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Effect of Alberta Family Integrated Care (FICare) on Breastfeeding Self-Efficacy and Breastmilk Feeding in Moderate and Late Preterm Infants

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Effect of Alberta Family Integrated Care (FICare) on Breastfeeding Self-Efficacy and Breastmilk Feeding in Moderate and Late Preterm Infants

by

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Abstract

Background: Breastfeeding self-efficacy (BSE) predicts breastfeeding outcomes in mothers of full-term infants; however, neonatal intensive care unit (NICU) practices may impede BSE and breastmilk feeding in mothers of preterm infants. Alberta Family Integrated Care (FICare) integrates parents into the care of their infant while in the NICU, by enhancing parent support, parent education and information sharing. The objective of this PhD work was to explore how Alberta FICare works to inform maternal BSE and resultant infant feeding outcomes in mothers of moderate ($32^{0/7} – 33^{6/7}$ weeks) and late preterm infants ($34^{0/7} – 35^{6/7}$ weeks).

Methods: I conducted an explanatory sequential mixed-methods sub-study of the Alberta FICare trial. Based on BSE change scores between admission and discharge for mothers in the intervention group, I invited mothers scoring in the top or bottom quintiles to participate in interviews about infant feeding experiences in the NICU. Interviews were analyzed using inductive thematic analysis. To assess the effects of FICare on BSE and breastmilk feeding rates at discharge, I used repeated measures ANCOVA and Chi square. Finally, I used an integration matrix to integrate qualitative and quantitative findings.

Results: Overall, I included 457 mothers/infant dyads (70 twins; $M = 33^{6/7}$ weeks gestation) from the FICare trial. Interviews with 14 mothers revealed three major themes: (a) institutional influences, (b) relationship with the pump, and (c) establishing breastfeeding. FICare was effective at improving BSE for mothers of late preterm infants, $F(1, 232) = 3.97$, $p = .048$, partial $\eta^2 = .017$, but not for mothers of moderate preterm

infants, $F(1, 191) = 0.79$, $p = .375$. Although exclusive breastmilk feeding rates at discharge in late preterm infants enrolled in the FICare group were higher compared to the standard care group, these differences were not statistically significant, 72.3% versus 62.2%, $\chi^2(1) = 2.90$, $p = 0.089$; no notable difference in exclusive breastmilk feeding was observed in moderate preterm infants.

Conclusion: FICare is an effective model of care to improve BSE in mothers of late preterm infants at discharge from the NICU. More research is required to understand why FICare did not improve BSE in mothers of moderate preterm infants.

Keywords: breastmilk, breastfeeding self-efficacy, moderate and late preterm infants, mixed methods, thematic analysis

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This journey has been a product of dedication, sacrifice and love. First, to my supervisor, Dr. Karen Benzies, I express sincere gratitude. Your faith in my crazy ideas and my expertise in infant feeding has been inspiring. Your ability to let me pursue my research ideas provided me with the confidence and experience to launch as a blossoming academic in maternal-child health. It takes an insightful supervisor to support a disruptor like myself and you saw potential in me. For this, I will be forever grateful.

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friendship and support. To all of you, know that we are creating a better world and we are fantastic role models for our children.

To my family, your patience, love, and support have been unwavering throughout this journey. You have always been there to carry me forward to meet my dream. To my step-mother, Lynne, you have been my sounding board, my emergency childcare, and my nurse. They say that a PhD is a product of tenacity, not of intelligence. Dad, from day one you have taught me not to give up, to push through adversity, and to see my goals to completion. Mom, from you, I got my disruptive tendencies; I learned that I do not always have to follow the rules. To my boys, Brock, Quinn, and Drake, you are the reason I have done this. I want to show you that you can do anything, if you are dedicated and inspired. To my husband Travis, you are my rock. Your unwavering confidence in me and utter dedication to my passion have made my dreams attainable and the journey enjoyable.

Dedication

"By placing breastfeeding focus on the biomedical and nutritional benefits of breastmilk, as opposed to maternal experience associated with nursing her infant, health care providers are perpetuating the patriarchal conceptualization of the 'good mother' as one who is defined as selflessly giving by nursing her child while asking for nothing in return." (Benoit, Goldberg, & Campbell-Yeo, 2016, p. 61)

Breastfeeding is complex and laden with biological, social, and emotional expectations that can impact a woman for the rest of her life. This work is dedicated to all mothers who have wanted to breastfeed their infant. Some have found success, some have found guilt, some have found resiliency…none have failed.

Preface

This PhD dissertation is a hybrid of published manuscripts and thesis writings to explore the impact of Alberta Family Integrated Care (FICare) on breastfeeding self-efficacy (BSE) and resultant breastmilk feeding outcomes for mothers of moderate and late preterm infants in level II NICUs. In Chapter 1, I present the BSE theoretical framework, the research question and situate my PhD work within the larger Alberta FICare study. In Chapter 2, I provide a review of the literature discussing evidence around breastfeeding and breastmilk feeding for preterm infants. Chapter 3 is a systematic review and meta-analysis published in the *Journal of Human Lactation* (Brockway, Benzies, & Hayden, 2017). This article provides a proof of concept around the theoretical framework of BSE as a social change mechanism to improve breastmilk feeding rates in mothers of full-term infants and remains one of the top three most accessed and cited articles for the *Journal of Human Lactation* https://journals.sagepub.com/home/jhl#focus; accessed March, 2019). Chapter 4 presents the study protocol, which is published in the *International Breastfeeding Journal* (Brockway, Benzies, Carr, & Aziz, 2018). Qualitative results are presented in Chapter 5 and further explore the link between maternal experiences with infant feeding and reflective properties of BSE theory. This chapter has been prepared as a manuscript for submission to the *Journal of Clinical Nursing*. Chapter 6 provides the results from the quantitative analysis of Alberta FICare on breastmilk feeding outcomes and BSE as well as integrates the qualitative and quantitative findings. This chapter provides a comprehensive understanding of how Alberta FICare influenced BSE and resultant

breastmilk feeding at discharge. Chapter 6 will be submitted as a manuscript at a later date, once Chapter 5 has been accepted for publication and follow-up breastmilk feeding results (2 months) are available for analysis. As chapters 3, 4, and 5 have been formatted as stand-alone manuscripts, information in the introduction and discussion sections may be repetitive between chapters. References are included at the end of the dissertation.

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List of Abbreviations

Abbreviation	Definition
BSE	Breastfeeding Self-Efficacy
BSES	Breastfeeding Self-Efficacy Scale
cRCT	Cluster Randomize Controlled Trial
CA	Corrected Age
DHM	Donor Human Milk
FICare	Family Integrated Care
GA	Gestational Age
HCMV	Human Cytomegalovirus
HMF	Human Milk Fortifier
KMC	Kangaroo Mother Care
LOS	Length of Stay
NICU	Neonatal Intensive Care Unit
OECD	Organization for Economic Cooperation and Development
RCT	Randomize Controlled Trial
WHO	World Health Organization

Chapter 1: Introduction

Background

Alberta has the highest rate of preterm birth of the Canadian provinces, with over 8% of infants being born prior to 37 weeks (Canadian Institutes for Health Information, 2017; Coles et al., 2017). In Canada and the United States, approximately 12% of preterm infants are born moderately preterm ($32^{0/7}$ – $33^{6/7}$ weeks gestation) and 72-74% are born late preterm (Canadian Institute for Health Information, 2009; Chawanpaiboon et al., 2019; Shapiro-Mendoza & Lackritz, 2012). In Canada, the majority of preterm infants are admitted to the neonatal intensive care unit (NICU) and are at risk for health and developmental issues included necrotizing enterocolitis (Natarajan & Shankaran, 2016; Walsh et al., 2017), neurodevelopmental disabilities (S. Johnson et al., 2015), and growth restrictions (Boyle, 2012). The economic burden of preterm birth ranges from $10,000 - $67,467 per infant in the first 10 years of life (Johnston et al., 2014). Appropriate nutrition beginning at birth is a key component to lifelong health, and breastmilk is the ideal nutrition for preterm infants (American Academy of Pediatrics, 2012; S. Johnson et al., 2015; Lucas & Smith, 2015). Preterm infants who are not fed breastmilk are at an increased risk for infection (Gouyon, Iacobelli, Ferdynus, & Bonsante, 2012), necrotizing enterocolitis (Gephart, McGrath, Effken, & Halpern, 2012), growth restrictions (Hair et al., 2019), and lifelong health concerns (Victora et al., 2016). Breastmilk feeding rates among preterm infants are substantially lower than those of full-term infants (Hackman, Alligood-Percoco, Martin, Zhu, & Kjerulff, 2016; Ross & Browne, 2013). Current practitioner-focused care in the NICU can result in reduced breastfeeding self-efficacy

(BSE), potentially contributing to lower breastmilk feeding rates (Callen & Pinelli, 2005; Gerhardsson, Hildingsson, Mattsson, & Funkquist, 2018). Integrating parents into the care of their infant while in the NICU may improve maternal BSE and increase breastmilk feeding rates at discharge. Alberta Family Integrated Care (FICare) is a model of care that integrates parents into the care team while they are in the NICU. The aim of this study was to explore how Alberta FICare works to inform maternal BSE and resultant infant feeding outcomes in mothers of moderate and late preterm infants. The findings from this study will provide insight to the mechanisms of Alberta FICare and NICU care practices that inform, support, and hinder maternal BSE while in the NICU and impact breastmilk feeding outcomes at discharge.

Statement of the Problem

Breastmilk feeding is the recommended and optimum method for preterm infant nutrition (Kim & Unger, 2010). The Canadian Pediatric Society (Critch, 2013), Health Canada (2012), and the World Health Organization (2015) recommend that full-term infants are exclusively breastfed for 6 months and that breastmilk feeding is sustained until 2 years of age and beyond. While preterm infants may require additional supplementation, breastmilk is considered the optimal nutritional source and is important for short- (Gephart et al., 2012; Quigley, Embleton, & McGuire, 2018) and longer-term health outcomes (Blesa et al., 2019; Lechner & Vohr, 2017). Research is emerging regarding the vital role that breastmilk feeding plays in establishment of the gut microbiome (Azad et al., 2016; Bäckhed et al., 2015). Additionally, breastfeeding can

help to enhance maternal–infant attachment and maternal role attainment (Callen & Pinelli, 2005).

Numerous barriers exist that prevent preterm infants from receiving breastmilk as their exclusive nutritional source. Physical and neurodevelopmental immaturity contribute to poor feeding skills and may delay breastfeeding initiation, which may limit breastmilk intake and jeopardize infant growth and development (Engle, Tomashek, & Wallman, 2007; Nyqvist, 2012). Barriers incurred through hospital care practices and the physical environment of the NICU can result in physical and emotional separation of infants from their parents, posing a substantial risk to establishing and maintaining breastmilk feeding (Callen & Pinelli, 2005). The current care model in many Canadian NICUs situates the healthcare professional as the primary care provider and parents as supplementary care providers or observers, potentially limiting transfer of information and time parents are able to spend with their infants (Staub et al., 2014). This model of care can result in feelings of parental detachment, ineffective parenting, parental stress, and loss of control, as well as detracting from maternal BSE (Staub et al., 2014; Wheeler & Dennis, 2013). Realigning care provision within the NICU to integrate parents into the care team may help to alleviate the negative psychosocial aspects that parents experience while their infant is hospitalized (Gooding et al., 2011), as well as improve maternal BSE and resultant breastmilk feeding rates.

FICare is a model of care that educates and supports parents to actively participate in the care of their infant as soon as possible after admission to the NICU. Previous

research indicates that FICare has positive outcomes for infant weight gain trajectories and breastfeeding for early preterm infants (born prior to 33 weeks) (O'Brien et al., 2018; O'Brien et al., 2013). Preterm infants who received FICare had significantly higher rates of high-frequency breastfeeding (≥ 6 times per day; 279/396 [70%]) compared to infants who received standard care (O'Brien et al., 2018). However, the O'Brien et al. (2018; 2013) studies did not clearly define how breastmilk feeding was measured and *high frequency exclusive breastfeeding* is an outcome that has not previously been examined in the breastfeeding literature. Further, infant feeding outcomes were limited to dichotomous assessment of breastmilk feeding and did not adequately assess breastmilk feeding rates or maternal perceptions of breastfeeding experiences with FICare (O'Brien et al., 2013). As such, the effect of FICare on breastfeeding outcomes warrants further investigation.

Finally, maternal experiences and perceptions of infant feeding while in the NICU work to inform BSE (Swanson et al., 2012), and can significantly affect breastfeeding outcomes (Giannì et al., 2016). As such, it is vital to comprehensively assess if and how FICare influences breastmilk feeding rates and maternal experiences with infant feeding. Examining quantitative and qualitative components of BSE will provide complementarity and will enhance understanding of BSE results and resultant infant feeding outcomes.

Theoretical Framework: Breastfeeding Self-Efficacy Theory

Maternal BSE is one of the most influential, modifiable factors in determining breastmilk feeding outcomes (K. A. McQueen, Dennis, Stremler, & Norman, 2011). Interventions focused on improving BSE and maternal confidence have been shown to

improve breastmilk feeding exclusivity and contribute to increased breastmilk feeding rates in mothers of preterm infants (Brockway et al., 2017; Wheeler & Dennis, 2013).

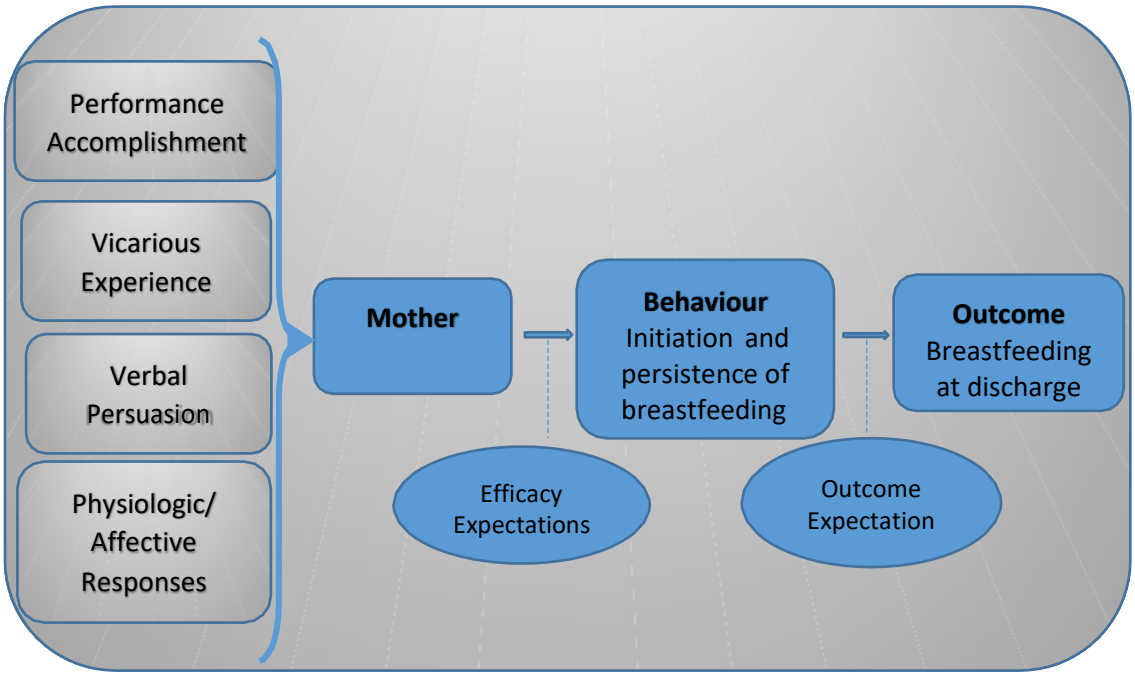

Figure 1.1 Schematic of the Breastfeeding Self-efficacy Theory (expanded upon from Dennis, 1999).

The basic premise of BSE theory is that a mother may have a desire to feed her infant breastmilk; however, if she lacks the confidence in her breastfeeding ability, it is unlikely that she will achieve the desired outcome. BSE is based on a mother's perceived ability to be successful in breastmilk feeding and not on her true ability to succeed in breastmilk feeding (Dennis, 1999). BSE theory assumes that perceptions are related to personal beliefs about performing tasks in certain situations and not on personality characteristics. Additionally, these perceptions are regulated and motivated by contextual

and environmental factors (Bandura, 1977, 2012). As such, construction of maternal BSE occurs through the interactions that a breastfeeding mother has with her environment.

I will operate under the assumption that BSE is socially produced and that individual psychologies, sociocultural contexts, and structural conditions all work to influence a mother's breastfeeding behaviours. BSE theory will serve as the theoretical framework to guide the study.

In chapter 3, I present the systematic review and meta-analysis we conducted to explore the link between BSE theory and breastfeeding rates in mothers of full-term infants. We limited the population of interest to mothers of full-term infants because, at the time of the literature review (2016), there was a paucity of literature regarding BSE in mothers of preterm infants. More recently, evidence has emerged indicating the BSE is predictive of breastfeeding outcomes in mothers of late preterm infants (Wang, Briere, Xu, & Cong, 2018).

Operational and Conceptual Definitions

Inconsistent classification of breastfeeding is a major critique that continually emerges from the body of research examining infant feeding outcomes (Labbok & Starling, 2012). Breastfeeding, breastmilk feeding, and human milk feeding are terms that are often used interchangeably in the literature. For the purposes of this study, *breastfeeding* or *direct breastfeeding* will be defined as feeding of the infant directly from the mother's breast and *human milk feeding* will be defined as the feeding of another woman's breastmilk, usually donor human milk (DHM), to the infant

(Underwood, 2013). *Breastmilk* feeding is defined as feeding of mother's own breastmilk to the infant, either directly from the breast or as expressed breastmilk. Due to the nature of the maternal questionnaire used for infant feeding recall, I was unable to separate out timing of DHM supplementation from the overall infant feeding outcomes. However, standard practice in Alberta is to discontinue DHM and transition infants to either formula or mother's own milk prior to discharge from the NICU (Jannette Festival, Director - Northern Star Mother's Milk Bank, personal communication, March 4, 2019). As the outcome of interest for this study is infant feeding at discharge from the NICU, for the purposes of this study I assumed that infants were no longer receiving DHM when they were discharged from the NICU.

