS: NICU).

The PSS: NICU is a 50-item scale that captures parental perceptions of stress arising from the NICU environment on four subscales: (a) sights and sounds, (b) appearance and behavior of the infant, (c) impact on the parental role and relationship with the infant, and (d) parental relationship and communications with staff (Miles, Funk, & Carlson, 1993). The 5-point Likert response categories range from 1 *(not at all stressful)* to 5 *(extremely stressful)*, with higher scores indicative of higher levels of stress. The PSS: NICU has been used extensively in the NICU (Holditch-Davis et al., 2015; O'Brien et al., 2013; Turner, Chur-Hanse, Winefield & Stanners, 2015; Zelkowitz et al., 2011). The internal consistency reliability for the total scale was high with Cronbach's alphas ranging from 0.89 to 0.94 (Miles et al., 1993). The PSS: NICU was adapted for the FICare study to include 34-items (Benzies et al., 2017). For this study, Cronbach's alpha was .95 at admission and discharge. The PSS: NICU takes approximately 10 to 15 minutes to complete.

State-trait anxiety inventory (STAI).

The STAI is a 40-item questionnaire that captures both state and trait anxiety with 20 items each (Spielberger, Gorsuch, & Lushene, 1970). The state anxiety scale assesses frequency of feelings in general using 4-point response categories ranging from 1 *(almost never)* to 4 *(almost always)*. The trait anxiety scale assesses how an individual feels at a particular moment using response categories ranging from 1 *(not at all)* to 4 *(very much so).* The theoretical range of scores for both scales is 20 to 80, with higher scores indicative of greater anxiety (Julian, 2011). The internal consistency (0.86 to 0.95) and test-retest (0.73 to 0.86) reliabilities are high. For this study, Cronbach's alphas were as follows: 0.91 (STAI trait at admission), 0.93 (STAI state at admission), and 0.94 (STAI state at discharge). The STAI is often used with mothers of infants in the NICU (Greene, 2015; Holditch-Davis et al., 2015; Melnyk et al., 2006; O'Brien et al., 2015; Zelkowitz et al., 2011). The STAI takes approximately 10 minutes to complete.

Procedures

The larger study was coordinated through Dr. Benzies' research office in the Faculty of Nursing, University of Calgary. Study nurses, who were employees of Alberta Health Services and Covenant Health in their respective NICUs, and received specific training regarding the FICare study purpose, consent, and data collection procedures (Benzies et al., 2017). Prior to data collection, mothers provided written informed consent for both themselves and their infant (Benzies et al., 2017). Mothers completed questionnaires using a web-based platform (Fluid Surveys or Qualtrics) on an iPad, shortly after admission and shortly before discharge. At the conclusion of the study, data were downloaded and imported to statistical software for analyses.

Downloaded data were stored on University of Calgary servers on timed out, password protected computers in a locked research office, and backed up daily.

Data Cleaning

Based on variables required to answer my research questions, a research assistant created a data set for analysis. With support from a research assistant from the FICare study, I cleaned the data. From the original 305 cases provided in the data set, I deleted those with a missing admission or discharge survey, and those with incomplete surveys. In addition, I deleted cases with study identification (ID) numbers 312, 785, and 307 (completed the admission survey outside the 14-day window) and study ID numbers 288, 507, and 187 (completed the discharge survey outside the 7 to 10 day window). Participant with study ID number 149 was deleted because the discharge survey was completed when the infant was between 4 and 5 months old. Participant with ID number 498 was deleted, as information on proportion of breastfeeding was not answered. Participant with ID 186 was deleted because the mother reported ‘unknown’ for the category of mode of delivery. In total, I deleted 84 participants because of pertinent missing data (e.g., did not answer proportion of breastfeeding at discharge) or incomplete baseline and discharge surveys. Thus, my sample included cases with complete data collected according to the study protocol. A total of 221 participants remained in my sample.

To identify any meaningful group differences in characteristics between the mothers who were deleted from this study as a result of pertinent missing data ($n = 84$) and those who were included in this study ($N = 221$), a chi-square test of independence was conducted. There we no statistically significant differences ($p < 0.05$) between mothers who were excluded and included in this study based on age, education, and income. However, there was a trend for mothers with lower education to be excluded from the final sample ($p = .051$). The mothers that remained in this study were similar to those excluded and it is unlikely that selection bias was introduced as a result of deleting cases.

Participants with the following study IDs (479, 306, 46, 462, 510, and 511) reported a combination ethnicity; for the purposes of this study, responses were coded as either Caucasian or other. Participant with study ID 188 reported ‘prefer not to answer’ for the category of marital status, therefore a decision was made to replace the response with ‘married,’ which was the mode for the marital status variable. Participant with study ID 435 was missing information for the variable born in Canada (yes/no). As neither the participant’s name nor other information informed replacement, a decision was made to not replace the missing value. Due to a possible error on the survey, participants with study IDs (1, 2, 3, and 4) did not report maternal age and these values were left as missing. For the category of income, 15.8% of the participants chose ‘don’t know/prefer not to answer.’ No values were replaced on this item.

Items 1, 2, 5, 7, 8, 10, 11, 15, 16, 19, and 20 on the STAI (state) were negatively worded. I reverse scored the negatively worded items prior to data analysis. Items 21, 23, 26, 27, 30, 33, 34, 36, and 39 on the STAI (trait) were negatively worded. I reverse scored prior to data analysis. To capture the ‘overall stress level’ that was produced by the NICU environment, scale developers recommended recoding ‘not applicable’ responses to 1, which indicated that ‘no stress’ was experienced (Miles, Funk, & Davis, 1993). Therefore, I replaced all not applicable values (1513 values) with a 1. I recoded the following categories: (a) income (combined from 4 categories to 2 to represent <$80,000 and >$80,000); (b) small for gestational age was assigned based on gestational age (weeks), sex (male or female), and birth weight (<10th percentile) (Fenton & Kim, 2013); (c) education (collapsed from 3 categories to 2 to represent either high school or less and greater than high school).

Given that the FICare survey did not specifically collect information about previous breastfeeding experience, upon the recommendation of my supervisory committee, I chose the categories of ‘primiparous’ and ‘multiparous’ as proxies for no previous breastfeeding experience or previous breastfeeding experience, respectively. From the dataset, I collapsed groups from the GTPAL acronym (gravidity, term, preterm, abortion, living) to categorize mothers into either primiparous (first live birth) or multiparous (second live birth or more) sub-groups. Given the limitations of the FICare study survey and that Canada has a high breastfeeding initiation rate (89%) (Statistics Canada, 2015), the supervisory committee believed that this strategy was an important opportunity to capture the association between human milk feeding and previous breastfeeding experience. This decision is also consistent with BSE theoretical subscale performance accomplishment.

Missing Values on Scales

Missing values on scales ranged from 0.5% to 8.1% (refer to Table 2 for full details). In the absence of recommendations from authors to replace missing values on the BSES-SF, PSS: NICU, EPDS, and STAI (state and trait), if <20% of values were missing for an individual case, the missing values were replaced by the mean score on the scale for that individual.

Data Analysis

Following cleaning and recoding, data analysis was conducted using SPSS version 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). Characteristics of the maternal and infant samples were described using means/standard deviations and frequencies/percentages. Human milk feeding at discharge (dependent variable) and scale scores (i.e., modified BSES-SF (independent variable) and potential covariates (EPDS, PSS: NICU, STAI) were described using means and standard deviations, or frequencies and percentages. The STAI (trait) was administered at admission only, so a discharge score was not applicable. I chose not to include the following scales in the model: EPDS, STAI (state and trait), and PSS: NICU. This decision was based on the fact that as a Lactation Consultant working in the clinical setting, there is limited time, not all mothers can be offered breastfeeding support, and they must be prioritized according to need. It is more realistic and meaningful from a clinical perspective to consider implementing the modified BSES-SF in practice, as opposed to all four scales. If stress and anxiety were identified as a concern, these issues might be better addressed with the NICU social worker, community mental health supports, public health nurse, or their family physician. The modified BSES-SF has undergone psychometric testing with the preterm population and may be a valid and reliable measure of BSE for this population (Wheeler & Dennis, 2013). Overall, little change was noted between the mean admission and discharge scores across any feeding type for both depression and stress. As a result, it is unlikely that including the other three scales in the model would have resulted in a statistically significant association ($p < 0.05$) with human milk feeding at discharge.