The classification of proportion of breastfeeding and breastmilk feeding is inconsistent in the literature. As such, there have been repeated calls for researchers to consistently and effectively report breastmilk feeding rates (Chung, Raman, Trikalinos, Lau, & Ip, 2008; Labbok & Starling, 2012). For the purpose of this study, the Labbok and Krasovec (1990) classification system, which has been adopted by the WHO (World Health Organization, 2015), was used to categorize proportion of breastmilk feeding. Exclusive breastmilk feeding was defined as the infant receiving only (100%) mother's breastmilk; with the exception of medications, human milk fortifier (HMF), and DHM; no other oral liquids or solids were provided (Labbok & Krasovec, 1990). Partial breastmilk feeding was categorized as high, medium and low, depending on the proportion of breastmilk to formula being provided (75%, 50% or 25%) and no breastmilk feeding was defined as receiving no breastmilk in the last 24 hours, only

formula (Labbok & Krasovec, 1990; Morse, Harrison, & Prowse, 1986). I attempted to quantify the amount of expressed breastmilk that infants were receiving, however the answers for this item were inconsistent with the corresponding infant feeding questions and were not incorporated into the data analysis. As such, feeding of mothers' own expressed breastmilk was included in the overall feeding outcomes (e.g. 100% breastmilk feeding, including mother's own expressed breastmilk). Infants fed fortifiers or additives to enhance their growth, were classified as per the above-mentioned guidelines; however, I have made a note of fortification to control for it when considering subsequent analyses of health outcomes (not included in this study).

Summary of Study

The purpose of this study was to assess the effect of Alberta FICare on maternal BSE and breastmilk feeding rates in moderate ($32^{0/6} – 33^{6/7}$) and late ($34^{0/7} – 34^{6/7}$) preterm infants in Level II NICUs in Alberta. There is a call to develop breastfeeding research methodologies that embrace "interpretation from the social sciences" rather than strictly relying on quantitative measures of breastfeeding outcomes (Spencer, 2007, p. 779). Unilaterally implementing a quantitative or a qualitative research design will not fully honour the complexity of breastfeeding and BSE within the NICU environment (Spencer, 2008). Mixed methods research has emerged as the third major research paradigm and is an effective approach to integrating qualitative and quantitative inquiry into a single research design (R. B. Johnson, Onwuegbuzie, & Turner, 2007). Mixed methods research is ontologically situated in pragmatism, where emphasis is placed on answering a research question rather than adhering to a particular research method.

Purposeful and thoughtful integration bridges the qualitative and quantitative paradigms by drawing on the strengths each of these paradigms to effectively answer research questions (R. B. Johnson & Onwuegbuzie, 2004). Utilizing quantitative methodologies to measure BSE and breastmilk feeding rates and qualitative methodologies to explore breastfeeding experience, beliefs, or norms, allows for the research question to be explored from multiple perspectives (R. B. Johnson et al., 2007).

I used an explanatory, sequential mixed methods design (Creswell & Clark, 2011), to provide complementarity and enhance understanding of BSE and infant feeding for mothers exposed to Alberta FICare. Using an explanatory sequential design allowed for an examination of the convergence, corroboration, and correspondence of results from the quantitative and qualitative findings (Greene, Caracelli, & Graham, 1989). This study design provided a comprehensive understanding of how Alberta FICare informed maternal BSE and how it affected breastfeeding outcomes and breastmilk feeding rates.

Research questions

In the present study, I sought to explore the overall question: How does Alberta FICare work to inform maternal BSE and resultant feeding outcomes in preterm infants? The first, qualitative phase of the study sought to answer the question: How do maternal experiences with Alberta FICare work to inform breastfeeding self-efficacy? The second, quantitative, phase of the study sought to answer the question: What is the effect of Alberta FICare on maternal BSE and resultant breastmilk feeding rates at discharge from

NICU? I hypothesized that Alberta FICare will improve maternal breastfeeding self-efficacy and breastmilk feeding rates in moderate and late preterm infants.

The above research will be accomplished by conducting a two phased, mixed methods study. Initially, a systematic review and meta-analysis were conducted as a proof-of-concept, to determine if BSE was an effective modifiable factor to improve breastfeeding rates in full-term infants (Brockway et al., 2017). This review and meta-analysis were conducted in the full-term population, because evidence for this theory is sparse in the preterm population and was limited to two articles at the time of publication. Our findings demonstrated that interventions to improve BSE are an effective method to increase breastfeeding rates at 2 months postpartum. Further, BSE is a significant predictor of exclusive breastfeeding at 2 months postpartum as each 1-point increase in mean BSE scores between intervention and control groups predicted a 10% increase in exclusive breastfeeding at 2 months postpartum in the intervention group.

The first phase of the study (Figure 1.2) sought to explore maternal experiences with infant feeding while in the NICU environment to determine if elements of FICare and/or BSE emerged in their experiences. I used maximum variation sampling from the quantitative data to select mothers enrolled in the intervention arm of the Alberta FICare cRCT. Mothers with BSE change scores in the top or bottom quintiles were invited to participate in a semi-structured interview. Change scores were calculated by subtracting admission from discharge scores. Semi-structured interviews were conducted with mothers to discuss their experiences with infant feeding while they were in the NICU.

These interviews were conducted over the telephone with women from all five Alberta FICare intervention sites.

Finally, the second phase of the study examined the quantitative data to determine if Alberta FICare was effective to increase BSE and resultant breastmilk feeding rates in mothers of moderate and late preterm infants. Phase 2 informed how the Alberta FICare model worked to improve or detract from maternal BSE and breastmilk feeding rates. Integration of the qualitative and quantitative findings provided a deeper understanding of the experiences and processes that worked to inform a mother's BSE while in an Alberta FICare NICU environment.

Alberta FICare©™ in Level II NICUs

As this sub-study was nested within the larger Alberta FICare cluster randomized controlled trial (cRCT), it is important to briefly discuss the history and elements of this cRCT. FICare was introduced to Canada at the Mount Sinai Hospital NICU in Toronto, Ontario (O'Brien et al., 2013). The program originated from the Humane Neonatal Care model developed in Tallinn, Estonia (Levin, 1994), and was adapted to the Canadian NICU environment where parents actively participated in the care of their infants and nurses provide education and support (O'Brien et al., 2018; O'Brien et al., 2013). FICare involves learners (parents), coaches (healthcare providers and veteran NICU parents), structured curriculum, and implementation strategies focused on actively involving parents in the care of their infant while in the NICU. The four pillars of FICare involved: (a) an education program for parents; (b) specialized staff training; (c) access to

psychosocial supports, including peer and professional support; and (d) modifications to the policies, procedures and physical layout of the unit to better accommodate increased parental involvement (O'Brien et al., 2018). With advice from patient care managers and nurses, Alberta FICare was modified to include three components: (a) parent education, (b) access to parent support, and (c) information sharing (Benzies et al., 2017).

Phase	Procedure	Product / Output
Quantitative Data Collection	• cRCT BSES survey data • Assessed quarterly throughout cRCT • *N* = 660	• Numeric Data
Case selection: Qualitative interviews	• Maximum variation sample o BSES change score • Data saturation	• Participants (*n* = 15-20)
Qualitative data collection	• Telephone interviews • Infant feeding experiences in NICU • 2 months after discharge	• Interview transcripts (textual data)
Qualitative data analysis	• Qualitative descriptive • Inductive coding • Thematic analysis	• Tables and quotes to display themes and sub-themes • Thematic network
Quantitative Data Collection	• Quantitative survey data from cRCT • 1^0: Breastfeeding self-efficacy • 2^0: Breastmilk feeding rates • *N* = 660	• Numeric Data
Quantitative Data Analysis	• SPSS Software	• Descriptive statistics • Repeated Measures ANOVA
Integration of qualitative and quantitative results	• Interpretation and explanation of the quantitative and qualitative results o Individual level o Systems level o Study level (FICare Intervention)	• Discussion • Suggestions for improvements to intervention • Practice changes • Future research

Figure 1.2 Study flow diagram.

Rectangles depict quantitative phase, ovals depict qualitative phases, and hexagons depict integration phases. Abbreviations: cluster randomized control trial (cRCT), Breastfeeding Self-efficacy Scale (BSES), Co-variates (Cov), length of stay (LOS), ParentingStress Index (PSI), Edinburgh Postnatal Depression Screen (EPDS).

Specifically, Alberta FICare required parents to spend 6 hours per day (the equivalent to three feeds) in the NICU. To address the *parent education* component, nurses educated and encouraged parents in their role as parent by involving them in progressively complex levels of infant care. Parents were also involved with formal and informal educational sessions on a variety of topics regarding their preterm infants (breastfeeding, infant development, caring for preterm infants). Additionally, parents were provided with information about a no-cost educational app (Life's Little Love; Larocque, 2015). To address the *information sharing* component, parents participated in bedside rounds, providing updates about their infant(s)' progress to the multidisciplinary healthcare team. To enhance informational exchange, healthcare staff were trained in relational communication strategies by FICare super-users (Benzies, 2016). Relational communication is an interventive strategy that involves using reciprocal communication, such as questioning, information sharing and power sharing, to involve family members in the care of their loved one (Wright & Leahey, 2012). The third component of *parent support* was addressed by healthcare staff (predominantly nurses) and family mentors. Family mentors were parents who previously had an infant in the level II NICU environment and were trained to provide only practical advice and informal social support to parents in the NICU.

Family Integrated Care in Level II NICUs: An Innovative Program for Alberta was a cRCT that assessed multiple outcomes of the FICare intervention for moderate ($32^{0/7}$- $33^{6/7}$ weeks gestation) and late preterm infants ($34^{0/7}$- $34^{6/7}$ weeks gestation) in all 10 level II NICUs across Alberta. The primary outcome of the Alberta FICare study was

length of stay (LOS) measured in days from time of birth (admission) to time of discharge. Secondary outcomes included: rate of infection, readmission and unplanned physician visits to 2 months corrected age, infant feeding outcomes, healthcare provider satisfaction, parental outcomes, and economic costs.

All level II NICUs in Alberta (N = 10) were recruited for the study and were randomized to standard care (n = 5) or Alberta FICare (n = 5). Each site had specially trained healthcare staff (super-users) who were responsible for recruiting participants; at intervention sites super-users trained healthcare staff and were the key contacts for parent volunteers (family mentors). Alberta FICare study staff conducted quarterly fidelity checks and provided booster doses of training as required. Mothers of preterm infants born between 32 weeks and $34^{6/7}$ weeks GA, admitted to a level II NICU in Alberta were eligible to participate in the study. Given that otherwise healthy preterm infants are typically discharged at 36^{0} weeks, a cut-off of $34^{6/7}$ weeks gestational age (GA) was required to ensure a minimum of 5 – 7 days exposure to Alberta FICare. Eligible participants were sufficiently literate in English to communicate effectively with healthcare staff and complete questionnaires. Mothers of infants with a severe congenital or chromosomal anomaly or who required palliative care were excluded.

Sample size.

In total, Alberta FICare enrolled 654 mothers and 457 were included in the present study (see Figure 6.3 for CONSORT Flow diagram, Chapter 6). Due to the previously determined sample size calculation for the LOS outcome (Benzies et al.,

2017), I conducted a post-hoc power analysis on the outcomes of BSES and breastmilk feeding rates to determine if the present study was sufficiently powered (Chapter 6).

Maternal recruitment.

Recruitment for the Alberta FICare study began in December 2015. Nurses informed all mothers of infants about the study, within 72 hours of admission or transfer to a level II NICU. Super users screened interested mothers for eligibility, answered questions about the study, obtained informed consent, and administered the baseline questionnaire. Infants of mothers who did not wish to participate in the study received the same level of care as infants whose mothers were participating in the study.

Ethics approval.

Ethical approval for the study was granted by the Conjoint Health Research Ethics Board (CHREB ID REB15-0067), the University of Alberta, Health Research Ethics Board (Pro00060324), and the Covenant Health Research Ethics Board (ID 1762).

Reflexivity Statement

My professional association as a registered nurse and as an International Board-Certified Lactation Consultant has allowed me to view this work from the standpoint of a nurse and breastfeeding expert. While my professional experience is limited to the community and post-partum setting, I have walked with many mothers who have worked to establish breastfeeding after their infant was discharged from the NICU. Through my professional work, maternal confidence, or self-efficacy, has emerged as a unifying factor that permeates maternal experiences with breastfeeding. Interactions with healthcare

providers work both as efficacy enhancers or efficacy detractors that inform maternal breastfeeding self-efficacy and, in my experience, ultimately inform breastfeeding outcomes.

Summary and Significance

In 2016, over 30,000 preterm infants were born in Canada (Statistics Canada, 2019). Preterm birth results in an economic cost burden of over $8 billion annually to the Canadian healthcare system (Lim et al., 2009; Shah et al., 2018). Compared to formula or DHM feeding, increased breastmilk feeding improves health outcomes and can reduce length of stay (Liosis, Valsami, Polychronopoulos, & Skouroliakou, 2016), thereby reducing the cost burden that preterm infants place on the healthcare system. However, breastmilk feeding rates are considerably lower in the preterm population, especially in late preterm infants, when compared to the full-term population (Hackman et al., 2016). There is a need to evaluate care models that may improve breastmilk feeding rates for infants admitted to the NICU. The key to successful breastmilk feeding may be through increased BSE (Brockway et al., 2017). The additional exploration of BSE theory in this unique population will help to extend the application of this theory in healthcare practice and breastfeeding research. The findings from this research study are fundamental to better understanding how BSE informs breastmilk feeding outcomes in mothers of moderate and late preterm infants. Further, my research contributes to the evidence to support Alberta FICare as an effective care strategy to improve breastmilk feeding outcomes in level II NICUs.

Chapter 2 - Literature Review

An initial review of the literature was conducted to build my proposal and protocol for this study in 2016. To augment and update the original work, I conducted a rapid review of the CINAHL and PubMed databases in March 2019 using the following terms: *Breastfeeding* OR *breastmilk* AND *preterm* AND *moderate* OR *late*. I also conducted an additional search for the term *donor milk* on PubMed. I have included articles predominantly reporting preprocessed information such as meta-analyses, systematic and integrative reviews, and qualitative syntheses. For systematic and integrative reviews, I cited the original studies to ensure clarity and consistency of reporting. I highlighted the major themes (Whittemore & Knafl, 2005) presented in the NICU breastfeeding literature and have presented them as: (a) moderate and late preterm infants, (b) breastmilk feeding in the NICU, (c) breastmilk feeding and preterm infant outcomes, (d) maternal characteristics, (e) barriers to optimal breastmilk feeding within the NICU, (f) maternal experiences with breastfeeding in the NICU, and (g) interventions to support breastfeeding in the NICU. Where evidence permits, I incorporated the unique characteristics of the moderate and late preterm population into each theme.

Moderate and Late Preterm Infants

There has been extensive research dedicated to exploring health outcomes for preterm infants. However, this research has focused predominantly on the general preterm population and has not distinguished between the unique needs of early- (< 32 weeks), moderate ($32^{0/7} – 33^{6/7}$ weeks) and late-preterm infants ($34^{0/7} – 36^{6/7}$ weeks) (Engle et al., 2007; Walsh et al., 2017). Moderate and late preterm birth accounts for

more than 80% of all preterm deliveries (Shapiro-Mendoza & Lackritz, 2012); however, the unique needs and outcomes of these infants have only recently been examined (Boyle et al., 2015; Hackman et al., 2016; Muelbert, Harding, & Bloomfield, 2018). While morbidity rates decline as gestational age increases (Walsh et al., 2017), moderate and late-preterm infants are still at risk for several morbidities related to prematurity, including necrotizing enterocolitis (Natarajan & Shankaran, 2016), respiratory distress, bacterial sepsis (Shapiro-Mendoza & Lackritz, 2012), cognitive impairments, neurodevelopmental disabilities (S. Johnson et al., 2015), and issues around weight gain and growth (Boyle et al., 2012; Natarajan & Shankaran, 2016). Breastmilk feeding, specifically feeding of unpasteurized raw breastmilk, has been demonstrated to ameliorate or prevent many of these conditions including necrotizing enterocolitis, weight gain problems, poor neurodevelopmental outcomes, and infection (Dritsakou, Liosis, Valsami, Polychronopoulos, & Skouroliakou, 2016; Quigley et al., 2018; Victora et al., 2016). These topics will be considered in detail in the latter sections of this review.

Breastmilk Feeding in the NICU

Once preterm infants are established on non-fortified, full oral feeding, Alberta Health Services recommendations for feeding preterm infants align with feeding guidelines for healthy full-term infants (Alberta Health Services, 2016; American Academy of Pediatrics, 2012; Lapillonne, O'Connor, Wang, & Rigo, 2013). Preterm infants should be exclusively breastfed for 6 months and then maintained on breastmilk with a slow and progressive introduction of solid foods (World Health Organization, 2015). However, establishing breastmilk feeding in preterm infants is complex due to

their medical instability, gut immaturity, and neurodevelopmental immaturity (Lucas & Smith, 2015; Radtke, 2011). Full oral feeding, rather than exclusive breastmilk feeding, is commonly the goal for discharge from the NICU (Lucas & Smith, 2015). Initiation of oral feeding varies from unit to unit and from infant to infant. However, the literature indicates that full oral feeding at the breast generally occurs between 32 and 35 weeks gestational age (Lucas & Smith, 2015).

Preterm infants often fall below the WHO recommendations for 6 months of exclusive breastfeeding and are at a higher risk of early cessation of breastmilk feeding compared to preterm infants (Callen & Pinelli, 2005; Ericson, Eriksson, Hoddinott, Hellström-Westas, & Flacking, 2018; Hackman et al., 2016). Mothers in the NICU tend to have high breastmilk feeding initiation rates (Pinchevski-Kadir et al., 2017); however, these numbers fall considerably with significantly fewer preterm infants receiving breastmilk following discharge compared to their full-term counterparts (Hackman et al., 2016). Additionally, new research is emerging indicating that late preterm infants have lower breastfeeding rates compared to their early preterm and full-term counterparts, *OR* 0.44, 95% CI [0.28,0.69], $p < .0001$ (Hackman et al., 2016). Partial, rather than exclusive breastmilk feeding at discharge is one of the strongest predictors of early breastmilk cessation, *HR* 1.81, 95% CI [1.35, 2.41], $p < .001$ (Ericson et al., 2018). Further, direct breastfeeding has also been associated with continued breastmilk feeding at 6 months, *OR* 5.5, 95% CI [2.00, 15.37], $p = .001$ (Pinchevski-Kadir et al., 2017).

Breastmilk versus donor milk versus formula milk.

When mother's own milk is not available, the WHO recommends pasteurized donor human milk (DHM) as the preferred supplemental alternative over infant formula (World Health Organization, 2003a). With the 1985 foundation of the Human Milk Banking Association of North America (HMBANA) and re-establishment of human milk banks into Canada (Moro, 2018), the use of DHM has become the standard of care for supplementation in the NICU when mother's own breastmilk is not available (Meier, Patel, & Esquerra-Zwiers, 2017). While DHM is superior to formula for several infant health outcomes, including neurodevelopmental outcomes, late onset sepsis (Bertino et al., 2013), necrotizing enterocolitis and feeding intolerance (Quigley et al., 2018), it still falls short of mother's own milk (Hard et al., 2018). As the use of DHM in the NICU is a relatively new phenomenon, research comparing DHM to formula and mother's own milk is relatively sparse. However, single studies and some reviews have been conducted on this topic. One study found that compared to infants who received DHM, infants who were fed mother's own milk were able to initiate direct breastfeeding sooner, 33.6 weeks GA compared to 35.2 weeks GA, *OR* 0.10, 95% CI [0.05, 0.19], have lower rates of oxygen desaturation, *OR* 0.02, 95% CI [0.00, 0.07], $p < .001$, and reduced lengths of stay (Dritsakou et al., 2016). Likely the most important difference between DHM and mother's own milk in the NICU, is infant growth (Hair et al., 2019; Hard et al., 2018). This is likely due to the impact of pasteurization on many nutritional and bioactive components in human milk. The Holder pasteurization process degrades most enzymes, growth, microbial, and immune-protective factors but certain lipids, saccharides or

cytokines remain unchanged (Peila et al., 2016). Evidence examining the impact of Holder pasteurization on energy content, nitrogenous compounds (proteins), and vitamins is discordant and requires further investigation (Peila et al., 2016).

Anecdotally, some practitioners expressed concerns regarding discontinuation or reduced breastmilk feeding rates due to the use of DHM as it may be considered an equal alternative to mother's own breastmilk (Williams, Nair, Simpson, & Embleton, 2016). A recent systematic review found that supplementation with DHM produced mixed effects on breastmilk feeding outcomes in mothers of early preterm infants (<32 weeks) (Williams et al., 2016). The samples in this review were heterogenous, used inconsistent breastfeeding definitions, and did not control for maternal health conditions that may influence breastmilk production and resultant breastmilk feeding rates (such as diabetes and preeclampsia; De Bortoli & Amir, 2016; Demirci, Schmella, Glasser, Bodnar, & Himes, 2018). Nonetheless, while provision of DHM shows many improved infant health outcomes compared to formula supplementation, it is clear that DHM is inferior to mother's own breastmilk. As such, NICU practitioners need to be supportive of using DHM only as a bridge to achieving full feeds of mother's own breastmilk and working with mothers and families to encourage exclusive and continued breastmilk feeding.

Breastmilk Feeding and Preterm Infant Outcomes

Breastmilk feeding in preterm infants has been associated with reduced incidence of late-onset sepsis (Schanler, Shulman, & Lau, 1999), hospitalizations in the first year of life (Vohr, 2013), reduced blood pressure (Singhal, Cole, & Lucas, 2001), and low-

density lipoprotein levels (Singhal, Cole, Fewtrell, & Lucas, 2004). Increasingly, breastmilk and human milk feeding have also been associated with improved neurodevelopmental outcomes in preterm infants (Lechner & Vohr, 2017), although the evidence on this finding is based on loose associations from observational studies (Quigley et al., 2018; Vohr et al., 2007; Vohr et al., 2006). One of the most pervasive arguments for promoting breastmilk feeding, specifically that of mother's own milk, in the NICU is the mitigation of several of the more common comorbidities associated with prematurity: (a) neurodevelopmental delays (S. Johnson et al., 2015), (b) feeding intolerance (Hair et al., 2019; Quigley et al., 2018), (c) necrotizing enterocolitis (Gephart et al., 2012), (d) infection (Gouyon et al., 2012; Miller et al., 2018), and (e) growth limitations (Seppo, Autran, Bode, & Järvinen, 2017). While these morbidities occur less frequently in moderate and late preterm infants, they are still a concern and present a significant risk to the short and long-term health outcomes for this unique population.

Neurodevelopmental outcomes.

Compared to full-term controls, moderate and late preterm infants are at increased risk for neurocognitive deficits (Boyle et al., 2012), learning difficulties (Cserjesi et al., 2012), and developmental delays (Kerstjens et al., 2011). While these neurocognitive impairments are inversely correlated with gestational age, numerous studies demonstrated that moderate and late preterm infants still show marked delays when they reach school age (S. Johnson et al., 2015). The evidence demonstrating that breast and human milk feeding mitigate neurodevelopmental delays is equivocal, due to potential confounding from factors such as maternal education and socio-economic status (Lechner & Vohr,

2017). One protracted theory states that because breast and human milk feeding reduce other co-morbidities of prematurity, this in turn decreases the consequences of these co-morbidities on neurodevelopment and thereby minimizes adverse outcomes (Lechner & Vohr, 2017). However, recent studies that included magnetic resonance imaging demonstrated that compared to infants receiving formula, infants receiving human milk have increased white matter and receptive language scores (Belfort et al., 2016). Research specific to the early preterm population indicated a dose response of predominant breastmilk feeding (>50%), with an associated increase in gray matter volume, 0.15 cc/day, 95% CI [0.05, 0.25], intelligent quotient, 0.5 points/day; 95% CI [0.2, 0.8], and working memory, 0.5 points/day, 95% CI [0.1, 0.9] (Belfort et al., 2016). Yet, a recent systematic review and meta-analysis found that overall, evidence for human milk compared to formula on the impact of cognitive and motor development is inconclusive (Miller et al., 2018). This is likely due to inconsistent reporting of neurodevelopmental outcomes as well as a paucity of literature examining exclusive human milk feeding compared to exclusive formula feeding.

Feeding intolerance.

Safely and effectively establishing oral feeds is a central concern to practitioners in the NICU. Establishment of oral feeding needs to be managed effectively because delaying oral feeds restricts infant growth and weight gain and can potentially contribute to long term cognitive delays (Patole, 2005). Conversely, accelerating oral feeding places the infant at increased risk for necrotizing enterocolitis and long-term feeding issues. Interestingly, over 40% of adult patients followed by feeding disorder clinics are former

preterm infants (Lau, 2006). While feeding intolerance is inversely correlated with gestational age, some evidence indicates that moderate and late preterm infants are more susceptible to feeding intolerance than their full-term counterparts (Gouyon et al., 2012). Feeding intolerance manifests as gastric residuals, abdominal distention, emesis, bloody stool, and periods of bradycardia and apnea (Patole, 2005).

The use of formula places preterm infants at an increased risk, *RR* 4.92, 95% CI [1.17, 20.70], of developing feeding intolerance (Quigley et al., 2018). Additionally, formula-fed preterm infants are less likely to tolerate full enteral feeds by 2 weeks after birth; with 32.89% of formula fed infants failing to tolerate feeds compared to 10.84% of DHM fed infants (Quigley et al., 2018). Use of mother's own milk over DHM further decreases the risk of developing feeding intolerance demonstrated by fewer days of *nil per os*, 1.2 ± 2.7 compared with 2.9 ± 5.8, $p = .04$, and a 60% decrease in held feedings per day (Hair et al., 2019). Breast and human milk feeding is an effective method to reduce the risk of feeding intolerance and may help preterm infants to achieve full enteral feeds faster than infants who are fed formula (Quigley et al., 2018).

Necrotizing enterocolitis.

Necrotizing enterocolitis is the most common and dangerous complication of prematurity (Gephart et al., 2012). Although not well understood, the pathogenesis of necrotizing enterocolitis is one of the costliest complications of prematurity and can lead to life-long feeding intolerance. As well, necrotizing enterocolitis can progress to the point of surgical intervention, sepsis, or death (Gephart et al., 2012). Incidence of necrotizing enterocolitis is directly related to prematurity; whereby the older the GA of

the infant, the less likely they are to develop necrotizing enterocolitis. While rates of necrotizing enterocolitis are reduced in the moderate preterm population (2.4% compared to 8% in early preterm infants), these infants are still at risk for developing necrotizing enterocolitis and suffering long-term co-morbidities related to this complication of prematurity (Walsh et al., 2017). One of the most significant risk factors for developing necrotizing enterocolitis is not receiving breast or human milk (Cristofalo et al., 2013; Gephart et al., 2012; McGuire & Anthony, 2003; Quigley et al., 2018). While the etiology of necrotizing enterocolitis is multifactorial, there is a strong association with the infant gut microbiome (Meier, Johnson, Patel, & Rossman, 2017), which is directly linked to the provision of breastmilk and human donor milk; likely mediated by the presence of certain human milk oligosaccharides (Autran et al., 2018; Bode, 2018).

A randomized control trial examining human milk–based human milk fortifier, as opposed to bovine milk–based human milk fortifier, found a 77% reduction, *OR* 0.23, 95% CI [0.08, 0.66], in the odds of developing necrotizing enterocolitis with preterm infants who were fed an exclusive human milk diet (Sullivan et al., 2010). These findings highlight the importance of an exclusive human milk diet, and that even the introduction of bovine-milk based fortifiers may significantly increase the risk of necrotizing enterocolitis. A meta-analysis examining the use of DHM on preterm infant outcomes found a 0.22 risk reduction, 95% CI [0.06, 0.76], in the odds of developing necrotizing enterocolitis for preterm infants exclusively fed donor breastmilk compared with preterm infants receiving formula (Boyd, Quigley, & Brocklehurst, 2007). More recently, Quigley et al. (2018) found that compared to preterm infants receiving DHM, preterm infants fed

formula were 1.87 times more likely, 95% CI [1.23, 2.85], to develop necrotizing enterocolitis. The studies included in the Quigley et al. (2018) and Boyd et al. (2007) reviews were experimental or quasi-experimental, thereby providing a higher quality evidence of the positive relationship between breast and human milk feeding and the prevention of necrotizing enterocolitis. The use of mother's own milk compared to DHM does not appear to negatively influence necrotizing enterocolitis rates (Miller et al., 2018). As such, it appears that formula use is the significant contributor to the development of necrotizing enterocolitis in preterm infants.

Infection.

Severe infections, specifically sepsis, meningitis, and pneumonia are more common in moderate and late preterm infants compared to their full-term counterparts (Gouyon et al., 2012). Moderate preterm infants have double the risk of developing sepsis compared to late preterm infants (5% compared to 2.2%; Cohen-Wolkowiez et al., 2009). Many single studies indicated that there is a protective effect of human milk on infection outcomes; however, these were mainly clinical studies with weak definitions for infection. In a recent meta-analysis, Miller et al. (2018) found that compared to an exclusive formula diet, an exclusive human milk diet resulted in a 5% reduced risk of late onset sepsis. However, this reduction in risk was only present in exclusive human milk diets and was not observable in preterm infants who were receiving mixed formula and human milk diets.

Conversely, one of the few risk factors attributed to providing fresh breastmilk to preterm infants is the potential risk for transmission of human cytomegalovirus (HCMV).

While ~50% of adults carry HCMV, prematurity is a risk factor for developing symptomatic HCMV. Infection rates of HCMV via breastmilk, range from 66-96% in preterm infants whose mothers are HCMV seropositive (Kurath, Halwachs-Baumann, Müller, & Resch, 2010). However, this translates into median rates of 3.7% for symptomatic disease and 0.7% for severe sepsis (Kurath et al., 2010). Symptomatic HCMV infection is difficult to ascertain from other comorbidities of prematurity and further research on this transmission via breastmilk needs to be conducted. Some agencies recommend pasteurizing breastmilk for seropositive mothers of infants > 35 weeks GA, while others recommend > 32 weeks GA. (Kurath et al., 2010). As such, some clinicians may struggle with balancing the benefits of breastfeeding with the risk of transmitting HCMV, which may result in restricting provision of raw breastmilk or colostrum in preterm infants (Kurath et al., 2010).

Growth and weight gain.

Infant weight gain and growth is often the focus of practitioners in the level II NICU (Dutta et al., 2015; Mauer et al., 1985). Compared to formula fed preterm infants, weight gain trajectories are generally lower in infants fed DHM, but not raw mother's own milk (Boyd et al., 2007; Brownell et al., 2018). While Dritsakou et al. (2016) did not observe a difference in weight gain, they found that compared to preterm infants who were fed DHM and formula, infants fed mother's own breastmilk had greater body length, *OR* 2.59, 95% CI [1.38, 4.88], $p = .003$, and head circumference, *OR* 2.82, 95% CI [1.35, 5.89], $p = .006$.

Conversely, Quigley et al. (2018) demonstrated a mean weight gain difference of 2.51 g/kg/day, 95% CI [1.93, 3.08], for formula fed preterm infants over DHM fed infants, and that DHM fed infants took an average of 4 days longer to regain their birthweight, 95% CI [-5.81, -2.18], $p < .0001$. Further, preterm infants receiving mother's own milk are more likely to regain their birth weight by day 3 of life, *OR* 0.83, 95% CI [0.76, 0.92], compared to infants receiving DHM or formula (Dritsakou et al., 2016). Montjaux-Régis et al. (2011) found that preterm infants who received <20% of mother's own milk had reduced weight gain by 5.10 g/kg/day compared to infants who received >80% of mother's own milk. Brownell et al. (2018) and Hair et al. (2019) have since replicated these findings, further identifying a dose response based on the proportion of mother's own milk in the preterm infant diet. Further, while Quigley et al. (2018) found that formula supplementation in comparison to DHM feeding resulted in improved short-term weight gain, these results did not translate to longer term growth outcomes. Evidence of short-term improved growth rates in formula-fed preterm infants presents a substantial barrier to the promotion of breastmilk feeding in the NICU as practitioners may be hesitant to promote breastmilk feeding if a preterm infant is struggling to maintain expected growth rates in anticipation of discharge.

Maternal Characteristics

Several factors need to be in place for mothers of preterm infants to achieve optimal breastfeeding outcomes. Various modifiable and non-modifiable characteristics contribute to a mother's decision and ability to engage in optimal breastfeeding. Although not unique to the moderate and late preterm population, non-modifiable factors

such as high socioeconomic status, ethnicity, education (Ericson et al., 2018), age, previous breastfeeding experience, and marital status predict exclusive breastfeeding at discharge from NICU (Briere, McGrath, Cong, Brownell, & Cusson, 2015; Maastrup et al., 2014; Wang et al., 2018). Additionally, modifiable factors such as maternal intention, maternal confidence, and BSE can contribute to breastfeeding exclusivity and duration in the preterm population (Blyth et al., 2002; Meedya, Fahy, & Kable, 2010; Whalen & Cramton, 2010; Wilhelm, Rodehorst, Stepans, Hertzog, & Berens, 2008). Additionally, multiparity, rooming-in, and maternal confidence may also influence maternal ability to recognize and address infant cueing and behaviours, thereby improving responsiveness and frequency of feeds (Flacking & Dykes, 2013).

Maternal illness can also influence breastfeeding outcomes. It is well documented that mothers with diabetes have lower rates of breastfeeding compared to women without diabetes (De Bortoli & Amir, 2016). The reasoning for these lower rates is likely multifactorial but is primarily due to significant delays in lactogenesis observed in mothers with diabetes (De Bortoli & Amir, 2016). Further, delayed lactogenesis, in conjunction with increased risk of infant hypoglycemia can contribute to increased supplementation with formula or DHM to augment breastmilk feeding (Riordan & Wambach, 2010). Additionally, while not as strongly supported as the link between diabetes and low breastfeeding rates, there is some evidence to suggest that women who are diagnosed with pre-eclampsia may also be at increased risk for premature cessation of breastfeeding (Demirci et al., 2018). Further, compared to healthy mothers, mothers who are diagnosed with pre-eclampsia or diabetes are at an increased risk for preterm birth

and their infants are more likely to be admitted to the NICU (Afrasiabi, Mohagheghi, Kalani, Mohades, & Farahani, 2014). As such, it is important to consider concomitant conditions, such as maternal health, when looking at breastmilk feeding rates in the NICU setting (Renfrew et al., 2010).