Bivariate and multivariable logistic regression analyses were conducted to determine associations between variables of interest and human milk feeding at discharge; crude and adjusted odds ratios with 95% confidence intervals were calculated. To determine whether the multivariable logistic regression models were a good fit overall, a Hosmer and Lemeshow goodness-of-fit chi-square test was conducted and statistical significance ($p < 0.05$) assessed. Maternal age, education, smoking in pregnancy, income, born in Canada, parity, preeclampsia, diabetes, small for gestational age, and modified BSES-SF scores (at admission) were selected as variables of interest. In addition to looking at associations in the full sample, I ran two additional logistic regression models with the assumption that the sub-group of primiparous mothers would have no previous experience with breastmilk feeding and the sub-group of multiparous mothers would have previous experience. Given that previous positive experience increases self-efficacy, I used a theoretical rationale to conduct this exploratory analysis. Parity was not included in the multivariable stratified models since it was the stratification variable.

Ethical Considerations

The maternal-infant dyads included in this study were considered a vulnerable population (Polit & Beck, 2017). Therefore, I ensured that the ethical principles of beneficence, nonmaleficence, respect for human dignity, and justice were upheld (Polit & Beck, 2017). Given that I conducted a secondary data analysis, maintaining patient privacy and confidentiality were most relevant to this study. Data analysis was completed in the Benzies' research lab at the University of Calgary using a timing-out, password protected computer. I completed training pertaining to research ethics (e.g., Tri-Council Policy Statement-2 Course on Research Ethics [CORE]), Collaborative Institutional Training Initiative-Good Clinical Practice, created a profile with the ethics board, and signed a confidentiality agreement. Prior to data analysis, I completed a Schedule A document to request access to specific variables relevant to this study. The study was approved by the Conjoint Health Research Ethics Board (REB 15-0067) and I was included as a study team member on the ethics application.

Chapter 4: Results

In this chapter, I will describe the characteristics of participants and report results from the scales that were collected between admission and discharge from the NICU. I will also report results from bivariate and multivariable analyses.

Characteristics of Mothers and Infants

Full sample.

See Table 1 for characteristics of mothers and infants. In the control group, 329 mothers were enrolled. Twenty-four participants withdrew or had to be removed from the dataset for incorrectly executed informed consents (father signing instead of mother or failure to check boxes pertaining to future use of data), which left a total of 305 participants (7.3 % withdrawn). In addition, 84 participants were removed because of pertinent missing data (e.g., did not answer proportion of breastfeeding at discharge) or incomplete baseline and discharge surveys. Overall, this left a remaining total of 221 participants in this study. Most mothers were < 35 years of age (73%, n = 158), partnered (95%, n = 208), non-smokers (88%, n = 191), delivered singletons (80%, n = 175), had a certificate/diploma or higher education (84%, n = 183), and were born in Canada (73%, n = 160). During their pregnancy, 3% (n = 7) of mothers reported drinking alcohol and 2% (n = 5) reported using street drugs. When looking at the infant characteristics of the entire sample, 55% (n = 120) were male and 5% (n = 11) were small for gestational age.

Experience with breastfeeding.

See Table 1 for characteristics of mothers and their infants, by parity, and grouped by type of feeding at discharge (human milk feeding vs. combination feeding). Mothers in both subgroups were similar on most categories, including education, ethnicity, marital status, and income. Mothers in both subgroups were different on a few categories, including age, multiple births, preeclampsia, and diabetes. Mothers in the primiparous subgroup were younger (60%, n = 95), had a higher rate of preeclampsia (76%, n = 25), and had a lower rate of diabetes (57%, n = 101), compared with mothers in the multiparous subgroup who were older (40%, n = 63), had a lower rate of preeclampsia (24%, n = 8), and had a higher rate of diabetes (43%, n = 75).

Table 1

Maternal and Infant Characteristics of full Sample by Human Milk Feeding at Discharge, Grouped by Primiparity and Multiparity to Represent Breastfeeding Experience, and Presented as n (%)

	Full Sample *N* = 221[t]			Primiparous *N* = 120[u]			Multiparous *N* = 99[v]		
	Feeding at Discharge			Feeding at Discharge			Feeding at Discharge		
		Combination *n* = 92	Human milk feeding *n* = 127		Combination *n* = 51	Human milk feeding *n* = 69		Combination *n* = 41	Human milk feeding *n* = 58
Variable	*n*	*n (%)*	*n (%)*	*n*	*n (%)*	*n (%)*	*n*	*n (%)*	*n (%)*
Maternal characteristics									
Age (years)[a]									
< 34	158	60 (38)	98 (62)	95	38 (40)	57 (60)	63	22 (35)	41 (65)
≥ 35	57	29 (51)	28 (49)	24	12 (50)	12 (50)	33	17 (51.5)	16 (48.5)
Education[b]									
High school diploma or less	36	18 (50)	18 (50)	17	6 (35)	11 (65)	19	12 (63)	7 (37)
Certificate/diploma and higher	183	74 (40)	109 (60)	103	45 (44)	58 (56)	80	29 (36)	51 (64)
Ethnicity[c]									
Other	67	23 (34)	44 (66)	28	12 (43)	16 (57)	39	11 (28)	28 (72)
Caucasian	150	68 (45)	82 (55)	90	38 (42)	52 (58)	60	30 (50)	30 (50)

Income[d]									
< $80,000	65	25 (38.5)	40 (61.5)	28	9 (32.10)	19 (67.9)	37	16 (43.20)	21 (56.8)
≥ $80,000	121	51 (42.1)	70 (57.9)	73	32 (43.80)	41 (56.2)	48	19 (39.60)	29 (60.4)
Marital status[e]									
Single	11	7 (64)	4 (36)	3	2 (67)	1 (33)	8	5 (62.5)	3 (37.5)
Partnered	208	85 (41)	123 (59)	117	49 (42)	68 (58)	91	36 (40)	55 (60)
Parity[f]									
Primiparous	120	51 (42.50)	69 (57.5)	-	-	-	-	-	-
Multiparous	99	41 (41)	58 (59)	-	-	-	-	-	-
Multiple birth[g]									
Singleton	175	73 (42)	102 (58)	95	39 (41)	56 (59)	80	34 (42.5)	46 (57.5)
Twins	44	19 (43)	25 (57)	25	12 (48)	13 (52)	19	7 (37)	12 (63)
Mode of delivery[h]									
Cesarean section	98	42 (43)	56 (57)	49	22 (45)	27 (55)	49	20 (41)	29 (59)
Vaginal	120	49 (41)	71 (59)	71	29 (41)	42 (59)	49	20 (41)	29 (59)
Preeclampsia[i]									
Yes	33	16 (48.50)	17 (51.5)	25	11 (44)	14 (56)	8	5 (62.5)	3 (37.5)
No	181	75 (41)	106 (59)	93	40 (43)	53 (57)	88	35 (40)	53 (60)
Diabetes[j]									
Yes	40	21 (53)	19 (47)	19	9 (47)	10 (53)	21	12 (57)	9 (43)
No	176	70 (40)	106 (60)	101	42 (42)	59 (58)	75	28 (37)	47 (63)
Born in Canada[k]									