Barriers to Optimal Breastmilk Feeding in the NICU

Infant feeding decisions are guided primarily by infant health requirements, unit protocols, and parental expectations (McInnes, Shepherd, Cheyne, & Niven, 2010). However, many barriers exist within the NICU environment that may prevent effective uptake of breastmilk feeding (Alves, Rodrigues, Fraga, Barros, & Silva, 2013; Nyqvist, 2012; Underwood, 2013). Lack of privacy, physical separation from the infant, and structured feeding routines are viewed by parents as significant barriers to breastfeeding (Alves et al., 2013; Boucher, Brazal, Graham-Certosini, Carnaghan-Sherrard, & Feeley, 2011; Cescutti-Butler, Hemingway, & Hewitt-Taylor, 2019). Mothers may struggle with the lack of privacy and constant disruption that can occur as a result of the physical layout of the NICU (Dowling, Blatz, & Graham, 2012), which can inhibit interactions between mother and infant, decrease pumping frequency and encourage preference for bottle feeding (Ikonen, Paavilainen, Kaunonen, Ikuta, & Zukowsky, 2015). Further, structured feeding routines and the stressful NICU environment are also cited as barriers to establishing breastmilk supply (Alves et al., 2013; Boucher et al., 2011). Mothers reported that maintaining infants on a feeding schedule limits the infants' access to the breast and does not fit with their natural infant feeding patterns (Boucher et al., 2011; Cescutti-Butler et al., 2019). Further, Cescutti-Butler et al. (2019) found that feeding

regimes were viewed as counterproductive by some mothers because they resulted in overfeeding and reduced infant cueing to feed.

Risk aversion among neonatal practitioners regarding breastfeeding competence in preterm infants may also contribute to reduced breastmilk intake (Nyqvist, 2013). Neurodevelopmental immaturity of preterm infants often prevents effective sucking, swallowing and breathing skills. Gestational age is routinely cited as the most common criteria for preterm infants to transition to full oral feeds at the breast, usually between 32 and 34 weeks GA (Nyqvist, 2012, 2013; Walsh et al., 2017). However, Nyqvist (2013) stated that these criteria are not evidence-based and research is inconclusive as when to introduce oral feeds, and how aggressively (Nyqvist, 2012; Underwood, 2013). As such, practitioners may limit infant access to the breast or policies may dictate that infants cannot remain at the breast for an extended duration of time.

Separation of the mother and infant are routinely cited as one of the most significant barriers to breastfeeding and provision of breastmilk in the NICU (Alves et al., 2013; Callen & Pinelli, 2005; Callen, Pinelli, Atkinson, & Saigal, 2005; Cescutti-Butler et al., 2019; Ikonen et al., 2015). NICUs are ‘high-tech’ environments, often where nurses are the primary caregiver and parents are observers of their infant’s care (O'Brien et al., 2018). Traditional care in the NICU often requires that infants are kept in incubators for thermoregulation and observation. Lack of maternal-infant contact can adversely impact production of oxytocin and prolactin, which are important components of lactogenesis (Wight, 2015). Despite expanding support for skin-to-skin and kangaroo care, protocols preventing parents from holding their infants for extended periods still exist in many

NICUs across Canada (King & Nolson, 2015; Seidman et al., 2015). Further, parents may be fearful of holding their infant because they are very small and have many tubes and lines attached to them (Alves et al., 2013; Seidman et al., 2015). This physical separation and inability to hold the infant can significantly impact breastmilk feeding outcomes.

Maternal Experiences with Breastfeeding a Moderate or Late Preterm Infant

In NICU, breastfeeding takes on a nutritional rather than a relational importance (Flacking & Dykes, 2013; Wijlen, 2019) and the mother takes on the role of breastmilk producer (Wijlen, 2019). Qualitative syntheses and integrative reviews of maternal experiences in NICU indicate that mothers see breastfeeding as a way to compensate for early birth and to mitigate the harm of a preterm delivery (Boucher et al., 2011; Ikonen et al., 2015). In the NICU environment, many mothers view breastmilk pumping as one of the only maternal tasks they are able to perform and that provision of breastmilk is a concrete way of caring for their infants (Ikonen et al., 2015). Further, a major focus of breastmilk expression is the quantity of breastmilk produced. Mothers who are unable to produce enough milk for their infant can experience feelings of inadequacy, guilt, failure, and disappointment (Ikonen et al., 2015; Lucas, Paquette, Briere, & McGrath, 2014). While mothers understand that pumping is necessary for breastmilk production, they view it as both a link and a wedge between themselves and their infant (Hurst, Engebretson, & Mahoney, 2013). Further, many studies indicate that mothers perceived that an emphasis is placed on pumping and producing breastmilk in the NICU, rather than on bringing infant to breast (Niela-Vilén, Axelin, Melender, & Salanterä, 2015; Wijlen,

2019). This further perpetuates the nutritional rather than relational aspect of breastfeeding.

Interventions to Support Breastfeeding in the NICU

Several interventions have been explored to improve breastmilk feeding rates in the NICU; however, only few have examined interventions specific to the needs of moderate and late preterm infants (Cartwright, Atz, Newman, Mueller, & Demirci, 2017; Evans, Hilditch, & Keir, 2019). A recent review of the literature indicated that kangaroo care, group support, and hospital care practices have been examined as potential interventions for mothers of late preterm infants (Evans et al., 2019).

Skin-to-skin and kangaroo mother care.

The World Health Organization defines kangaroo mother care (KMC), as "early, continuous and prolonged skin-to-skin contact between a mother and her newborn; frequent and exclusive breastfeeding, and early discharge from hospital" (World Health Organization, 2003b, p. 2). More frequently in well-resourced countries, KMC is defined as the infant being held skin-to-skin between the mother's breasts (Cartwright et al., 2017; Evans et al., 2019; Renfrew et al., 2010). Due to multiple discrepancies in the interpretation of KMC, provision of effective KMC is hard to elicit in the literature (G. J. Chan, Valsangkar, Kajeepeta, Boundy, & Wall, 2016), However, it is understood that KMC is one of the most effective interventions to improve breastmilk feeding in preterm infants (Renfrew et al., 2010). A Cochrane review of randomized control trials (RCTs) conducted in both developed and developing countries, found that preterm infants who received intermittent KMC were significantly more likely to be exclusively breastfed

upon discharge than infants who participated in conventional care (Conde-Agudelo, Belizan, & Diaz-Rossello, 2011). Similarly, a subsequent meta-analysis found that preterm infants who received any KMC (intermittent, continuous, or skin-to-skin only), were 50% more likely to be exclusively breastfed, *RR* 1.50; 95% CI [1.26, 1.78], I^2 = 93%, at discharge (Boundy et al., 2016). Further, infants who received intermittent KMC were significantly more likely to be exclusively breastfeeding at 1 – 3 months (Conde-Agudelo et al., 2011) and 1 - 4 months follow-up (Boundy et al., 2016), compared to infants who did not receive any KMC. Further, mothers who participated in KMC tended to be more satisfied with their care while in hospital than mothers who participated in conventional care, 91% vs 78%, *RR* 1.17, 95% CI [1.05, 1.30] (Conde-Agudelo et al., 2011).

Peer and professional support.

The literature indicates that provision of peer breastfeeding support had a positive impact on NICU breastfeeding rates (Renfrew et al., 2010). In an RCT, Agrasada, Gustafsson, Kylberg, and Ewald (2005) found that peer counselling in the Philippines resulted in higher rates of any breastfeeding in low birth weight infants at 3 months, *RR* 1.34, 95% CI [1.03, 1.75], and 6 months, *RR* 2.18, 95% CI [1.45, 3.29], than in low birth weight infants whose mothers received no peer counseling. Further, Rayfield, Oakley, and Quigley (2015) found that community based group support significantly increased the likelihood of breastfeeding at 10 days, *aOR* 3.14, 95% CI [1.40, 7.04], p = .006, in mothers of late preterm infants.

Provision of professional breastfeeding support such as lactation consultants produced mixed results on breastfeeding outcomes (Renfrew et al., 2010). A before-after study in the United States found improvements in provision of mother's own milk to preterm infants in hospital, *RR* 1.52, 95% CI 1.16, 1.99, and at discharge (Gonzalez et al., 2003). However, a Canadian RCT, examining provision of support by lactation consultants found no statistically significant differences between breastfeeding rates at term, *RR* 1.06, 95% CI [0.78, 1.42], or at any point in the first year of life (Pinelli, Atkinson, & Saigal, 2001). The Pinelli et al. (2001) findings provide evidence that lactation consultants in the NICU may not significantly improve breastfeeding rates. However, nursing support has been cited as a substantial contributor to breastfeeding success (Cartwright et al., 2017).

Baby-friendly hospital initiative.

While effective, single-pronged interventions are limited to specific qualities and may not apply to the entire moderate and late preterm population. The baby friendly hospital initiative (BFHI) incorporates several evidence-based interventions and is one of the most commonly cited and universally supported mechanisms to support breastfeeding outcomes in both preterm and full-term infants (Nyqvist et al., 2013; Renfrew et al., 2010). A retrospective chart review analyzing breastfeeding rates before and after implementation of BFHI in a NICU, found that breastfeeding initiation rates increased from 34.6% to 74.4% (Merewood, Philipp, Chawla, & Cimo, 2003). Further, at 2 weeks, the proportion of preterm infants receiving any breastmilk rose from 27.9% to 65.9%, $p <$

.001, and exclusive breastmilk feeding rose from 9.3% to 39%, $p = .002$ after BFHI implementation (Merewood et al., 2003).

A multidisciplinary panel of breastfeeding experts have modified the BFHI to address the unique needs of NICU infants and mothers (Nyqvist et al., 2013). FICare addresses several of the expanded BFHI steps to successful breastfeeding (O'Brien et al., 2013) and is cited as one of the foundational aspects of the three guiding principles for the expanded BFHI (Nyqvist et al., 2013). Additionally, Nyqvist (2005) cites the Talin, Estonia, Humane Neonatal Care model from which FICare originates, as an effective model of care that supports breastfeeding. The foundational aspects of FICare align with several recommendations from the literature and the expanded BFHI. As such, Alberta FICare may be an effective intervention to improve maternal BSE and breastfeeding rates for families in Alberta's level II NICUs.

Conclusion

Although methodological integrity in breastfeeding research is improving, it has been difficult to definitively establish the benefits of breastfeeding due to poor definitions and categorization of infant feeding (Chung et al., 2008). The majority of breastfeeding research is observational as it is unethical to randomize infants to receive breastmilk or formula. However, the resurgence of human milk banks and increased availability of human donor milk has allowed researchers to examine the role that human donor milk plays in infant health outcomes through RCTs. Much of the recent research regarding breastmilk in the NICU is situated around the provision of human donor milk and highlights the importance of providing human milk and breastmilk to preterm infants.

Chapter 3: Interventions to Improve Breastfeeding Self-Efficacy and Resultant Breastfeeding Rates: A Systematic Review and Meta-analysis[1]

Brockway, M., Benzies, K. M., & Hayden, K. A. (2017). Interventions to improve breastfeeding self-efficacy and resultant breastfeeding rates: A systematic review and meta-analysis. *Journal of Human Lactation*, 33(3), 486-499. doi:10.1177/0890334417707957

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Background

Breastfeeding is the safest and healthiest method to feed an infant and contributes to improved short- and long-term health outcomes for both mothers and infants (Victora et al., 2016). Evidence suggests that breastfeeding presents many nutritive, immune-protective and emotional benefits for infants and their mothers (Perrin, Fogleman, & Allen, 2013; Victora et al., 2016). Infants who are fed human milk have fewer hospitalizations and experience fewer infections than their formula-fed counterparts (Victora et al., 2016). Worldwide, healthcare agencies and providers have increased efforts to improve breastfeeding rates, usually measured as breastfeeding initiation, exclusivity, and duration (World Health Organization, 2010, 2015). However, breastfeeding rates in many countries still fall short of agency recommendations (United Nations Children's Fund, 2016; Victora et al., 2016). Substantial resources have been invested to improve breastfeeding rates, often through addressing modifiable factors that may contribute to breastfeeding success (Sinha et al., 2015; Skouteris et al., 2014). Efforts to improve breastfeeding rates by modifying psychosocial factors are often grounded in social change theories.

Breastfeeding self-efficacy theory.

Grounded in Social Cognitive Theory (SCT; Bandura, 2012) and adapted by Dennis (1999), breastfeeding self-efficacy (BSE) theory has been extensively used in breastfeeding research (Tuthill, McGrath, Graber, Cusson, & Young, 2015). Self-efficacy is the belief in one’s capabilities to achieve a goal or perform a task and can influence personal motivation and ability to succeed (Bandura, 1977; Wheeler & Dennis, 2013).

Individuals with high efficacy are more likely to overcome barriers that those with low self-efficacy would find insurmountable (Schwarzer & Fuchs, 1995). BSE theory postulates that the strength of a mother's BSE influences her responses to breastfeeding (effort and thoughts), which subsequently impact her initiation and maintenance of breastfeeding behaviours (Dennis, 1999).

Dennis maintains that BSE is influenced through (a) performance accomplishments, such as previous experiences with breastfeeding behaviour, (b) vicarious experience, such as seeing other women breastfeeding successfully, (c) verbal persuasion, such as breastfeeding encouragement from influential others, and (d) physiologic/affective responses, such as depression, anxiety, and fatigue (Bandura, 1977; Creedy et al., 2003; Dennis & Faux, 1999). Each of these sources may influence how a mother perceives her breastfeeding experience and inform her BSE. A mother's BSE may be affected by her interactions with her infant, healthcare providers, family and support system, and environment. BSE is reflective of a mother's *belief* in her ability, and not of her true *abilities* to succeed in breastfeeding (Dennis, 1999).

Dennis and Faux developed a 33-item tool to measure BSE (Dennis & Faux, 1999). Subsequent psychometric testing indicated a need for item reduction, resulting in the refinement of the BSES to a short form (BSES-SF) (Dennis, 2003). The BSES-SF is a 14-item scale with a 5-Likert response category and a theoretical range of scores between 14 and 70.

Although BSE theory has been used extensively in breastfeeding research, to our knowledge, there have been no systematic investigations of the literature to determine if

improvements in BSE result in improved breastfeeding rates. The purpose of this study was to systematically review the literature to explore the link between BSE theory and breastfeeding rates. Our guiding review question was: In mothers of full-term infants, do interventions that are successful in improving BSE increase breastfeeding exclusivity and duration?

Methods

Design.

We undertook a systematic review (Higgins & Green, 2011) with meta-analysis and meta-regression of randomized control trials (RCTs) and quasi-experimental studies to examine the relationship between BSE and breastfeeding rates. This review was guided by the PRISMA statement (Moher et al., 2015).

Eligibility criteria.

We developed the search strategy with an academic librarian (AH) and content expert (MB) and searched databases in August 2016. We included studies of healthy mothers of full-term infants who were breastfeeding or intending to breastfeed with no date restriction on the search strategy (Table 3.1). Interventions were generally education- or support-based; however, we included all intervention types, including screening and mechanical interventions (i.e., application of nipple cream). To minimize the risk of unknown factors contributing to BSE outcomes and breastfeeding rates, we included only RCTs and quasi-experimental studies comparing interventions to improve BSE versus standard care. The primary outcome was BSE scores and the secondary outcome was breastfeeding rates, measured at the time of assessment, or at any point after assessment,

of BSE. To maximize the precision of outcomes, studies must have used a previously validated BSE measurement tool.

Table 3.1 *Inclusion and Exclusion Criteria*

Inclusion Criteria

• Literature published in English
• Intervention research
  o Randomized control trials
  o Quasi-experimental studies
• Breastfeeding self-efficacy as an outcome measure (must use a previously validated tool)
• Breastfeeding rates as an outcome measure

Exclusion Criteria

• Mothers/infants with specific health conditions
  o Obesity, tongue-tie, asthma
  o Prematurity (< 37 weeks), small for gestational age
• Studies published in a language other than English
• Editorial / opinion papers / systematic reviews / literature reviews / concept analysis
• Breastfeeding Self-Efficacy scale used as a control

Sample.

Information sources.

We searched MEDLINE (In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present), EMBASE, PsycINFO, CINAHL, PsycARTICLES, Joanna Briggs Institute EBP Database, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, SocINDEX, and Family & Society Studies Worldwide. We focused on two main concepts: breastfeeding and self-efficacy. We used synonyms and variations of relevant keywords, and subject headings for each concept. We pretested the search for comprehensiveness in MEDLINE to ensure that known relevant research was retrieved. We translated the MEDLINE search (APPENDIX A) for each database, with the same keywords across

databases, and subject headings responsive to the controlled vocabulary of each database. We located additional studies by conducting a reverse look-up examining all intervention articles citing the original BSE scale development articles (Dennis, 2003; Dennis & Faux, 1999).

Study selection.

We imported all records into EndNote where we removed duplicates. Studies were screened in a two-stage process. First, titles and abstracts were assessed as per inclusion criteria. Articles of uncertain relevance were discussed between two reviewers (MB and KB). Second, articles selected for full-text review were screened for inclusion of BSE and breastfeeding rates; those not containing the required outcomes were excluded. Finally, an in-depth, full-text review was conducted by MB and KB to determine inclusion in the synthesis. Disagreements were resolved through consensus.

After excluding 1086 records, we reviewed 1366 titles and abstracts. Of these, we assessed 58 full-texts for inclusion. In total, we included 11 studies in the synthesis and meta-analysis (Figure 3.1).