No	58	22 (38)	36 (62)	29	11 (38)	18 (62)	29	11 (38)	18 (62)
Yes	160	70 (44)	90 (56)	90	40 (44)	50 (56)	70	30 (43)	40 (57)
Smoking in pregnancy[l]									
Yes	27	15 (56)	12 (44)	11	8 (73)	3 (27)	16	7 (44)	9 (56)
No	191	76 (40)	115 (60)	109	43 (39)	66 (61)	82	33 (40)	49 (60)
Alcohol in pregnancy[m]									
Yes	7	2 (29)	5 (71)	4	1 (25)	3 (75)	3	1 (33)	2 (67)
No	212	90 (42.5)	122 (57.5)	116	50 (43)	66 (57)	96	40 (42)	56 (58)
Street drugs in pregnancy[n]									
Yes	5	2 (40)	3 (60)	3	1 (33)	2 (67)	2	1 (50)	1 (50)
No	213	90 (42)	123 (58)	116	50 (43)	66 (57)	97	40 (41)	57 (59)
Infant characteristics	*n*	*n (%)*	*n (%)*	*n*	*n (%)*	*n (%)*	*n*	*n (%)*	*n (%)*
Gestational age (weeks)[o]									
32	32	7 (22)	25 (78)	19	4 (21)	15 (79)	13	3 (23)	10 (77)
33	58	17 (29)	41 (71)	33	11 (33)	22 (67)	25	6 (24)	19 (76)
34	129	68 (53)	61 (47)	68	36 (53)	32 (47)	61	32 (52.5)	29 (47.5)
Birth weight[p]									
SGA	11	3 (27)	8 (73)	6	1 (17)	5 (83)	5	2 (40)	3 (60)
AGA or LGA	208	89 (43)	119 (57)	114	50 (44)	64 (56)	94	39 (41.5)	55 (58.5)
Infant sex[q]									
Male	120	46 (38)	74 (62)	73	29 (40)	44 (60)	47	17 (36)	30 (64)
Female	99	46 (46.5)	53 (53.5)	47	22 (47)	25 (53)	52	24 (46)	28 (54)

Modified BSES-SF scores (admission)[w] Clinical Range	*n*	*n (%)*	*n (%)*	*n*	*n (%)*	*n (%)*	*n*	*n (%)*	*n (%)*
Low (< 50)	28	19 (68)	9 (32)	14	9 (64)	5 (36)	14	10 (71)	4 (29)
High (≥ 50)	175	59 (34)	116 (66)	100	36 (36)	64 (64)	75	23 (31)	52 (69)
Other Characteristics	*n*	*n (%)*	*n (%)*	*n*	*n (%)*	*n (%)*	*n*	*n (%)*	*n (%)*
Donor milk (ever received)[r]									
No	75	47 (63)	28 (37)	35	22 (63)	13 (37)	40	25 (62.50)	15 (37.5)
Yes	144	45 (31)	99 (69)	85	29 (34)	56 (66)	59	16 (27)	43 (73)
Additives to breastmilk[s]									
No	158	70 (44)	88 (56)	91	42 (46)	49 (54)	67	28 (42)	39 (58)
Yes	58	20 (34.5)	38 (65.5)	27	7 (26)	20 (74)	31	13 (42)	18 (58)

Note. [a] *n* = 215 due to missing data; [b] *n* = 219 due to missing data; [c] *n* = 217 due to missing data; [d] *n* = 186 due to missing data; [e] *n* = 219 due to missing data; [f] *n* = 219 due to missing data; [g] *n* =219 due to missing data; [h] *n* = 218 due to missing data; [i] *n* = 214 due to missing data; [j] *n* = 216 due to missing data; [k] *n* = 218 due to missing data; [l] *n* = 218 due to missing data; [m] *n* = 219 due to missing data; [n] *n* = 218 due to missing data; [o] *n* = 219 due to missing data; [p] *n* = 219 due to missing data; [q] *n* = 219 due to missing data; [r] *n* = 219 due to missing data; [s] *n* = 216 due to missing data; [t] *n* = 219 due to missing data; [u] *n* = 120 due to missing data; [v] *n* = 99 due to missing data; [w] n = 203 due to missing data.

Scale Scores

On the modified Breastfeeding Self-Efficacy Scale – Short Form, mothers in the combination group demonstrated a greater increase (16.2%) in self-efficacy between admission and discharge, compared to mothers in the human milk feeding group (9.4%) (Table 2). On the Parental Stressor Scale: Neonatal Intensive Care Unit and Edinburgh Postnatal Depression Scale, there was little change in stress and depressive symptom scores between admission and discharge across any feeding type (Table 2). On the State-Trait Anxiety Inventory (state), mothers in the human milk feeding group demonstrated a greater decrease in anxiety (13.3%) between admission and discharge, compared to mothers in the combination group (10%).

Table 2

Scale Scores, Presented as M (SD), and Grouped by Combination or Human Milk Feeding at Discharge

Scales	Full Sample $N = 221$		Feeding at Discharge: Combination $n = 92$		Feeding at Discharge: Human milk feeding $n = 127$	
	Admission	Discharge	Admission	Discharge	Admission	Discharge
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
BSES-SF[a]	65.72 (14.52)[a]	73.17 (12.94)[b]	59.58 (13.98)[c]	69.26 (13.09)[d]	69.35 (13.62)[e]	75.86 (12.28)[f]
PSS: NICU	2.48 (0.80)	2.44 (0.83)	2.44 (0.76)	2.41 (0.82)	2.50 (0.82)	2.46 (0.84)
EPDS	7.97 (4.86)	7.05 (4.59)[g]	8.20 (4.39)	7.28 (4.97)	7.85 (5.01)	6.96 (4.45)[h]
STAI (State)	37.37 (11.32)	32.87 (10.04)[g]	37.00 (9.98)	33.31 (9.84)	37.55 (11.97)	32.56 (10.10)[h]
STAI (Trait)	34.88 (8.84)	--	35.39 (8.19)	--	34.63 (9.16)	--

Note. [a]n = 203 due to missing data; [b]n = 211 due to 10 mothers not completing the scale because their infants were not receiving any breastmilk at discharge; [c]n = 78 due to missing data; [d]n = 84 due to 10 mothers not completing the scale because their infants were not receiving any breastmilk at discharge; [e]n = 125 due to missing data; [f]n = 125 due to missing data; [g]n = 220; and [h]n = 146 due to missing data. BSES-SF = Breastfeeding Self-Efficacy Scale – Short Form; PSS: NICU = Parental Stressor Scale: Neonatal Intensive Care Unit; EPDS = Edinburgh Postnatal Depression Scale: STAI (State) = State-Trait Anxiety Inventory (State); STAI (Trait) = State-Trait Anxiety Inventory (Trait).

Bivariate Analyses

Bivariate analyses were conducted to determine associations between variables of interest and human milk feeding at discharge (presented as unadjusted odds ratios in Table 3). For the full sample, and primiparous and multiparous sub-groups, modified BSES-SF scores at admission were associated with type of feeding at discharge ($p < 0.05$). Maternal age, education, smoking in pregnancy, income, born in Canada, parity, preeclampsia, diabetes, and small size for gestational age were not associated with human milk feeding at discharge ($p > 0.05$).

Multivariable Logistic Regression

The following describes the associations between variables of interest and human milk feeding at discharge. This section will expand on the three different logistic regression models, including: (a) full sample, (b) primiparous sub-group, and (c) multiparous sub-group.

Full sample.