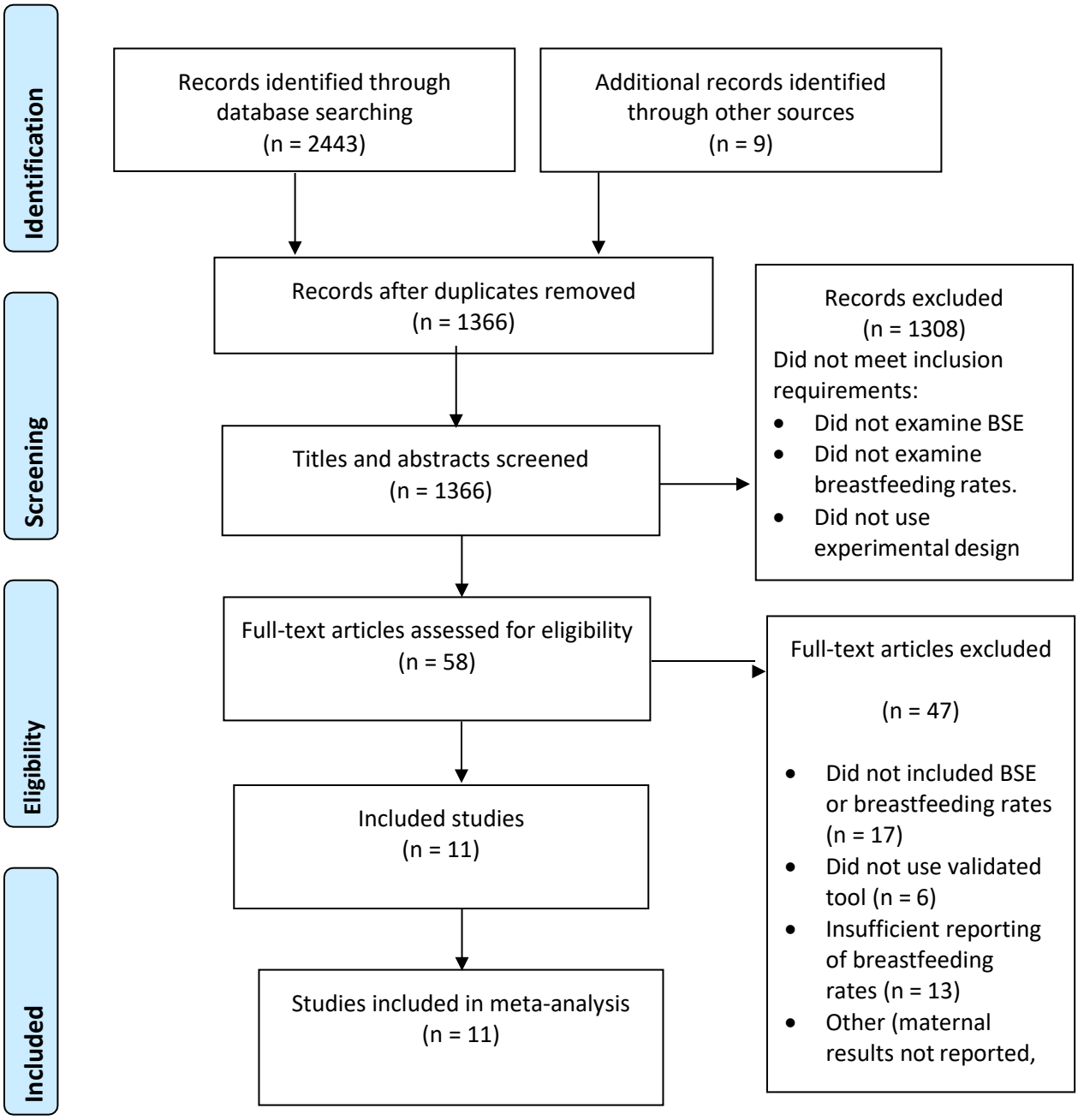


Figure 3.1 PRISMA flow diagram

Measurement.

Data extraction.

MB extracted study data using a standard form in Excel and imported to Review Manager 5 (RevMan; The Nordic Cochrane Centre, 2014). RevMan 5 is a software program that manages systematic reviews, performs meta-analyses, and presents the results graphically. MB cross-validated extracted data in Excel and RevMan. Data extraction fields included country, number of participants, intervention characteristics, pertinent methodological details, mean baseline and follow-up BSE scores, and rate of breastfeeding. Breastfeeding rates were defined and recoded guided by Labbok and Krasovec (1990) and the World Health Organization (2010) classification: a) exclusive breastfeeding - only breast milk (directly from the breast or as expressed breast milk); b) predominant breastfeeding - breast milk and other fluids including formula but not greater than one bottle per day; c) partial breastfeeding - more than one bottle of formula per day; and d) any breastfeeding - infant receives any breast milk (i.e., includes all previous categories). Due to inconsistent reporting in many studies, predominant and partial breastfeeding were combined into partial breastfeeding to ensure adequate sample size for meta-analysis.

Risk of bias and strength of evidence.

We used the Cochrane Collaboration tool for assessing risk of bias (Higgins et al., 2011) to assign a low, high, or unclear risk of bias to random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, and selective reporting. Evidence profiles and

summary of findings assessments were conducted using the grading of recommendations assessment, development, and evaluation (GRADE) guidelines (Guyatt et al., 2011). We evaluated each study based on limitations, inconsistencies, indirectness, imprecision, and the Cochrane risk of bias and assigned a GRADE score of high, moderate, low, or very low. We calculated a quality score for each study to provide a quality assessment for the summary of findings (BSE and breastfeeding rates) at each time point (APPENDIX B).

Data synthesis.

We entered mean and *SD* BSE scores and breastfeeding frequencies for intervention and control groups for each assessment point (baseline, discharge, 2 weeks, 1, 2, 3, and 6 months postpartum). We imputed and pooled data in RevMan5 (The Nordic Cochrane Centre, 2014). When an outcome was reported for two or more studies, we conducted meta-analyses employing an inverse variance method for random effect models using RevMan5 (The Nordic Cochrane Centre, 2014). Heterogeneity among the studies (countries, multiple interventions, Baby Friendly Hospital Initiative [BFHI]) guided our use of a random effect model, which produces a more conservative assessment of the outcomes (Higgins & Green, 2011). We reported results as relative effects standardized mean differences (SMD), mean differences (MD), and odds ratios (*OR*). We calculated SMD when similar outcomes were measured using different scales (BSE-Short and Long Form) in order to express the effect size in relation to the variability of the study (Higgins & Green, 2011). We reported MD when the same instrument was used to measure outcomes in order to express the difference (in points) between the intervention and control group BSE scores. We assessed heterogeneity using

I^2 and used subgroup analysis and forest plots to explore significant results. I^2 describes the percentage of variation across studies that is due to heterogeneity (Higgins & Green, 2011). Subgroup comparisons were pre-specified based on evidence from previous literature reviews and meta-analyses (Haroon, Das, Salam, Imdad, & Bhutta, 2013; Jolly et al., 2012; Sinha et al., 2015; Skouteris et al., 2014).

To provide a statistical link between changes in BSE and breastfeeding rates, we calculated mean BSE change score between baseline and post-intervention for intervention and control groups in each study. We used STATA 12.1 to run a random effect meta-regression model with the mean BSE change score from each study as the predictor of breastfeeding rates. All *p* values were two-tailed and considered significant at < 0.05.

Results

Study characteristics.

Three studies employed quasi-experimental designs while the remaining studies were RCTs. Publication dates ranged from 2006 to 2016. Studies originated from both Organization for Economic Cooperation and Development (OECD) classified countries (Canada, Japan, USA) and non-OECD classified countries (China, Brazil, and Iran; see Table 3.2). OECD countries are generally high-income and tend to be considered as *developed* countries (Organization for Economic Co-operation and Development, 2016).

Table 3.2 *Literature Review Table of Included Manuscripts*

Study, Country	Sample	Intervention	BSE Measure	Breastfeeding Outcomes	Results	Methodological Comment
Randomized Control Trials						
ANSARI et al., 2014 Iran	Simple random sample of health centres. 130 pregnant Iranian women recruited from public health centers; basic education; intention to breastfeed; 120 completed 6-month follow-up	2 **prenatal** educational training sessions; and one-on-one post-natal support.	BSES (Persian), antenatally, 1 month postpartum	Self-report at 6 months postpartum.	BSE increased significantly in intervention group @ 1-month postpartum. Exclusive breastfeeding @ 6 months postpartum significantly higher in intervention group.	Random sampling of recruitment site, lowers risk of sampling bias. Did not report on all breastfeeding outcomes collected only on exclusive breastfeeding. Persian translation was not previously validated in another study. Did not use standardized breastfeeding classification.
BUNIK et al., 2010 USA	Convenience sample of 341 medically-underserved (88% Hispanic/Latino) mothers, recruited from a subsidized hospital in Denver; 249	Daily scripted telephone calls (post-discharge - **2 weeks postpartum**), included screening for lactation or medical problems.	BSES-SF (Dennis, 2003) at 3 months postpartum	Self report at 1, 3, and 6 months postpartum. Classified using modified WHO definitions.	No significant difference between intervention and control BSE. No significant difference in breastfeeding outcomes between intervention and	Self-report rather than direct observation; not generalizable beyond low-income Latino population. No baseline BSES conducted. High attrition rate (27%).

	mothers included in final analysis.				control groups at 1, 3 or 6 months postpartum.	
Chan Man et al., 2016 Hong Kong, China	Convenience sample of 71 primigravid, Chinese (95%) women recruited from a public hospital in Hong Kong; 60 mothers completed follow-up.	2.5 hr **prenatal** (28-38 weeks) workshop. Telephone counselling (30-60 min) @ 2wks **postpartum.**	BSES-SF Chinese (Ip, Yeung, Choi, Chair, & Dennis, 2012). Prenatally and 2 weeks postpartum.	Self-report at 2 weeks, and 1, 2, and 6 months postpartum.	Significantly higher BSE in intervention group compared to control group @ 2 weeks. Significantly higher exclusive breastfeeding in intervention group compared to control group at 8 weeks.	Used intention to treat. Well reported. High refusal rate. Risk of contamination between groups. Did not use standardized breastfeeding classification.
Study, Country	**Sample**	**Intervention**	**BSE Measure**	**Breastfeeding Outcomes**	**Results**	**Methodological Comment**
Jackson et al., 2016 Canada	Convenience sample of 186 mothers with nipple pain and damage; 165 completed follow-up.	**Postpartum** lanolin treatment for nipples following each feed for 7 days. Compliance = application after >75% of feeds.	BSES-SF (Dennis, 2003), immediately (timeline)postpartum (in hospital), 4 days postpartum	Self-report at 4 days, 7 days, 1 month and 3 months. Classified as per Labbok and Krasovec (1990)	No significant group differences were found for BSE or breastfeeding rates post-intervention.	Inconsistent intervention compliance. Potential confounding factors (nipple infection, BFHI). Risk of contamination (12% of control group used lanolin).
Laliberte et al., 2016 Canada	Convenience sample (unequal groups) of 472 healthy mothers.	**Postpartum** clinic visit w/in 48 hrs discharge - maternal-newborn care/assessment, breastfeeding	BSES-SF (Dennis, 2003) at 2, 4 and 12 weeks postpartum.	Self-report at 2, 4, 12, and 24 weeks. Classified as per WHO definition.	No significant group differences in either BSE or breastfeeding	Study may be overpowered. Not generalizable to other countries with different health

	Delivering in public hospital urban setting; 429 completed follow-up.	assessment and support. Follow-up clinic visits provided as indicated or as desired by participants.			rates at any assessment point.	systems/maternity leave. 'High-risk' population not accessed.
McQueen et al., 2011 Canada	Convenience sample of 150 Healthy, primiparous, mothers delivering in tertiary care center in Northern Ontario; 134 completed follow-up.	2 in-hospital (24 and 48 hours **postpartum)** and 1 phone contact. Assessment/strategies to increase BSE based on low-scoring items. Self-efficacy enhancing strategies based on 4 sources of information.	BSES-SF (Dennis, 2003), baseline, 4 weeks postpartum, 8 weeks postpartum	Self-report at 4 weeks, 8 weeks. Classified as per Labbok and Krasovec (1990)	No significant group differences in BSE and breastfeeding self-efficacy post-intervention.	Pilot study - not sufficiently powered. Uneven group allocation.
Noell-Weiss et al., 2006 Canada	Convenience sample of 92 pregnant, nulliparous, healthy, mothers. Planning to breastfeed; 74 completed follow-up.	2.5-hour **prenatal** breastfeeding workshop designed using self-efficacy theory and adult learning principles.	BSES-SF (Dennis, 2003) at baseline, 4 weeks and 8 weeks postpartum	Self-report at 4 and 8 weeks. Classified as per Labbok and Krasovec (1990).	Intervention participants had significantly higher BSE and higher exclusive breastfeeding rates.	Insufficiently powered. Breastfeeding rates were not reported for 4 months – potential for reporting bias.
Study, Country	**Sample**	**Intervention**	**BSE Measure**	**Breastfeeding Outcomes**	**Results**	**Methodological Comment**
Wu et al., 2014 China	Quasi-random sample of 74 healthy Chinese mothers in large city in	Individualized intervention, 3 **postpartum** sessions (2 in-person, 1 telephone). Individualized	BSES-SF (Dai & Dennis, 2003) at baseline, 4 and 8 weeks postpartum	Self-report at 4 weeks, 8 weeks. Classified as per Labbok and Krasovec (1990)	BSE and exclusive breastfeeding significantly higher in intervention	Weak reporting of outcomes, no description of randomization.

	China; 67 completed follow-up.	interventions based on BSES=SF scores. Self-efficacy enhancing strategies based on 4 sources of information.			group compared to control group.	
Quasi-experimental studies						
AWANO et al, 2010 Japan	Convenience sample (non-synchronized, non-equivalent control group) of 117 primiparous, Japanese women from two hospitals; certified BFHI certified; 115 completed follow-up.	Breastfeeding Self Care Program: pamphlet & DVD; breastfeeding education, positioning latching, cuing; administered 4-5 days **postpartum**.	BSES-SF (Otsuka, Dennis, Tatsuoka, & Jimba, 2008) at 4 days and 1 month postpartum	Self-report at 4 days and 1 month postpartum; Breastfeeding outcomes recorded as fully breastfeeding - no formula (but may have glucose water).	Breastfeeding self-efficacy increased significantly for intervention group, compared to control group. Fully breastfeeding rates were significantly higher for intervention compared to control group.	Hospital population may not reflect general population. Exclusion of women with no access to technology; Significant difference between intervention and control group baseline BSE. One hospital BFHI certified. Short study period. Did not use standardized breastfeeding classification.
Dodt et al., 2015 Brazil	Convenience sample of 201 healthy mothers delivering in large, public hospital - follows BFHI 10 steps (non-certified);	**Postpartum** flip-chart - "I can breastfeed my child" developed based on BSE theory.	BSES-SF (Dodt, Ximenes, Almeida, Oria, & Dennis, 2012) delivered at 6 hrs postpartum, hospital discharge, 2 months postpartum	Exclusive breastfeeding, self-report at 2 months postpartum. Classified as per WHO definition.	Intervention participants had significantly higher BSE and BF scores post-intervention.	High attrition. BSES-SF scores were standardized (0-100).

	96 completed follow-up.					
Study, Country	**Sample**	**Intervention**	**BSE Measure**	**Breastfeeding Outcomes**	**Results**	**Methodological Comment**
Otsuka et al., 2014 Japan	Convenience sample of 781 pregnant, healthy, Japanese mothers intending to breastfeed. Recruited from 2 BFHI and 2 non-BFHI certified hospitals; 556 completed follow-up.	Breastfeeding self-efficacy workbook, completed **prenatally.**	BSES-SF (Otsuka et al., 2008) at baseline, 4 weeks postpartum,	Self-report at 4 and 12 weeks. Classified as per Labbok and Krasovec (1990).	Significant increase in BSE and exclusive breastfeeding at 4 weeks, only in BFHI hospitals. No significant differences in breastfeeding at 12 weeks.	Followed intention to treat. Low intervention compliance. Risk of contamination. Analyses were stratified by BFHI certification.

Participants and interventions.

Sample sizes ranged from 71 – 781 and included only healthy mothers of full-term singletons (Table 3.2). The majority of interventions were implemented in the postpartum period; however, two were implemented prenatally and one over the perinatal period. With the exception of one study that used a nipple ointment, interventions were educational or support-based. Educational interventions were identified as those that provided information, demonstration, and/or discussion, whereas supportive interventions provided social support, counseling, or consultation (Benzies, Magill-Evans, Hayden, & Ballantyne, 2013). Interventions were delivered using individual, group, or telephone interactions. Five interventions were developed based on BSE theory, two of which tailored interventions based on BSE subscales. Four studies recruited at least a portion of their participants from BFHI-certified hospitals, with one study controlling for BFHI as a potential confounder. Control groups for all studies received standard care.

Quality assessment.

Six studies had a low risk of selection bias. There was a substantial risk of performance and detection bias as only four studies blinded observers to allocation status. Intention to treat was used in only six studies indicating attrition bias was a concern. Using GRADE guidelines two studies scored very low, five studies scored low, and four studies scored moderate (Figure 3.2).

Study, year	Random sequence generation (selection bias)	Allocation Concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	GRADE
ANSARI et al., 2014	+	?	-	?	-	?	⊕⊕⊖⊖ Low
AWANO et al., 2010	-	-	-	-	-	+	⊕⊖⊖⊖ Very Low
BUNIK et al., 2010	+	-	-	?	?	+	⊕⊕⊖⊖ Low
CHAN MAN et al., 2016	+	+	-	+	+	+	⊕⊕⊕⊖ Moderate
DODT et al., 2015	-	-	-	-	-	+	⊕⊖⊖⊖ Very Low
JACKSON et al., 2016	+	+	-	+	+	+	⊕⊕⊕⊖ Moderate
LALIBERTE et al., 2016	+	+	-	-	+	+	⊕⊕⊕⊖ Moderate
MCQUEEN et al., 2011	+	+	-	+	-	+	⊕⊕⊕⊖ Moderate
NOEL-WEISS et al., 2006	?	+	-	+	+	-	⊕⊕⊖⊖ Low
OTSUKA et at., 2014	-	-	-	-	+	+	⊕⊕⊖⊖ Low
WU et al., 2014	?	?	-	?	-	-	⊕⊕⊖⊖ Low

Figure 3.2 *Risk of bias and GRADE assessment*

Outcomes.

Breastfeeding self-efficacy.

All studies used previously validated versions of Dennis' (2003) BSE - Short Form, with the exception of Ansari, Abedi, Hasanpoor, and Bani (2014) who used a Persian translation of the BSE - Long Form. All but two studies (Bunik et al., 2010; Laliberte et al., 2016) conducted a baseline BSE assessment, and seven studies (Ansari et al., 2014; Awano & Shimada, 2010; Laliberte et al., 2016; K. A. McQueen et al., 2011; Noel-Weiss, Rupp, Cragg, Bassett, & Woodend, 2006; Otsuka et al., 2014; Wu, Hu, McCoy, & Efird, 2014) examined BSE outcomes at 1 month postpartum with repeated BSE assessments throughout the postpartum period.

Baseline assessments of BSE indicated no overall statistically significant differences between BSE scores in the control and intervention groups prior to implementation of the intervention (see Table 3.3; Figure 3.3). There was considerable heterogeneity for this outcome; however, this was due entirely to the Awano and Shimada (2010) study, which demonstrated significant differences in BSE scores at baseline between intervention and control groups.

Table 3.3 *Summary of findings: Relative Effect of Interventions on Breastfeeding Self-efficacy and Breastfeeding Rates*

Outcomes	*N* (Studies)	Relative Effect [95% CI]	Quality of Evidence (GRADE)	Heterogeneity I^2	Heterogeneity *p*
Baseline					
BSE	1784 (9)	SMD -0.32 [-0.75, 0.12]	⊕⊕⊖⊖ Low	I^2 = 94%	***p* < .05**
Discharge					
BSE	1040 (3)	**SMD 0.14 [0.02, 0.27]**	⊕⊕⊖⊖ Low	I^2 = 0%	*p* = 0.72
2 weeks					

BSE	506 (2)	SMD 6.13 [-4.96, 17.22]	⊕⊕⊕⊖ Moderate	I^2 = 96%	***p* < .05**
EBF	506 (2)	OR 1.43 [0.97, 2.10]	⊕⊕⊕⊖ Moderate	I^2 =1%	*p* = 0.32
PBF	506 (2)	OR 0.86 [0.58, 1.28]	⊕⊕⊕⊖ Moderate	I^2 = 0%	*p* = 0.96
ABF	506 (2)	OR 1.91 [0.98, 3.71]	⊕⊕⊕⊖ Moderate	I^2 = 0%	***p* = 0.46**
1 month					
BSE	1535 (7)	**SMD 0.86 [0.29, 1.42]**	⊕⊕⊖⊖ Low	I^2 = 96%	***p* < .05**
EBF	1508 (6)	OR 1.36 [0.92, 2.00]	⊕⊕⊖⊖ Low	I^2 = 59%	***p* < .05**
PBF	1699 (6)	OR 1.11 [0.90, 1.36]	⊕⊕⊖⊖ Low	I^2 = 0%	*p* = 0.44
ABF	1766 (7)	**OR 1.56 [1.15, 2.12]**	⊕⊕⊖⊖ Low	I^2 = 0%	*p* = 0.61
2 months					
BSE	371 (4)	**MD 4.86 [3.11, 6.61]**	⊕⊕⊖⊖ Low	I^2 = 1%	*p* = 0.39
EBF	393 (4)	OR 2.46 [0.95, 6.38]	⊕⊕⊖⊖ Low	I^2 = 60%	*p* = 0.06
PBF	297 (3)	OR 0.81 [0.46, 1.41]	⊕⊕⊖⊖ Low	I^2 = 0%	*p* = 0.74
ABF	364 (4)	**OR 1.66 [1.03, 2.69]**	⊕⊕⊖⊖ Low	I^2 = 0%	*p* = 0.59
3 months					
EBF	1150 (3)	OR 1.09 [0.85, 1.40]	⊕⊕⊕⊖ Moderate	I^2 = 0%	*p* = 0.61
PBF	1399 (4)	OR 0.94 [0.73, 1.20]	⊕⊕⊖⊖ Low	I^2 = 0%	*p* = 0.83
ABF	1416 (4)	OR 1.12 [0.81, 1.54]	⊕⊕⊖⊖ Low	I^2 = 0%	*p* = 0.77
6 months					
EBF	621 (3)	OR 2.73 [0.70, 10.68]	⊕⊕⊕⊖ Moderate	I^2 = 87%	***p* < .05**
PBF	750 (3)	OR 0.86 [0.60, 1.21]	⊕⊕⊖⊖ Low	I^2 = 0%	*p* = 0.38
ABF	750 (3)	OR 1.07 [0.67, 1.72]	⊕⊕⊖⊖ Low	I^2 = 33%	*p* = 0.22

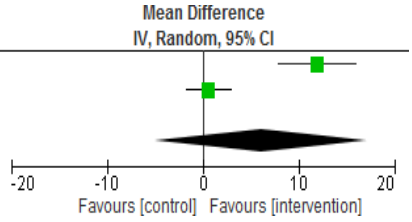
Note. Relative effects of intervention are comparing standard care groups to intervention groups. Breastfeeding Self-Efficacy = BSE, Mean difference = MD, standard mean difference = SMD, exclusive breastfeeding = EBF, partial breastfeeding = PBF, any breastfeeding = ABF. Significant findings in **bold**. I^2 = variation across studies that is due to heterogeneity, $p < .05$ indicates significant heterogeneity and should be interpreted with caution.

a.

b.

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Chan Man 2016	55.89	6.94	35	43.97	10.31	36	48.9%	11.92 [7.84, 16.00]
Laliberte 2016	55.7	12.2	295	55.1	11.4	140	51.1%	0.60 [-1.75, 2.95]
Total (95% CI)			**330**			**176**	**100.0%**	**6.13 [-4.96, 17.22]**

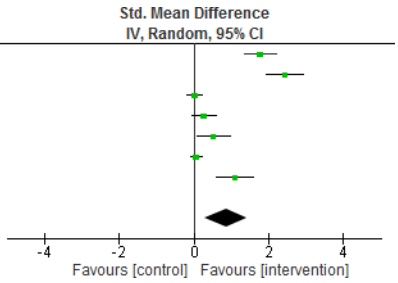
Heterogeneity: Tau² = 61.19; Chi² = 22.24, df = 1 (P < 0.00001); I² = 96%
Test for overall effect: Z = 1.08 (P = 0.28)



c.

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Ansari 2014	123.66	12.4	60	101.7	12.19	60	14.1%	1.77 [1.35, 2.20]
Awano 2010	49.9	0.9	53	46.5	1.7	62	13.7%	2.43 [1.94, 2.92]
Laliberte 2016	55.8	12.3	294	55.5	11.4	134	15.0%	0.02 [-0.18, 0.23]
McQueen 2011	58.4	11.4	64	55	13.7	78	14.5%	0.27 [-0.07, 0.60]
Noel-Weiss 2006	57.98	8.6	41	53.38	9.1	39	14.0%	0.51 [0.07, 0.96]
Otsuka 2014	50.36	11.27	283	49.64	11.18	307	15.1%	0.06 [-0.10, 0.23]
Wu 2014	58.88	5.26	35	52.29	6.6	35	13.6%	1.09 [0.59, 1.60]
Total (95% CI)			**830**			**715**	**100.0%**	**0.86 [0.29, 1.42]**

Heterogeneity: Tau² = 0.55; Chi² = 144.32, df = 6 (P < 0.00001); I² = 96%
Test for overall effect: Z = 2.96 (P = 0.003)



d.

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Dodt 2015	58.2	5.02	54	53.5	9.15	42	31.8%	4.70 [1.63, 7.77]
McQueen 2011	59	13.7	61	54.9	15.8	73	12.1%	4.10 [-0.90, 9.10]
Noel-Weiss 2006	61.7	5.8	40	58.91	9.1	34	23.9%	2.79 [-0.76, 6.34]
Wu 2014	59.85	5.04	33	53	7.52	34	32.1%	6.85 [3.79, 9.91]
Total (95% CI)			**188**			**183**	**100.0%**	**4.86 [3.11, 6.61]**

Heterogeneity: Tau² = 0.04; Chi² = 3.03, df = 3 (P = 0.39); I² = 1%
Test for overall effect: Z = 5.46 (P < 0.00001)

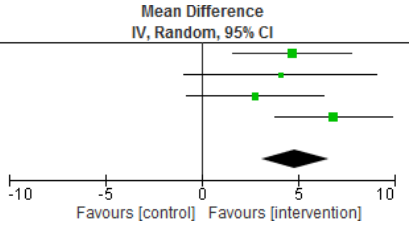


Figure 3.3 Forest plot of BSE comparisons at: (a) discharge, (b) 2 weeks, (c) 1 month, and (d) 2 months.

Compared to those receiving standard care, mothers in intervention groups reported BSE scores that were significantly higher at discharge, 1 month, and 2 months postpartum. No significant differences between groups were detected at 2 weeks postpartum. These findings suggest that interventions to improve BSE are effective at increasing breastfeeding rates at 1 and 2 months postpartum with maximum efficacy at 1 month postpartum. Only one study assessed BSE at each of 3 months and 6 months; therefore, meta-analysis could not be conducted on BSE outcomes beyond 2 months postpartum. This time point aligns with the psychometric testing of the BSE scale, which has not been validated beyond 8 weeks postpartum (Dennis, 2003; Dennis & Faux, 1999).

Breastfeeding rates.

Due to inconsistent data collection timelines and breastfeeding classification strategies, the number of studies included for each time period differs (Table 3.3). At 1-month postpartum, mothers in the intervention group were 1.56 times more likely to be doing any breastfeeding than mothers in the control group (Figure 3.4). However, the interventions had no significant effect on exclusive breastfeeding or partial breastfeeding at 1-month postpartum. The quality of evidence at 1-month was low, and these results should be interpreted with caution.

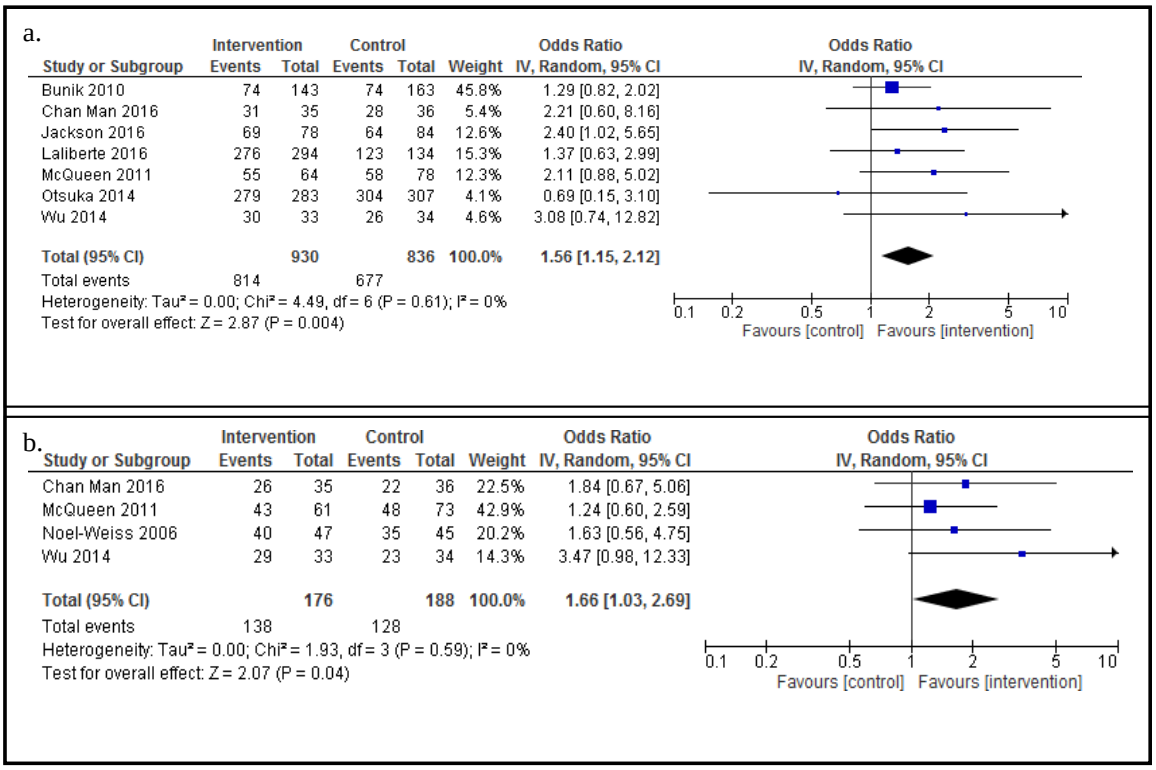


Figure 3.4. Forest plot comparison of rates of any breastfeeding at: (a) 1 month and (b) 2 months.

At 2 months postpartum, mothers in the intervention groups were 1.66 times more likely to be doing any breastfeeding than mothers in the control groups. However, no significant differences between groups were found in partial or exclusive breastfeeding rates at 2 months postpartum. The quality of evidence at 2 months was low, and again, these results should be interpreted with caution.

Meta-regression.

Using meta-regression, we determined that for each 1-point increase in the mean BSE score between the intervention and control group at post-intervention, the odds of exclusive breastfeeding increased by 10% in the intervention group compared to the control group (*OR* = 1.10, 95% CI [1.05, 1.14]).

Subgroup analysis.

We conducted subgroup analyses to determine the intervention qualities that significantly influenced BSE or breastfeeding rates. Due to reporting timelines for the studies, these assessments were conducted at 1 month postpartum, with the exception of OECD status, which was also conducted at 2 months postpartum.

Intervention type.

Education, but not support, had a significant effect on BSE. Mothers participating in educational interventions scored an average of 2.66 points higher at 1 month postpartum compared to those receiving standard care (see Table 3.4). However, this did not translate to improved breastfeeding rates at 1 month postpartum.

Table 3.4 *Summary of findings: Relative Effect for Intervention Type on Breastfeeding Self-efficacy and Breastfeeding Rates.*

Intervention Type	*N* (Studies)	Relative Effect BSE [95% CI]	*N* (Studies)	Relative Effect ABF [95% CI]
Delivery				
Education	780 (3)	**MD 2.66 [0.55, 4.76]**	752 (2)	*OR* 1.06 [0.91, 1.22]
Support	1146 (2)	MD 1.64 [-1.37, 4.65]	570 (2)	*OR* 1.66 [0.93, 2.97]
Theory				
BSE	882 (4)	**MD 3.70 [0.58, 6.82]**	870 (4)	***OR* 1.91 [1.06, 3.46]**
Non- BSE	663 (3)	SMD 1.40 [-0.18, 2.98]	896 (3)	***OR* 1.45 [1.02, 2.07]**
Timing				
Prenatal	665 (2)	MD 2.22 [-1.49, 5.93]	661 (2)	*OR* 1.31 [0.42, 4.10]
Postpartum	755 (4)	**MD 3.34 [1.20, 5.48]**	637 (3)	***OR* 1.81 [1.06, 3.10]**
Setting				
Hospital	387 (2)	SMD 0.16 [-0.04, 0.36]	468 (2)	*OR* 1.57 [0.89, 2.77]
Community	698 (4)	SMD 0.84 [0.00, 1.68]	1089 (3)	*OR* 1.36 [0.74, 2.51]
Both	212 (2)	**MD 5.37 [2.33, 8.41]**	209 (2)	***OR* 2.33 [1.11, 4.90]**
Frequency				
One contact	785 (3)	**MD 2.67 [0.58, 4.77]**	752 (2)	*OR* 1.51 [0.46, 4.91]
> One contact	760 (4)	SMD 0.77 [0.00, 1.54]	1014 (5)	***OR* 1.52 [1.09, 2.13]**
Economic Status				
OECD	1355 (5)	**MD 2.28 [0.55, 4.00]**	1625 (5)	***OR* 1.48 [1.07, 2.04]** EBF (2 months)* *OR* 1.32 [0.77, 2.27]
Non-OECD	190 (2)	MD 14.18 [-0.88, 29.24]	138 (2)	*OR* 2.57 [0.98, 6.74] EBF (2 months)* OR 10.03 [2.48, 40.53]

Interventions that were informed by BSE theory had a significant effect on BSE. However, the presence/absence of BSE theory did not appear to impact breastfeeding rates. Compared to standard care, mothers participating in BSE-informed or non-BSE-informed interventions were both significantly more likely to be breastfeeding at 1 month postpartum. Two studies (K. A. McQueen et al., 2011; Wu et al., 2014) tailored their BSE intervention to participant needs and had significant improvements in both BSE and any breastfeeding rates at 1 month postpartum. Wu et al. (2014) did not report exclusive breastfeeding rates, and the impact of BSE-informed interventions on exclusive breastfeeding could not be assessed.

Timing, setting, and frequency.

Only interventions delivered in the postpartum period, and in a combination of settings significantly improved BSE and breastfeeding rates. Compared to standard care, postpartum interventions resulted in higher BSE and rates of any breastfeeding at 1 month postpartum. Similarly, interventions that were delivered in both the hospital and community settings had significant effects on both BSE and rates of any breastfeeding at 1 month postpartum. Interventions delivered prenatally or solely in the community or hospital setting did not have any significant impacts on BSE or breastfeeding rates. Interventions with only one contact point had a significant effect on BSE; however, only interventions that used more than one contact point resulted in significantly higher rates of any breastfeeding.

Economic status.

There was sufficient representation of studies from OECD and non-OECD countries to assess if economic development status had an effect on BSE and breastfeeding rates. Compared to standard care in OECD countries, intervention participation resulted in significantly higher BSE and rates of any breastfeeding at 1 month postpartum. Conversely, compared to standard care in non-OECD countries, mothers who participated in interventions did not experience any significant improvements in BSE, but were over 10 times more likely be exclusively breastfeeding at 2 months postpartum. However, the wide confidence interval suggests that the effect of BSE interventions may not be applicable to all non-OECD countries.

Discussion

The aim of this review was to explore the theoretical link between BSE and breastfeeding rates by investigating (a) if interventions to improve BSE were successful and (b) if improvements in BSE resulted in improved breastfeeding rates. Of the 11 included studies, seven reported higher BSE in the intervention group versus control group, and five studies reported higher breastfeeding rates in the intervention group versus control group. Overall, interventions had positive effects on BSE at hospital discharge, 1 month and 2 months postpartum. Mothers in intervention groups were significantly more likely to be breastfeeding at 1 and 2 months postpartum. Improvements in BSE predicted increases in rates of exclusive breastfeeding, which suggests that BSE is an effective social change theory to explain breastfeeding rates. Interventions that (a) were implemented in the postpartum period, (b) used combined

delivery settings, and (c) were informed by BSE theory had the greatest influence on both BSE and breastfeeding rates.