In the full sample multivariable model, only modified BSES-SF scores at admission were associated with human milk feeding at discharge ($p < 0.05$). Mothers with higher modified BSES-SF scores at admission were more likely to be human milk feeding at discharge, compared to mothers with lower modified BSES-SF scores at admission, while controlling for other variables in the model. For each unit increase on the modified BSES-SF, the odds of using human milk at discharge increased by a factor of 1.06, 95% CI [1.03, 1.09]; $p < 0.001$. Maternal age, smoking in pregnancy, income, born in Canada, parity, preeclampsia, diabetes, and small for gestational age were not associated with human milk feeding at discharge ($p > 0.05$). The logistic regression model was statistically significant, $\chi2 = 23.92$, $df = 10$, $p = 0.008$. Since the Hosmer and Lemeshow goodness-of-fit chi-square test was not significant, $p = 0.184$, the model was a relatively good fit with the data.

Primiparous sub-group.

In the primiparous sub-group, maternal education and modified BSES-SF scores at admission were associated with human milk feeding at discharge ($p < 0.05$). Mothers with higher modified BSES-SF scores at admission were more likely to be human milk feeding at discharge, compared to mothers with lower modified BSES-SF scores at admission, while controlling for other variables in the model. For each unit increase on the modified BSES-SF, the odds of human milk feeding at discharge increased by a factor of 1.08, 95% CI [1.03, 1.14]; $p = 0.001$. Mothers with a high school diploma or less were 11.30, 95% CI [1.11, 115.38] times more likely to be combination feeding at discharge, compared to mothers with a college diploma/certificate and higher. This association was significant ($p = 0.04$) in the multivariable model, while controlling for other variables in the model. The logistic regression model was statistically significant, $\chi 2 = 25.73$, $df = 9$, $p = 0.01$. Since the Hosmer and Lemeshow goodness-of-fit chi-square test was not significant, $p = 0.667$, the model was a relatively good fit with the data. In contrast, at the bivariate level, education was not associated ($p > 0.05$) with human milk feeding at discharge, *OR* = 1.42, [CI = 0.49, 4.14]. Maternal age, smoking in pregnancy, income, born in Canada, preeclampsia, diabetes, and small for gestational age were not associated with human milk feeding at discharge ($p > 0.05$).

Multiparous sub-group.

In the multiparous sub-group, only modified BSES-SF scores at admission were associated with human milk feeding at discharge ($p < 0.05$). Mothers with higher modified BSES-SF scores at admission were more likely to be human milk feeding at discharge, compared to mothers with lower modified BSES-SF scores at admission, while controlling for other variables in the model. For each unit increase on the modified BSES-SF, the odds of human milk feeding at discharge increased by a factor of 1.05, 95% CI [1.00, 1.10]; $p = 0.034$. The logistic regression model was not statistically significant, $\chi 2 = 16.03$, $df = 9$, $p = 0.07$. Since the Hosmer and Lemeshow goodness-of-fit chi-square test was not significant, $p = 0.365$, the model was a relatively good fit with the data.

Maternal age, education, smoking in pregnancy, income, born in Canada, preeclampsia, diabetes, and small for gestational age were not associated with human milk feeding at discharge ($p > 0.05$).

Bivariate versus multivariate analyses, stratified and unstratified by parity.

The associations between modified BSES-SF scores at admission and human milk feeding at discharge were similar in the bivariate ($OR = 1.05$) versus multivariable ($OR = 1.06$) analyses (Table 3), indicating that the covariates (maternal age, education, smoking in pregnancy, income, born in Canada, parity, preeclampsia, diabetes, and small for gestational age) controlled in the multivariable models did not confound the associations. In an attempt to examine the effect of previous experience with breastfeeding, no differences between groups were observed when stratified by parity. Multivariate (full sample $OR = 1.06$) analyses: primiparous ($OR = 1.08$) and multiparous ($OR = 1.05$) (Table 3), indicated that parity was not a modifier of the association between modified BSES-SF scores at admission with human milk feeding at discharge.

The breastfeeding experience analyses using parity as a proxy (stratification by primiparous vs. multiparous in the logistic regression models) were exploratory and based on BSE theory that suggested previous breastfeeding experience (e.g., performance accomplishments) increases BSE and subsequent breastfeeding duration. Although statistically significant results were determined for the modified BSES-SF scores at admission and human milk feeding at discharge for both sub-groups ($p < 0.05$), it should be noted that these sub-groups within the parity stratification had relatively small samples sizes (multiparous, $n = 99$; primiparous, $n = 120$) compared to the full-sample analysis ($N = 221$). This may have resulted in inadequate ‘power’ required for sub-group analyses, possibly preventing a noticeable change in effect size between the primiparous and multiparous groups.

Table 3

Factors Associated with Human Milk Feeding at Discharge, Grouped by Primiparity and Multiparity to Represent Breastfeeding Experience, and Presented by n (%) with UOR and AOR

	Full Sample $N = 221$[k]				Primiparous $N = 120$[l]				Multiparous $N = 99$[m]			
	Feeding at Discharge				Feeding at Discharge				Feeding at Discharge			
	Combo $n = 92$	Human milk $n = 127$			Combo $n = 51$	Human milk $n = 69$			Combo $n = 41$	Human milk $n = 58$		
Variables	*n (%)*	*n (%)*	*UOR* [95% CI]	*AOR* [95% CI]	*n (%)*	*n (%)*	*UOR* [95% CI]	*AOR* [95% CI]	*n (%)*	*n (%)*	*UOR* [95% CI]	*AOR* [95% CI]
Maternal characteristics												
Age (years)[a]												
< 34	60 (38)	98 (62)	1.69 [0.92, 3.12]	1.90 [0.76, 4.74]	38 (40)	57 (60)	1.50 [0.61, 3.69]	1.23 [0.29, 5.24]	22 (35)	41 (65)	1.98 [0.84, 4.67]	3.11 [0.76, 12.81]
Education[b]												
High school diploma or less	18 (50)	18 (50)	0.68 [0.33, 1.39]	1.19 [0.41, 3.42]	6 (35)	11 (65)	1.42 [0.49, 4.14]	11.30* [1.11, 115.38]	12 (63)	7 (37)	0.33 [0.12, 0.94]	0.21 [0.04 1.04]
Smoking in pregnancy[c]												

Yes	15 (56)	12 (44)	0.53 [0.24, 1.19]	0.43 [0.13, 1.42]	8 (73)	3 (27)	0.24 [0.06, 0.97]	0.18 [0.02, 1.71]	7 (44)	9 (56)	0.87 [0.29, 2.56]	1.16 [0.19, 6.95]
Income[d]												
< $80,000	25 (38.50)	40 (61.50)	1.17 [0.63, 2.16]	0.94 [0.40, 2.22]	9 (32.10)	19 (67.90)	1.65 [0.66, 4.13]	1.19 [0.30, 4.65]	16 (43.20)	21 (56.80)	0.86 [0.36, 2.05]	0.78 [0.21, 2.93]
Born in Canada[e]												
No	22 (38)	36 (62)	1.27 [0.69, 2.36]	1.72 [0.70, 4.29]	11 (38)	18 (62)	1.31 [0.56, 3.09]	1.82 [0.48, 6.83]	11 (3 8)	18 (62)	1.23 [0.51, 2.98]	1.69 [0.38, 7.48]
Parity[f]												
Primip	51 (42.50)	69 (57.50)	0.96 [0.56, 1.64]	1.27 [0.59, 2.76]	--	--	--	--	--	--	--	--
Preeclampsia[g]												
Yes	16 (48.50)	17 (51.50)	0.75 [0.36, 1.58]	0.69 [0.27, 1.79]	11 (44)	14 (56)	0.96 [0.39, 2.34]	0.87 [0.27, 2.82]	5 (62.50)	3 (37.50)	0.40 [0.09, 1.77]	0.28 [0.03, 2.47]
Diabetes[h]												
Yes	21 (53)	19 (47)	0.60 [0.30, 1.19]	1.68 [0.59, 4.81]	9 (47)	10 (53)	0.79 [0.30, 2.12]	1.89 [0.33, 10.71]	12 (57)	9 (43)	0.45 [0.17, 1.19]	1.42 [0.30, 6.74]
Infant characteristics												
Birth weight[i]												
SGA	3 (27)	8 (73)	1.99 [0.51, 7.73]	1.13 [0.23, 5.67]	1 (17)	5 (83)	3.91 [0.44, 34.51]	3.64 [0.32, 41.27]	2 (40)	3 (60)	1.06 [0.17, 6.67]	1.10 [0.06, 21.49]