Intervention type.

Compared to interventions using support, interventions that used education were more effective at improving BSE at 1 month postpartum. However, this did not translate into improved breastfeeding rates at 1 month. This is in contrast to research that suggests educational interventions are effective in improving rates of exclusive and any breastfeeding at 1 month postpartum (Haroon et al., 2013). The increase in BSE could be due to the interactive, face-to-face nature of breastfeeding education (Skouteris et al., 2014). Additionally, the consistent delivery and messaging of the educational interventions may have contributed to an increase in BSE, but it is unclear why breastfeeding rates were influenced inconsistently. Due to inadequate study representation we were unable to evaluate if timing (prenatal/postpartum), setting, or frequency, in combination with the type of intervention, had an effect on breastfeeding rates. It is possible that the timing of the interventions may have impacted the success of educational interventions compared to interventions that used support.

The evidence supports the use of social learning theories to influence breastfeeding behaviours (Skouteris et al., 2014). Although the primary outcome of this review was to determine if interventions to improve BSE were effective in improving breastfeeding rates, not all interventions were informed by BSE theory. Interventions that integrated BSE theory were effective in improving BSE and rates of any breastfeeding at 1 month postpartum. Two studies, (K. A. McQueen et al., 2011; Wu et al., 2014) used the

BSES as a screening method to identify specific weaknesses in maternal BSE and tailored interventions accordingly. Tailoring clinical interventions to specifically address unique maternal needs appears to be an effective approach to increase BSE and breastfeeding rates and should be studied further.

Timing, setting and frequency.

The setting of the intervention influenced the success of the intervention. Compared to interventions delivered exclusively in hospital or community, interventions delivered in the combined hospital and community setting had an effect on both BSE and breastfeeding rates. Evidence suggests that compared to interventions delivered in single settings, interventions delivered in combined settings had the greatest improvements on breastfeeding rates (Haroon et al., 2013). However, these findings may be related to greater intensity or duration of interventions delivered in combined settings.

The majority of studies included in this review used two to three contacts, with three studies employing only one contact and one study employing 14 contacts. Jackson and Dennis (2016) and Otsuka et al. (2014) had limited interactions with participants, with each using only one contact point to provide generic information regarding implementation of the intervention. As such, there was minimal interaction between participants and educators, which may have contributed to the insignificant improvement in breastfeeding rates. Subgroup analysis in this review indicated that participants in studies that used more than one contact had significant improvements in breastfeeding rates but not in BSE at 1 month postpartum. In a previous systematic review, more intensive interventions (employing five or more contacts) were more effective than less

intensive interventions (employing fewer than five contacts) at improving breastfeeding rates (Jolly et al., 2012). In the present study, it is possible that limited contacts, rather than the nature of the intervention, contributed to insignificant improvement in breastfeeding rates.

OECD status.

Studies in OECD countries were more successful at improving BSE and rates of any breastfeeding at 1 month postpartum; whereas, studies from non-OECD countries were more successful at improving rates of exclusive breastfeeding at 2 months postpartum. These findings are supported by previous research indicating that interventions delivered in non-OECD countries showed a higher effect on exclusive breastfeeding rates compared to those delivered in OECD countries (Haroon et al., 2013; Sinha et al., 2015). Breastfeeding in non-OECD countries tends to be the socially accepted norm, and interventions to improve BSE may not increase rates of any breastfeeding because the majority of mothers may already be breastfeeding (Sinha et al., 2015). However, mothers non-OECD countries may not have a comprehensive understanding of the benefits of exclusive breastfeeding and interventions to improve this knowledge may have increased exclusive breastfeeding rates. Additionally, the availability of formula in OECD countries may contribute to increased rates of supplementation thereby increasing rates of partial or any breastfeeding (Haroon et al., 2013). Improvements in exclusive breastfeeding rates are especially important for infants in non-OECD countries because exclusive breastfeeding significantly reduces infant mortality rate (Victora et al., 2016).

Although evidence suggests that BFHI certification is one of the most effective interventions to improve breastfeeding rates (Haroon et al., 2013; Sinha et al., 2015), we were unable to effectively assess any potential mediating impact of BFHI in this study. Only four studies recruited participants from BFHI certified facilities with one study pooling results from both BFHI and non-BFHI certified hospitals. The single study that controlled for BFHI (Otsuka et al., 2014) found that BFHI certification was a mediating factor for BSE and breastfeeding rates at 1 month postpartum.

Limitations

Our study was limited by the quality of the primary studies included in the meta-analysis. Inconsistent reporting timelines and breastfeeding classification systems resulted in rejection of several studies. The GRADE guideline indicated that two studies were of very low quality, five studies were of low quality, and four studies were of moderate quality. The nature of breastfeeding interventions prevents double blinding and only four studies single blinded outcome assessors. As such there was a high risk of performance and detection bias in all of the included studies. Further, breastfeeding status was assessed using self-report in all studies, increasing the risk of desirability and reporting bias. We found significant heterogeneity among several outcome comparisons in this meta-analysis. Conducting a random effects compared to a fixed effect meta-analysis offsets some of the effects of heterogeneity, however it is not a substitute for exploration of heterogeneity (Higgins & Green, 2011). Conducting subgroup analyses to investigate characteristics of studies that may to contribute to heterogeneity helped us to draw more reliable conclusions. However, the comparisons with high heterogeneity need

to be interpreted with caution and may not be applicable to all clinical settings (Higgins et al., 2011).

The Cochrane Collaboration (Higgins et al., 2011) recommends that meta-regression be used with 10 or more studies. There were only eight studies that could be included in the meta-regression, which suggests that analysis may be under powered. As with meta-analyses, our meta-regression was limited by measurement and reporting in the included studies. Finally, this meta-analysis incorporated both RCT and quasi-experimental studies to maximize the number of included studies. Quasi-experimental studies are often considered of lower quality than RCTs and incorporating these studies may have increased the risk of bias and effects of heterogeneity.

Conclusion

Interventions to improve BSE are effective to increase breastfeeding rates at 1 and 2 months postpartum. Practitioners and researchers should consider interventions that use BSE as a social change theory as they may contribute to improved rates of exclusive breastfeeding. Interventions were most successful when focused on education and delivered in both in hospital and community setting, using multiple contact points. It is important that researchers are aware of the societal, cultural, and economic influences that may also impact breastfeeding outcomes as differences in intervention effectiveness were noted between OECD and non-OECD countries. Controlling for the potential confounding effects of BFHI certification, socio-cultural influences, and OECD status should be considered for future research studies.

Chapter 4: Exploring Breastfeeding Self-Efficacy and Assessing Breastmilk Feeding Outcomes for Moderate and Late Preterm Infants in the Family Integrated Care (FICare) Trial: A Sequential Explanatory Mixed Methods Study Protocol[2]

Brockway, M., Benzies, K. M., Carr, E., & Aziz, K. (2018). Breastfeeding self-efficacy and breastmilk feeding for moderate and late preterm infants in the Family Integrated Care trial: A mixed methods protocol. *International Breastfeeding Journal*, 13(1), 29. doi:10.1186/s13006-018-0168-7

Note. This is the published protocol for the study and therefore uses future tense throughout. Due to unexpected delays in availability of the data, changes to the final protocol were required. These changes are detailed in the limitations section of Chapter 6.

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[2] Added with permission from the International Breastfeeding Journal Guidelines for BMC authors (https://www.biomedcentral.com/about/policies/reprints-and-permissions)

Introduction

Globally, preterm birth (born prior to 37 weeks gestational age [GA]) rates range from 5% to 18% (Canadian Institutes for Health Information, 2012; World Health Organization, 2012). Over 80% of preterm infants are born moderate (32 weeks and zero days [$32^{0/7}$] to $33^{6/7}$ weeks GA) or late ($34^{0/7}$ weeks to $36^{6/7}$ weeks GA) preterm (Blencowe et al., 2012; Engle et al., 2007). Prematurity is a significant contributor to child morbidity and a primary concern for child health clinicians (Blencowe et al., 2012; Canadian Institutes for Health Information, 2012; Morken, 2012; World Health Organization, 2012). Although not as medically complex as their early preterm (born prior to 32 weeks) counterparts, moderate and late preterm infants are at risk for several health and developmental issues (Natarajan & Shankaran, 2016), and often require level II neonatal intensive care (Barfield et al., 2012). Appropriate nutrition beginning at birth is a key component to lifelong health (Lucas & Smith, 2015) and breastmilk feeding is the recommended optimum feeding method for preterm infants (Kim & Unger, 2010; Victora et al., 2016; World Health Organization, 2011; Zhou, Shukla, John, & Chen, 2015). However, breastmilk feeding rates among preterm infants are substantially lower than those of full-term infants (Goyal, Attanasio, & Kozhimannil, 2014; Ross & Browne, 2013). Moderate and late preterm infants may have poor feeding skills that limit breastmilk intake and jeopardize infant growth and development (Natarajan & Shankaran, 2016). The physical environment of the neonatal intensive care unit (NICU), and practices that physically and emotionally separate infants from their mothers, pose a risk to establishing and maintaining breastmilk feeding (Callen & Pinelli, 2005). Despite

recommendations for family centered care (Gooding et al., 2011; Griffin, 2006; Schor & American Academy of Pediatrics Task Force on the, 2003), the traditional model of care in NICUs situates healthcare professionals as the primary care provider. Frequently, mothers are relegated to the role of supplementary care provider or observer (Gooding et al., 2011), which may limit time spent with their infant(s), and educational opportunities (Staub et al., 2014). The traditional model of care can result in feelings of parental detachment, ineffective parenting, parenting stress, and loss of control (Staub et al., 2014; Wheeler & Dennis, 2013). Further, traditional models of care decrease parenting and breastfeeding self-efficacy (BSE), potentially contributing to lower breastmilk feeding rates (Callen & Pinelli, 2005). Integrating mothers into the care of their infants in the NICU may improve maternal BSE and increase prevalence of breastmilk feeding at discharge.

Breastfeeding self-efficacy.

BSE is a social cognitive theory adapted by Dennis (Dennis, 1999). BSE captures how a mother perceives her ability to breastfeed rather than her *actual* ability to succeed at breastfeeding (Dennis, 1999, 2003; Dennis & Faux, 1999). Mothers with high self-efficacy are often able to overcome barriers that those with low self-efficacy would find overwhelming (Schwarzer & Fuchs, 1995). BSE is informed by four sources of information: a) performance accomplishments, b) vicarious experience of seeing other mothers breastfeed, c) verbal persuasion by influential others, and d) the mother's physiological/affective state (Bandura, 1977; Dennis, 1999). Measures of BSE can predict breastfeeding outcomes at 1 and 2 months postpartum in mothers of full-term

infants (Brockway et al., 2017) and is a modifiable factor that can influence breastfeeding success (Brockway et al., 2017; Skouteris et al., 2014; Tuthill et al., 2015; Wheeler & Dennis, 2013). Few studies have been conducted using BSE theory in mothers of preterm infants (Gerhardsson et al.; Wheeler & Dennis, 2013). Interventions to improve BSE may improve breastmilk feeding rates, and subsequent health outcomes for moderate and late preterm infants.

Study aims.

This study is nested within a larger cluster randomized control trial (cRCT) assessing multiple outcomes of a Family Integrated Model of Care (FICare) for moderate and late preterm infants in level II NICUs (Benzies et al., 2017). The primary outcome of the FICare cRCT is to evaluate the effect of FICare on length of stay in the level II NICU. The aim of the *present* study is to determine if FICare improves maternal BSE and resultant breastmilk feeding rates in mothers of moderate and late preterm infants who were admitted to a level II NICU. The specific objectives are:

i. To determine if FICare is effective in improving BSE in mothers of moderate and late preterm infants between admission to and discharge from a level II NICU.
ii. To determine if FICare is effective in increasing breastmilk feeding rates in mothers of moderate and late preterm infants at discharge from the NICU.
iii. To explore maternal experiences with infant feeding while admitted to the NICU.
iv. To determine if or how maternal experiences with infant feeding work to inform maternal breastmilk feeding rates while in the FICare NICU environment.

Methods

We will conduct a sequential explanatory mixed methods study (Figure1). Nested within the larger FICare cRCT, we will examine the BSE scores of participants in the intervention arm of the study. Using maximum variation sampling, we will select a sub-sample of mothers demonstrating the highest and lowest BSE change scores during their infants' hospital stay. We will conduct a semi-structured telephone interview to explore maternal experiences of infant feeding during hospitalization. We will then use these experiences to explain how, or if, FICare informs maternal BSE and resultant breastmilk feeding rates in mothers of moderate and late preterm infants. We adhered to the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) guidelines in the design of the protocol (Appendix C) (A.-W. Chan et al., 2013).

Rationale for mixed methods design.

There is a call to develop breastfeeding research methodologies that embrace "interpretation from the social sciences" rather than strictly relying on quantitative measures of breastmilk feeding rates (Spencer, 2007, p. 779). Unilaterally implementing one of the two dominant research paradigms will not fully honour the complexity of BSE and breastmilk feeding within the NICU (R. B. Johnson et al., 2007). Utilizing quantitative methodologies to measure BSE and breastmilk feeding rates and qualitative methodologies to explore infant feeding experiences will allow for our research objective to be explored from multiple perspectives (R. B. Johnson et al., 2007). By exploring maternal experiences associated with feeding moderate and late preterm infants while in the NICU, we can better understand if FICare is a successful model of care to improve

maternal BSE and breastmilk feeding rates. Semi-structured interviews will allow for intimate insights from mothers to emerge that will provide substantive content as well as individual experiential data (DiCicco-Bloom & Crabtree, 2006; Ryan, Coughlan, & Cronin, 2009). Further, examining both the quantitative and qualitative components of BSE will provide an enhanced understanding of BSE results and resultant infant feeding outcomes (Figure 4.1).

Phase	Procedure	Product / Output
Quantitative Data Collection	• cRCT BSES survey data • Assessed every 3 months throughout cRCT • *N* = 660	• Numeric Data
Case selection: Qualitative interviews	• Maximum variation sample o BSES change score • Data saturation	• Participants (*n* = 15-20)
Qualitative data collection	• Telephone interviews • Infant feeding experiences in NICU • 2 months after discharge	• Interview transcripts (textual data)
Qualitative data analysis	• Qualitative descriptive • Inductive coding • Thematic analysis	• Tables and quotes to display themes and sub-themes
Quantitative Data Collection: Occurs until sample size is met	• Quantitative survey data from cRCT • 1^0: Breastfeeding self-efficacy • 2^0: Breastmilk feeding rates • Cov: LOS, EPDS, Maternal Self-efficacy • *N* = 660	• Numeric Data
Quantitative Data Analysis	• STATA Software	• Descriptive statistics • Hierarchical Linear Modelling
Integration of qualitative and quantitative results	• Interpretation and explanation of the quantitative and qualitative results o Individual level o Systems level o Study level (FICare Intervention)	• Discussion • Suggestions for improvements to intervention • Practice changes • Future research

Figure 4.1 Study flow diagram.
Rectangles depict quantitative phase, ovals depict qualitative phases, and hexagons depict integration phases. Abbreviations: cluster randomized control trial (cRCT), Breastfeeding Self-efficacy Scale (BSES), Co-variates (Cov), length of stay (LOS), Parental Stress Index (PSI), Edinburgh Postnatal Depression Screen (EPDS).

FICare cluster randomized control trial.

All level II NICUs in the province of Alberta, Canada (N = 10) will be randomized into a control (n = 5) or an intervention group (n = 5). Each intervention site will have specially trained registered nurse super-users who are responsible to recruit participants, deliver the intervention, and collect data. To ensure intervention fidelity, we will conduct site visits quarterly to assess adherence and compliance with the intervention components. We will also monitor for activities (e.g. policy changes, guidelines, unit practices) that may influence implementation of the intervention.

FICare model.

FICare is a model of care that actively supports families to participate in the care of their infant and was originally introduced to Canada at the Mount Sinai Hospital level III NICU in Toronto, Ontario (O'Brien et al., 2013). The intervention originated from the Humane Neonatal Care model developed in Tallinn, Estonia, where parents actively participated in the care of their infants; while nurses and psychologists provided education and support (O'Brien et al., 2013). Existing research regarding the effectiveness of FICare is limited to level III NICUs, with small sample sizes, using quasi-experimental and case-control research designs (Bracht, Lee, & O'Brien, 2013; Galarza-Winton, Dicky, O'Leary, Lee, & O'Brien, 2013; O'Brien et al., 2013) and limited qualitative exploration (Broom, Parsons, Carlisle, & Kecskes, 2017).

FICare intervention.

Families participating in FICare are required to spend a minimum six hours per day, or approximately three feeding times at the NICU. Parents share in the care of their

infant(s), as soon as they are able, starting with simple tasks, such as skin-to-skin contact and diapering, and progressing to more complex tasks, such as feeding. Using a parent-education pathway and specially designed apps, nurses will support and educate mothers and fathers in their parenting role. FICare involves three main domains (Figure 2): a) information sharing, b) parent support and, c) parent education, all focused on actively involving parents in the care of their infants while in the NICU. Information sharing is bidirectional and involves parents verbally reporting on their infants' progress at daily bedside multidisciplinary rounds and actively contributing to discussions about the plan of care. Parent support involves one-on-one discussions with veteran parents. Veteran parents (those who have previously had an infant in the level II NICU environment) will provide practical advice, guidance, and support to parents in the FICare study. Finally, parent education includes standardized, evidence informed parent education delivered individually or in group settings.