Scale Scores	*M (SD)* *n*	*M (SD)* *n*			*M (SD)* *n*	*M (SD)* *n*			*M (SD)* *n*	*M (SD)* *n*		
BSES-SF[j] (admission)	59.58 (13.98) 78	69.35 (13.62) 125	1.05** [1.03, 1.08]	1.06** [1.03, 1.09]	58.56 (11.50) 45	66.16 (11.92) 69	1.06** [1.02, 1.09]	1.08** [1.03, 1.14]	60.97 (16.88) 33	73.29 (14.64) 56	1.05** [1.02, 1.08]	1.05* [1.00, 1.10]

Note. [a] n = 215 due to missing data; [b] n = 219 due to missing data; [c] n = 218 due to missing data; [d] n = 186 due to missing data; [e] n = 218 due to missing data; [f] n = 219 due to missing data; [g] n =214 due to missing data; [h] n = 216 due to missing data; [i] n = 219 due to missing data; [j] n = 203 due to missing data; [k] n = 203 due to missing data; [l] n = 203 due to missing data; [m] n = 203 due to missing data.

Combo = combination feeding; Human milk = human milk feeding; SGA = small for gestational age; BSES-SF (admission) = Breastfeeding Self-Efficacy Scale – Short Form.

*$p < 0.05$ (2-tailed test).

** $p < 0.01$ (2-tailed test).

Additional Analyses

Prior to initial data analyses, no clinical cut-point was identified for the modified BSES-SF in the literature. Post initial data analyses, it was identified that researchers in Japan determined a clinical cut-point of 50 for the Japanese BSES-SF, which enables grouping of mothers into ‘high’ (≥ 50) vs. ‘low’ (< 50) BSES-SF scores (Nanishi, Green, Taguri, & Jimba, 2015). As an additional exploratory analysis, the cut-point of 50 was used to conduct a logistic regression with mothers grouped into low vs. high scores. A cut-off score may be more relevant in the clinical setting. Given that parity did not alter the effect size with the primary exposure variable and human milk feeding at discharge (Table 3), regression analyses were conducted only for the full sample model (Table 4). Mothers with higher modified BSES-SF scores at admission (≥ 50) were 6.43, 95% CI [1.81, 22.86] times more likely to be human milk feeding at discharge, compared to mothers with lower modified BSES-SF scores at admission (< 50). This association was significant ($p = 0.004$) in the multivariable model, while controlling for other variables in the model. The logistic regression model was not statistically significant, $\chi 2 = 16.170$, $df = 10$, $p = 0.095$. In contrast, at the bivariate level, this association was also significant ($p = 0.001$) and mothers with higher modified BSES-SF scores at admission (> 50) were 4.15, 95% CI [1.77, 9.74] times more likely to be human milk feeding at discharge, compared to mothers with lower modified BSES-SF scores at admission (< 50).

Table 4

Factors Associated with Human Milk Feeding at Discharge, Grouped by Type of Feeding, and Presented by n (%) with UOR and AOR

	Full Sample $N = 221^{k}$			
	Feeding at Discharge			
	Combination n = 92	Human milk feeding n = 127		
Variables	*n (%)*	*n (%)*	*UOR* [95% CI]	*AOR* [95% CI]
Maternal characteristics				
Age (years)[a]				
< 34	60 (38)	98 (62)	1.69 [0.92, 3.12]	2.13 [0.87, 5.19]
Education[b]				
High school diploma or less	18 (50)	18 (50)	0.68 [0.33, 1.39]	1.18 [0.42, 3.31]
Smoking in pregnancy[c]				
Yes	15 (56)	12 (44)	0.53 [0.24, 1.19]	0.46 [0.15, 1.45]
Income[d]				
< $80,000	25 (38.50)	40 (61.50)	1.17 [0.63, 2.16]	1.07 [0.47, 2.45]
Born in Canada[e]				
No	22 (38)	36 (62)	1.27 [0.69, 2.36]	1.72 [0.70, 4.24]
Parity[f]				
Primip	51 (42.50)	69 (57.50)	0.96 [0.56, 1.64]	0.90 [0.43, 1.85]

Preeclampsia[g]				
Yes	16 (48.50)	17 (51.50)	0.75 [0.36, 1.58]	0.76 [0.30, 1.94]
Diabetes[h]				
Yes	21 (53)	19 (47)	0.60 [0.30, 1.19]	1.68 [0.60, 4.70]
Infant characteristics				
Birth weight[i]				
SGA	3 (27)	8 (73)	1.99 [0.51, 7.73]	1.38 [0.29, 6.69]
Scale Scores				
BSES-SF[j] (admission)				
High (≥ 50)	59 (34)	116 (66)	4.15** [1.77, 9.74]	6.43** [1.81, 22.86]

Note. [a] *n* = 215 due to missing data; [b] *n* = 219 due to missing data; [c] *n* = 218 due to missing data; [d] *n* = 186 due to missing data; [e] *n* = 218 due to missing data; [f] *n* = 219 due to missing data; [g] *n* =214 due to missing data; [h] *n* = 216 due to missing data; [i] *n* = 219 due to missing data; [j] *n* = 203 due to missing data; [k] *n* = 219 due to missing data
SGA = small for gestational age; BSES-SF (admission) = Breastfeeding Self-Efficacy Scale – Short Form.
*$p < 0.05$ (2-tailed test).
** $p < 0.01$ (2-tailed test).

Chapter 5: Discussion

In this observational study, a secondary data analysis was conducted to investigate the association between BSE and human milk feeding at discharge among mothers of moderate and late preterm infants in level II NICUs. In this chapter, I will describe the study results, discuss limitations, and provide recommendations for future practice.

Predictors of Human Milk Feeding at Discharge

The primary hypothesis for this study was that mothers with higher modified BSES-SF scores at admission would be more likely to be providing human milk at discharge, compared to mothers with lower modified BSES-SF scores at admission. This hypothesis was supported and for all models (full sample, primiparous sub-group, and multiparous sub-group), BSE at admission was significantly associated with human milk feeding at discharge. That is, mothers with higher modified BSES-SF scores at admission were more likely to be human milk feeding at discharge. The secondary hypothesis for this study was that the mothers with previous breastfeeding experience (multiparous) were more likely to be providing human milk at discharge, compared to mothers with no previous breastfeeding experience (primiparous). This hypothesis was not supported since there was no difference in the association between higher modified BSES-SF scores at admission and providing human milk at discharge when stratified by parity. Only for mothers in the primiparous sub-group, education contributed to the model and was significantly associated with human milk feeding at discharge. The following discussion will compare and contrast my results with those of other studies.

Breastfeeding self-efficacy.

Breastfeeding self-efficacy places emphasis on the mother's breastfeeding confidence and recognizes the importance of empowering and supporting, rather than diminishing her breastmilk feeding efforts (Dennis; 1999; Dennis, 2003). Theoretically, BSE is believed to be influenced by four main factors: (a) performance accomplishments (e.g., previous breastfeeding experiences), (b) vicarious experience (e.g., observing other woman breastfeeding), (c) verbal persuasion (e.g., encouragement from influential others, such as: lactations consultants, family, and friends), and (d) physiological and affective states (e.g., pain, stress, exhaustion, anxiety) (Dennis, 1999). Although important, this study did not capture information related to vicarious experience or explore how stress, depression, or anxiety influenced BSE and human milk feeding in the regression models. As a result, the following discussion will highlight how performance accomplishments and verbal persuasion may have influenced BSE in this study.

Performance accomplishments.

Modified BSES-SF scores at admission was a variable that remained significantly associated with human milk feeding at discharge across regression analyses (i.e., for mothers of moderate and late preterm infants, and by sub-group [primiparous and multiparous]. Gerhardsson et al. (2018) found that mothers with previous breastfeeding experience (multiparous) had higher levels of BSE when their preterm infant reached 40 weeks postmenstrual age and at 3 months corrected age, compared to mothers with no previous breastfeeding experience. It was unclear whether this resulted in a longer duration of breastmilk feeding in multiparous mothers (Gerhardsson et al., 2018). Given that we used multiparity as a proxy for breastfeeding experience, it is possible that not all the mothers in this group had previous breastfeeding experience. In addition, Dennis (1999) discussed that not all previous breastfeeding experiences are positive (e.g., a mother may be unable to successfully latch their infant at the breast or to provide adequate breastmilk volumes to meet their infant's needs) and this may have detrimental outcomes on maternal self-efficacy. It is also possible that previous breastfeeding experiences may not apply to mothers of moderate and late preterm infants given that their first successful breastfeeding experience might have been with a healthy/term infant. Alternatively, the stress of navigating the NICU may negate any previous positive breastfeeding experience. Parity may influence BSE for mothers of late preterm infants post-discharge from a NICU (Gerhardsson et al., 2018), but further research is needed to understand whether parity influences BSE for mothers of moderate and late preterm infants at admission to a level II NICU.

Verbal persuasion.

Dosani et al. (2017) highlighted the many breastfeeding challenges with late preterm infants and reinforced that support is crucial to ensure breastfeeding success. Mothers with low BSE at admission may have had inadequate support to overcome their breastfeeding challenges, which may have contributed to early discontinuation of breastmilk feeding. Current breastfeeding practices in Western Society are unsupportive and prioritize the medical model, which lowers a mother's BSE and reinforces the medicalization of breastfeeding and breastfeeding pathologies (Apple, 1987; Torres, 2014). For example, breastfeeding mothers are often made to believe they are incapable or providing adequate quantities of breastmilk for their infant (Torres, 2014). In NICUs, healthcare providers reinforce this concept by focusing their breastfeeding efforts on pumped milk volumes and timed breastfeeding sessions. In addition, the message 'breast is best' (Murphy, 1999; Stanway & Stanway, 1978) is a common phrase that is outdated (41 years ago) and continues to be used that reinforces the biomedical discourse on breastfeeding and shapes breastfeeding practices in a way that promotes either success or failure (Debevec & Evanson, 2016). This message was determined to be unsupportive by mothers and found to be detrimental to the initiation and success of breastfeeding (Debevec & Evanson, 2016). All breastfeeding mothers who face breastfeeding difficulties suffer in silence and avoid seeking assistance, due to fear of shame and judgment related to the unrealistic expectation that the message ‘breast is best’ imposes (Debevec & Evanson, 2016; Larsen, Hall, & Aagaard, 2008).

Mothers of preterm infants face additional breastmilk feeding challenges because of the fast-paced and isolating NICU environment, which can threaten breastmilk feeding (Wheeler & Dennis, 2013). Improving breastmilk feeding for moderate and late preterm infants will need to involve more than just educating mothers and their families about the benefits of breastmilk (Debevec & Evanson, 2016). Understanding how healthcare providers can provide support to breastfeeding mothers in the NICU is essential. To my knowledge, no studies have identified specific support interventions that can be used to increase BSE for mothers of moderate and late preterm infants in a NICU environment. Maternal empowerment was identified as a key component of breastfeeding support and believed to influence breastfeeding success from the mother’s perspective (Debevec & Evanson, 2016). Praising successful components of a breastfeeding session may enhance a mother’s self-efficacy. Praise from individuals with greater perceived credibility (e.g., Lactation Consultants) may have a greater influence on maternal self-efficacy, compared to individuals who are perceived to lack credibility (Dennis, 1999). Being honest, non-judgmental, and in tuned to the mother’s breastfeeding goals was also recommended as a way that healthcare providers can be supportive when caring for a breastfeeding mother (Debevec & Evanson, 2016). Lastly, breastfeeding mothers should be treated in a sensitive, patient-centred way, that values their needs as much as the infant's needs (Debevec & Evanson, 2016).

Lactation consultants and nurses working in level II NICUs might consider a more individualized approach to breastfeeding support that enhances collaboration with breastfeeding mothers and enables them to feel more central to the process. Briere et al. (2016) found that infants of mothers who were provided with opportunities to direct breastfeed at least once per day had improved breastfeeding outcomes in the long term. This reinforces the recommendation that mothers with medically stable infants in the NICU should feel supported when breastfeeding, and efforts should be made to avoid imposing strict intervals between feeds and time limits at the breast. When mothers are provided with support, they experience increased BSE, which results in an earlier initiation and duration of breastmilk feeding (Debevec & Evanson, 2016; Mulder, 2006; Wheeler & Dennis, 2013). To improve health outcomes and increase maternal self-efficacy and resulting breastfeeding success, it is important to understand what breastfeeding support means from the mother's perspective. It will be crucial to promote interprofessional collaboration between researchers, policymakers, and clinicians within NICUs to enhance breastfeeding policies, which must include components related to support. It would also be beneficial to involve mothers of moderate and late preterm infants on a BSE advisory committee to inform other researchers and clinicians about what breastfeeding support means from the mother's perspective.

Breastfeeding self-efficacy in clinical practice.

Gerhardsson et al. (2018) were among the first researchers to use the modified BSES-SF in clinical practice in a Swedish NICU. Their findings were similar to ours as they found that higher modified BSES-SF scores soon after birth (time point not specified) in the late preterm population predicted exclusive breastfeeding at both 40 weeks postmenstrual age and 3 months corrected age. Given the association in this study between BSE at admission and human milk feeding at discharge, healthcare providers working in level II NICUs might consider using the modified BSES-SF to capture a mother's BSE at admission. Mothers with lower BSE scores could be flagged and provided with additional support, potentially enhancing their ability to be successful at providing human milk.

When considering how BSE theory influences mothers' perceived ability to successfully breastfeed, many factors may have contributed to their success in human milk feeding at discharge. Although this study did not explore the other two sources of information for BSE theory (vicarious experience, and physiological and affective states), it is possible that having this additional information may have influenced the results. For example, within the category of vicarious experience, observational learning and peer support (e.g., role models) are associated with perceived self-efficacy and can offer positive benefit in the absence of personal experience (Dennis, 1999). Verbal persuasion from a credible source (e.g., lactation consultants) has been associated with a greater impact on maternal self-efficacy, compared with individuals who are perceived to be less credible (e.g., individuals with no previous breastfeeding training or personal experience) (Dennis, 1999). This reinforces the value that lactation consultants play in potentially enhancing mothers' perceived BSE in the NICU. If this study had included vicarious experience as a variable in the logistic regression model, it is unlikely a significant association ($p < 0.05$) would have been identified between vicarious experience and human milk feeding at discharge or that vicarious experience would have changed the effect size between the primary exposure of modified BSES-SF scores at admission and the outcome of human milk feeding at discharge. Components of physiological and affective states (EPDS, STAI (state and trait), and PSS: NICU) were also not included in my data analyses for reasons previously discussed (refer to data analysis section), but the literature does imply that mothers who experience pain and fatigue tend to have lower self-efficacy, compared to mothers who are excited and experience satisfaction (Dennis, 1999). As a result, if I had access to additional variables (e.g., pain, fatigue, etc.) in this study or included the stress, anxiety, or depression scales, it is possible that a significant association ($p < 0.05$) would have been identified between mothers with anxiety, depression, or pain, and modified BSES-SF scores at admission and human milk feeding at discharge. It is also possible that these variables could have reduced the effect size between the primary exposure of modified BSES-SF scores at admission and the outcome of human milk feeding at discharge (e.g., mothers in pain experience reduced perceived self-efficacy, which results in delayed initiation or continuation of breastmilk feeding). Researchers should consider exploring in greater detail how pain, anxiety, stress, or depression influence BSE and breastmilk feeding at discharge for mothers of moderate and late preterm infants.

The relationship between BSE and breastmilk feeding in mothers of healthy-term infants has been well established (Blyth, Creedy, Dennis, Moyle, Pratt, & De Vries, 2002) and interventions to increase BSE within healthy, term samples have been identified (Brockway et al., 2017) and have demonstrated varying levels of success. These points are discussed in greater detail in the following section Implications for Nursing Practice. Given the lack of research related to factors associated with human milk feeding in moderate and late preterm infants, there were limited comparisons between the results from this study and other studies. Further research is needed to investigate BSE with the moderate and late preterm population.

Maternal education level.

Evidence suggests that higher education is associated with a greater sense of self-efficacy and high levels of task attainment (Bandura, 1977). For instance, individuals who were educated at the university level had higher levels of self-efficacy and increased success with tasks (Bandura, 1977). In this study, I found that primiparous mothers with a high school diploma or less were less likely to be providing human milk at discharge, compared to mothers with a certificate/diploma or higher. This result is supported by other research, including Niela-Vilén et al. (2016) who found that mothers with a university education or higher were more likely to initiate breastfeeding sooner (average of 5 days), compared to mothers with lower levels of education (average of 8 days). In contrast, Gerhardsson et al. (2018) found no relationship between education and BSE in mothers of late preterm infants. Similar results (e.g., no association) were also found in studies looking at BSE and education in full term infants (Gerhardsson, Nyqvist, Mattsson, Volgsten, Hildingsson, & Funkquist, 2014; Gregory, Penrose, Morrison, Dennis, & MacArthur, 2008). In this study, no significant associations were found between education and human milk feeding at discharge when looking at both the full sample and the multiparous sample. My sample had a larger proportion of women with higher education levels, compared to mothers with a high school diploma or less. Given the small sample size for mothers with a high school diploma or less in the primiparous subgroup, it is possible that this significant association occurred due to chance or was confounded by other variables in the multivariable logistic regression model. Given a lack of clarity regarding the association between education and breastmilk feeding with mothers of moderate and late preterm infants, further research is recommended.

Factors Not Associated with Human Milk Feeding at Discharge

Many factors were not associated with human milk feeding at discharge. In this study, marital status, maternal age, born in Canada, smoking, income, small for gestational age, diabetes, and pre-eclampsia were not significantly associated with human milk feeding at discharge. These results were surprising given research that supports their relationship with breastfeeding duration. For example, women who were married, non-smokers, older, and from a higher socioeconomic status were more likely to breastfeed for longer durations (Niela-Vilén et al., 2016). In addition, women of an ethnic minority and who were unsupported, were less likely to breastfeed (Dennis, 2002). The results from this current study were consistent with Gerhardsson et al. (2018), who determined that maternal age was not associated with BSE and subsequent exclusive breastfeeding in the late preterm population at both 40 weeks postmenstrual age and 3 months corrected age.

Other studies have demonstrated that mothers of late preterm infants found breastfeeding to be extremely challenging, due to difficulty latching and waking sleepy infants to feed (Dosani et al., 2017). In addition, the NICU environment was stressful and overwhelming for new parents, which often prevented them from being able to directly care for their infant (Briere et al., 2016). Data for this current study did not include information on infant behaviors at the breast or time spent at the breast. Thus, characteristics of moderate and late preterm infants and

NICU environment may outweigh demographic and lifestyle factors in predicting human milk feeding at discharge. Although the predictors of breastfeeding were similar in mothers of term and preterm infants (Niela-Vilén et al., 2016), there is little research that has specifically studied the late preterm population and even less research on breastfeeding in the moderate preterm population. These findings reinforce the need for further research to investigate predictors of human milk feeding with this specific maternal-preterm infant population.

Limitations and Recommendations for Future Research

Breastmilk definitions vary throughout the literature and lack clarity (Labbok & Krasovec 1990; WHO, 2008), which may have resulted in measurement errors within the breastfeeding definitions category during data collection. For example, the breastfeeding categories (only, mostly, half, minimal, and no) may have been unclear to mothers when reporting human milk feeding, potentially leading to incorrect responses. Given that the type and method of feeding changes frequently throughout an infant's progression in the NICU, mothers may find it difficult to keep track of the type of feeding an infant has received. Additional research is needed to help clarify breastfeeding definitions, which has the potential to enhance their accuracy in both research and clinical practice. In addition, breastfeeding experience was speculated to be an important variable influencing BSE and subsequent breastfeeding at discharge, but this variable was not available. Parity was used a proxy for breastfeeding experience, which may not have been able to accurately capture this information (e.g., multiparous mothers do not always choose to breastfeed or have the ability to successfully breastfeed because of illness or breast anomalies). Further research that specifically captures breastfeeding experience as a variable is recommended.

It should be noted that all odds ratios for the associations between modified BSES-SF scores at admission and human milk feeding at discharge were < 2 and > 0.5, which may indicate a lack of clinical significance. Since the odds ratio for a continuous variable was interpreted as a 1-unit increase (e.g., for every 1-unit increase on the modified BSES-SF, the odds of using human milk at discharge increased by a factor of 1.06), the results from a clinical standpoint are not very meaningful. For example, a mother who scores 20 vs. 21 on the modified BSES-SF at admission is likely to be similar from a BSE perspective. A 1-unit difference in scores on the modified BSES-SF among breastfeeding mothers in the NICU is unlikely to be helpful when determining which mother should be prioritized in regard to breastfeeding support. Given that there were no initial recommendations for clinical cut-points on the modified BSES-SF, this variable was not dichotomized for the initial logistic regression analyses (Table 3). It is beneficial to have a defined cut-point regarding high and low modified BSES-SF scores, which may enhance clinical significance and provide a better understanding of the association between low modified BSES-SF scores and human milk feeding at discharge. Post initial logistic regression analyses, it was identified that Nanishi et al. (2015) conducted a secondary data analysis and used receiver operating curves (4 and 12 weeks postpartum) to determine a clinical cut-point. To obtain a high sensitivity (79%), they chose the cut-off score of 50 (specificity = 52%). BSES-SF scores were obtained at discharge and breastfeeding status (exclusive refers to only receiving breastmilk) was obtained at 4 weeks and 12 weeks postpartum. In hospitals without baby-friendly certification, Nanishi et al. (2015) provided evidence to suggest that mothers with low BSES-SF scores (< 50) were at risk of discontinuing breastfeeding prior to the recommended guideline of 6 months. It should be noted that this study was conducted using the

Japanese version of the BSES-SF and not the English version of the modified BSES-SF (Nanishi et al., 2015). A limitation of using this cut-point was that Nanishi et al. (2015) used the BSES-SF with mothers of term infants who did not experience adverse social determinants of health (low income, lack of social support, lower levels of education). Further validation of a clinical cut-point with the modified BSES-SF in preterm Canadian populations is warranted. In addition, given the low breastfeeding continuation rates in Canada (31%) with few mothers of preterm infants exclusively breastmilk feeding until 6 months of age, it is possible that capturing modified BSES-SF scores at discharge may prove to be more valuable from a public health standpoint. Identifying mothers at risk of discontinuing breastmilk feeding at discharge has potential to target mothers at risk of not reaching the 6-month exclusive breastmilk feeding goal.

There were additional limitations in this study. Participants represented a relatively homogenous sample (e.g., post-secondary education, high income, married); and the results are not generalizable to the population of mothers of moderate and late preterm infants. Future population-based research with heterogeneous populations (e.g., socioeconomic diversity and single parents) may be valuable in further understanding the association between BSE and human milk feeding at discharge, while also enhancing the generalizability of these results. Given that this study was a secondary data analysis and the main outcome of the larger FICare study was infant length of stay, the available variables may not have been able to capture the information that was needed to predict human milk feeding at discharge. A major limitation of this observational study is that regression analysis does not determine a cause and effect relationship, therefore these results should be used as a guide in future research and in context with other influencing variables. My results may inform future research related to breastmilk feeding for moderate and late preterm infants. Future studies with stronger methodological rigor (e.g., randomized controlled trials) that have a main outcome of human milk feeding in this preterm population are warranted.

Implications for Nursing Practice

This study is aligned with the strategic direction of Alberta Health Services (AHS), which involves improving both patient outcomes and healthcare sustainability (AHS, 2018). If moderate and late preterm infants are human milk feeding at discharge, there is a potential to reduce their risk of developing later health complications and morbidities during infancy, early childhood, and beyond. Given that my hypothesis was supported and BSE at admission was associated with human milk feeding at discharge, nurses and lactation consultants working in level II NICUs can flag mothers with low BSE at admission using the modified BSES-SF. These at-risk mothers could be provided with ongoing follow-up, which might include additional breastfeeding support through education and consistent messaging. A systematic review and meta-analysis conducted by Brockway et al. (2017) suggested that education sessions and consistent messaging about breastfeeding increased BSE for mothers of term infants. Thus, it is possible that these interventions could benefit the preterm population; however, further research is needed.

As a Registered Nurse/Lactation Consultant at the Stollery Children's Hospital NICU, I collaborate with a multidisciplinary feeding group, including neonatologists, managers, advanced practice nurses, nurse practitioners, dietitians, speech-language pathologists, and lactation consultants who also work in the NICU. Within this group, we are working to update feeding guidelines for preterm infants and develop strategies to reduce rates of necrotizing enterocolitis and enable preterm infants to receive their mother's own breastmilk within the first 4 to 12 hours postpartum (as opposed to formula or human donor milk). Advanced Practice Nurses (Nurse Practitioners and Clinical Nurse Educators) can integrate factors associated with human milk feeding identified in my research (e.g., BSE theory) to help inform these new feeding guidelines and breastfeeding policies within this working group. For example, breastfeeding education classes both prenatally and postnatally have demonstrated effectiveness in increasing BSE in mothers of healthy, term infants (Chan Man et. al., 2016; Noel-Weiss et. al, 2006). Mothers admitted antenatally for monitoring and at-risk of preterm delivery to a NICU may benefit from attending breastfeeding education classes while in hospital, which might increase their BSE and potentially ensure that these infants receive their mother's own milk prior to 12 hours postpartum. Online breastfeeding education sessions may be valuable for mothers who receive high-risk antenatal care at home, although this may be challenging for mothers with language barriers and who lack social support. Populations with adverse social determinants of health may require educational interventions that are implemented in person to help overcome some of these additional barriers (lack of access to pertinent resources, language barriers, and varying literacy levels).

When planning education sessions for breastfeeding mothers in a NICU setting and relating it back to BSE theory (e.g., verbal persuasion and performance accomplishments), healthcare providers should be aware of the importance of support and the valuable role it contributes to the breastfeeding process for mothers of preterm infants. Breastfeeding support might include individualized breastfeeding plans that identify a mother's personal breastfeeding goals and value her role in the decision-making process. Other strategies for support might include consistent and positive messaging from a lactation consultant that reinforces positive aspects of a breastfeeding session (as opposed to pumped breastmilk volumes and timed breastfeeding sessions). Supportive measures may prove to be a necessary component of breastfeeding care for mothers of preterm infants given the potential to improve a mother's BSE and subsequent breastfeeding duration. Given that support is a complex process and encompasses many different meanings for different individuals, further research investigating what support means from the mother's perspective is recommended to enable clinicians to improve health outcomes for the moderate and late preterm breastfeeding dyad.

Conclusion

Parity did not influence the effect size between the primiparous and multiparous subgroups, indicating that previous breastfeeding experience did not influence the association between the primary exposure and outcome. The additional covariates examined in the multivariable model (maternal age, education, smoking in pregnancy, income, born in Canada, preeclampsia, diabetes, and small size for gestational age) did not confound the association between modified BSES-SF scores at admission and human milk feeding at discharge. The results from this study highlighted that higher breastfeeding self-efficacy at admission was associated with human milk feeding at discharge. The odds ratios in the initial logistic regression analyses of < 2 and > 0.5 suggested a lack of clinical significance, but when a clinical cut-point of 50 was identified and further analyses conducted, clinical significance was demonstrated more effectively (OR = 6.43) and mothers with high (> 50) modified BSES-SF scores were more likely to be providing human milk at discharge.

Given that limited research explored predictors of human milk feeding for moderate and late preterm infants, healthcare providers working in level II NICUs might benefit from using the modified BSES-SF as a screening tool at admission to identify mothers at risk of early discontinuation of human milk feeding at discharge. Using a clinical cut-point of 50 has potential to prioritize mothers according to low vs. high scores, enabling healthcare providers to target mothers at greater risk of discontinuing breastmilk feeding prior to discharge. Lactation consultants who are viewed by many as credible sources of breastfeeding information can target mothers with low modified BSES-SF scores and provide consistent messaging through education sessions and using supportive measures, which may have a positive influence on breastfeeding outcomes.

Healthcare providers should also be aware of additional factors that influence BSE (e.g., physiological and affective states). Future studies might benefit from looking more closely at how pain, stress, anxiety, and vicarious experience are associated with BSE and human milk feeding. Other aspects may be considered as possible predictors, including infant and NICU factors (infant behaviors at the breast or time spent at the breast). For example, mothers of infants who are not provided with opportunities to breastfeed or taught how to wake sleepy infants may be more likely to discontinue breastmilk feeding early. BSE identified early in the postpartum period in mothers of late preterm infants may be a predictor of breastmilk feeding and should be considered an important area of research (Gerhardsson et al., 2018). Further research is needed to better understand details of this association and contribute to improved breastmilk feeding rates for moderate and late preterm infants.

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Appendix

Table A

Independent and Dependent Variables

Name of variable	Source	Type of variable	Timing
Human milk feeding	Hospital Records/Family-Integrated Care Study (Labbok & Krasovec, 1990; World Health Organization, 2008)	Categorical (y/n)	Discharge
Maternal characteristics			
Age	Demographic/health history sheet	Categorical	Baseline
Education	Demographic/health history sheet	Categorical	Baseline
Marital status	Demographic/health history sheet	Categorical	Baseline
Parity	Demographic/health history sheet	Categorical	Baseline
Maternal health data			
Mode of delivery	Demographic/health history sheet	Categorical	Baseline

Substance use (alcohol, smoking and street drugs)	Demographic/health history sheet	Categorical (y/n)	Baseline
Maternal psychosocial factors			
Breastfeeding-self efficacy	Modified Breastfeeding Self-Efficacy Scale Short-Form (Wheeler & Dennis, 2013)	Numeric (scale)	Baseline
Depression	Edinburgh Postnatal Depression Scale (Cox, Holden, & Sagovsky, 1987)	Numeric (scale)	Baseline
Stress	Parental Stressor Scale: NICU (Miles, Funk, & Carlson, 1993)	Numeric (scale)	Baseline
Anxiety	State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970)	Numeric (scale)	Baseline
Infant health data			
Gestational age	Demographic/health history sheet	Categorical	Baseline
Sex	Demographic/Health History Sheet	Categorical	Baseline

Multiple birth (twins)	Demographic/health history sheet	Categorical (y/n)	Baseline
Birth weight	Demographic/health history sheet	Categorical	Baseline