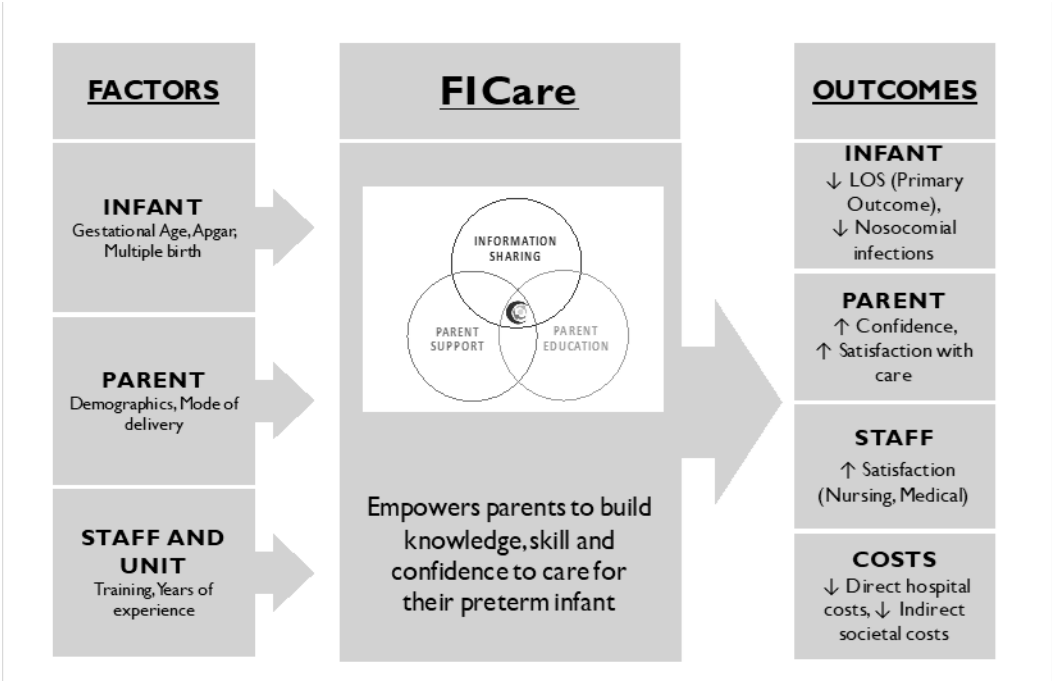

Figure 4.2 FICare model of change

FICare context, level II NICUs.

In Alberta, infants admitted to a level II NICU are generally born after 32 weeks, weighing more than 1500 grams. Nutritionally, these infants tend to be on total parenteral nutrition, receiving gavage feeds, or full oral feeds, depending on their developmental maturity (Barfield et al., 2012). All 10 level II NICUs in Alberta formally support the provision of mother's own milk as the first choice for infant feeding (Alberta Health Services, 2016). While there is no formalized breastfeeding education (World Health Organization, 2009) requirement for practitioners working in NICUs, all mothers have access to International Board Certified Lactation Consultants. Visitation models vary among the 10 sites, with most NICUs allowing parents unrestricted 24-hour access to their infant. There is a mix of open and closed ward models, with five of the NICUs

planning to transition over to single or shared room wards during the timeline of the FICare study.

FICare inclusion criteria.

The FICare cRCT will include mothers of preterm infants born between $32^{0/7}$- and $34^{6/7}$-weeks gestational age (GA), admitted to a level II NICU in Alberta, who speak, read, and write English. To ensure an adequate dose of the intervention, infants must have a minimum NICU stay of 5 days. Infants born greater than 35 weeks GA were excluded from the study as they tend to have shorter hospital stays and would not meet the minimum 5-day requirement. We will exclude mothers of infants with a severe congenital abnormality or chromosomal anomaly or receiving palliative care.

FICare sample size.

We based sample size estimates on the primary outcome, length of stay. Due to an anticipated skewed distribution for length of stay, we used a natural logarithm transformation to calculate sample size (Sedgwick, 2012). To achieve a power of 0.80, we need to recruit 181 mothers into each group for the primary FICare outcome of length of stay; and 211 to achieve a power of 0.9. In 2014, there were 1030 moderate and late preterm infants were admitted to a level II NICU in Alberta. To account for a response rate of 80% (O'Brien et al., 2013), attrition and infants with a length of stay of ≤ 5 days (6.08%), we will approach 824 potential participants over the 30-month recruitment period. This will also ensure that the sample size, 330 per group, is sufficient to assess the secondary outcomes and to provide the qualitative sample for the study.

FICare recruitment.

Within 72 hours of admission to the level II NICU, nurses will inform mothers about the study. If interested, a FICare super-user will screen mothers for eligibility, answer questions about the study, obtain informed consent, and administer the baseline questionnaire. The FICare super-user will obtain demographic information for all mothers approached to enable comparisons between participating and non-participating mothers. As this is a cRCT, infants of mothers at the intervention sites who do not wish to participate in the study, will receive the same hospital care as infants whose mothers are participating in the study. The present study will be nested within the larger FICare clinical cRCT (Figure 3).

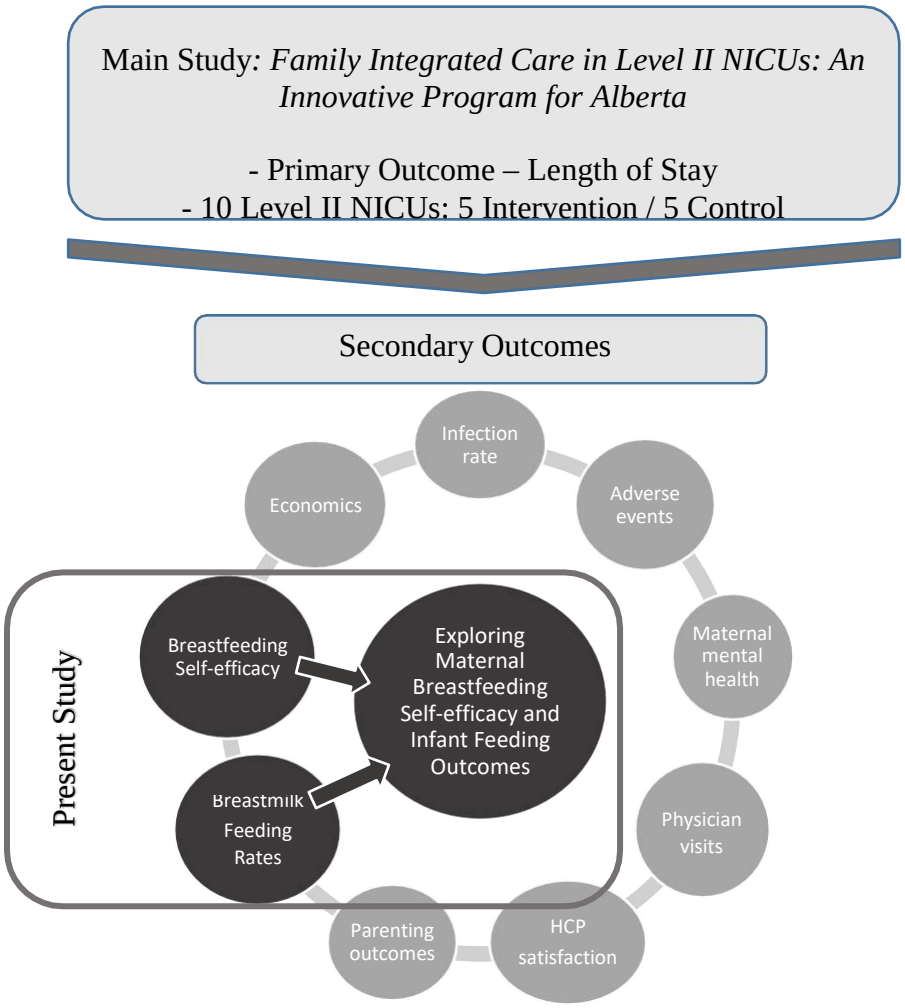

Figure 4.3. Situation of present study within larger FICare clustered randomised control trial.

Quantitative phase.

Procedures.

Online questionnaires will be administered to mothers at two time points in the study (Table 1). Upon enrollment, researchers will collect demographic information and the first set of questionnaires (baseline). The second set of questionnaires will be administered about 24 hours before the infants are discharged from the NICU.

Measurement.

BSE will be measured using the modified Breastfeeding Self-efficacy Scale – short form (BSES-SF; Table 1) for mothers of ill and preterm infants (Wheeler & Dennis, 2013). The BSES-SF will only be administered to mothers who are breastfeeding, expressing their own breastmilk, attempting to breastfeed, or are planning to breastfeed. Mothers who have weaned or are not planning to breastfeed will not complete the BSES-SF. However, infant feeding rates will be captured for all infants in the study. BSES-SF data will be assessed quarterly throughout the quantitative data collection period and will inform purposive sampling for the qualitative phase of the study. The remaining quantitative data will be assessed upon completion of quantitative data collection and completion of qualitative data analysis.

Table 4.1. *Outcome Measures and Potential Confounding with Breastfeeding Self-efficacy and Breastfeeding Outcomes.*

Measure	**Time Point**	**Description**
Primary Outcome		
Modified Breastfeeding Self-Efficacy Scale - Short Form (Wheeler & Dennis, 2013)	Baseline; Discharge;	18-item scale validated for mothers of ill and/or preterm infants. Assesses a mother's confidence in her ability to breastfeed. Internal consistency (0.88) is high.
Secondary Outcome		
Breastmilk feeding	Baseline; Discharge;	Labbok and Krasovek (Labbok & Krasovec, 1990) classification system, modified to include additives and fortification. 24-hour maternal recall.
Co-Variates and Potential Confounders		
Parental Stressor Scale: NICU (Miles, Funk, & Carlson, 1993)	Baseline; Discharge	50-item scale that captures parental perceptions of stress in the NICU: (1) sights and sounds; (2) appearance and behaviour of the infant; (3) impact on the parental role and relationship with the infant; and (4) parental relationship and communications with

		staff. Internal consistency (0.89 to 0.94 for the total scale) and test-retest (0.87) reliabilities are high. ***Potential Confounding:*** Decreasing maternal anxiety and stress will have a physiologic impact on breastmilk production (Dewey, 2001; Zanardo et al., 2011).
Edinburgh Postnatal Depression Scale (Cox, Holden, & Sagovsky, 1987)	Baseline; Discharge	The most commonly used pre- and post-natal depression screener validated for mothers. Consists of 10 items and has a sensitivity of 0.86 and specificity of 0.78, with a positive predictive value of 73%. ***Potential Confounding:*** Successful breastfeeding is predictive of lower maternal depressive symptomology Depression may be predictive of reduced breastfeeding rates (Hahn-Holbrook, Haselton, Dunkel Schetter, & Glynn, 2013)
State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970)*	Baseline; Discharge	40-item scale that captures dispositional/trait anxiety (20 items) and current state anxiety (20 items. Internal consistency (0.86 to 0.95) and test-retest (0.73 to 0.86) reliabilities are high. Scores on the STAI and PSS: NICU are correlated (Miles et al., 1993). ***Potential Confounding:*** Mothers that demonstrate high rates of anxiety or depressive symptomology routinely have lower breastfeeding rates than mothers that do not (Hahn-Holbrook et al., 2013).
Perceived Maternal Parenting Self-Efficacy scale (Barnes & Adamson-Macedo, 2007)	Baseline; Discharge	20-item measure of parenting self-efficacy validated for mothers of preterm infants. Captures maternal perceptions of ability to (1) give basic care; (2) elicit change in infant behaviour; (3) recognize infant behaviour; and (4) judge interactions with her infant. Exploratory factor analysis confirms four factors; internal consistency (0.91) and test-retest (0.96) reliabilities are high. Concurrent validity between general self-efficacy and BSES-SF (Dennis & Faux, 1999). ***Potential Confounding****:* Concurrent validity between general self-efficacy and BSES-SF (Dennis & Faux, 1999).

Note. *At admission, both State and Trait forms are completed; at discharge only State form is completed. Adapted from Benzies et al (Benzies et al., 2017).

The Labbok and Krasovec classification system (Labbok & Krasovec, 1990) will be used to assess infant feeding rates at admission and discharge (Table 1). Maternal recall

is frequently used as an effective method to collect infant feeding data (Launer et al., 1992). Maternal recall will be used to assess infant feeding over the previous 24 hours and will be classified as:

i. Exclusive breastmilk feeding – 100% of feeds were breastmilk (including expressed breastmilk, donor human milk and additives)
ii. Mostly breastmilk – 75% of feeds were breastmilk (including expressed breastmilk, donor human milk and additives)
iii. Partial breastmilk feeding - 50% of feeds were breastmilk (including expressed breastmilk, donor human milk and additives)
iv. Minimal breastmilk - 25% of feeds were breastmilk (including expressed breastmilk, donor human milk and additives).
v. No breastmilk feeding – baby is not receiving any breastmilk
vi. nil per os (NPO) or nothing by mouth

The infant feeding questions will be predicated by a) is your baby receiving any human donor milk and b) is your baby receiving any additives to your breastmilk to help them grow?

Data management.

We will collect data electronically and data will be stored on secure servers. Quantitative data will be managed as per Benzies et al, FICare protocol (Benzies et al., 2017).

Data analysis.

Statistical analysis of the quantitative results will be performed using STATA Data Analysis and Statistical Software. The primary outcome of the statistical analysis is to determine if a difference exists in: a) breastfeeding self-efficacy scores (BSES-SF) and b) breastmilk feeding rates, between the control and intervention groups. Results from the BSES-SF will be treated as continuous data whereas results from breastmilk feeding rates will be treated as categorical data (Jamieson, 2004; Wheeler & Dennis, 2013). Characteristics of participants and scores on scales will be presented as descriptive statistics (means, frequencies, and percentages). We will use an omnibus test (Hotelling's t-tests and Chi square) to assess for baseline differences between intervention and control groups on demographics, BSE, and breastmilk feeding rates.

To test if there is a difference in BSE and breastmilk feeding rates between the intervention and control groups, we will use Hierarchical Linear Modeling (HLM; also known as multilevel modeling or mixed-effect modeling) and Hierarchical general linear modeling (HLGM) respectively. This study is nested in a larger cRCT and there is a potential for variance in care delivery at each of the NICU sites. As such, there are multiple levels of data that need to be considered to accurately assess the effectiveness of the intervention on BSE and breastmilk feeding rates. By simultaneously investigating the relationships between the different levels of data, HLM and HGLM analysis can account for variance among variables at different levels (Woltman, Feldstain, MacKay, & Rocchi, 2012). The HLM approach will allow for the two observations (admission and discharge from the NICU) by treating each participant's BSE score and breastmilk

feeding rates at each assessment point as single data points (Woltman et al., 2012). There will be two levels of analysis in the data: Level 1 will refer to the outcome variables of BSE and breastmilk feeding rates; while Level 2 will be the maternal or subject effect. We will enter the subject effect into the model as a random effect to capture within and between-subject variation (Woltman et al., 2012). The group effect of intervention/control will be entered as fixed effect to determine if the intervention is effective.

Qualitative phase.

We will employ a qualitative descriptive exploration (Sandelowski, 2000) and thematic analysis (Braun & Clarke, 2006) of maternal experiences with the FICare intervention and infant feeding in the NICU. Qualitative description involves low-inference interpretation of the data (Sandelowski, 2000). Thematic analysis is often used by researchers as a technique to analyse data in qualitative descriptive studies (Nowell, Norris, White, & Moules, 2017; Vaismoradi, Turunen, & Bondas, 2013). Using thematic analysis will allow us to examine and compare different perspectives of infant feeding experiences while in the NICU, as well as help to generate unanticipated insights (Nowell et al., 2017).

Sampling.

Using a variation of purposive, maximum variation sampling (Kuzel, 1999; Patton, 2014), we will select mothers who experience high mean differences in their BSE scores between NICU admission and discharge. To capture experiences that may have worked to detract from maternal BSE, we will also select mothers with negative mean

differences. Assuming a normal distribution, we will sample from the top and bottom 20 percent of the change score distribution and sampling will continue until informational redundancy is achieved (Kuzel, 1999).

Data collection.

We will conduct semi-structured telephone interviews (Additional file 2). The geographical dispersion of participants in the FICare study render face-to-face interviews not feasible and telephone interviews will allow data collection to occur with minimal expenditure and time commitment. Telephone interviews are an effective and efficient approach to qualitative data collection and provide results similar to face-to-face interviews (Carr & Worth, 2001). Telephone interviews may also help to reduce social desirability responses and interviewer effects, that may be more prevalent in face-to-face interviews (Carr & Worth, 2001). Interviews will be conducted until informational redundancy is achieved and no new topics or concepts are emerging with additional interviews, with a projected sample size of 15 (Sandelowski, 2008). We will allow participants to guide the conversation, with minimal probing and redirection to maintain the content of the interview within the context of the themes requiring verification.

Data analysis.

We will conduct thematic analysis within a constructionist framework, focusing on the sociocultural context and structural conditions, (such as NICU policies, physical space and relationships with practitioners) that inform infant feeding experiences (Braun & Clarke, 2006). Employing theoretically driven coding may not fully capture maternal experiences with infant feeding while in the NICU. As such, we will use an inductive

approach to thematic analysis (Boyatzis, 1998; Braun & Clarke, 2006) to enable themes to be developed that are linked to the data and not to a previously determined theory. The inductive technique of data analysis will allow for codes and sub-codes to describe themes as they are observed in the data (Fereday & Muir-Cochrane, 2008). Inductively driven coding is constructed from the raw data and is interpreted by the researcher (Boyatzis, 1998). This may result in the development of themes that are not directly related to the pre-determined qualitative research question (Boyatzis, 1998). Coding will occur through a three-step process. The first step will be to read through transcripts to find codable moments that emerge from patterns in the data. Once the pattern is identified, we will move on to the second step of classifying or encoding the pattern by giving it a label (Boyatzis, 1998). Finally, once the data has been sufficiently coded and we have reached saturation, we will interpret the themes using thematic networks (Attride-Stirling, 2001). Selecting mothers based on their mean difference BSE scores will situate BSE as the criterion reference (Boyatzis, 1998). We will be able to compare-and-contrast themes that emerge from infant feeding experiences and identify observable differences between mothers with low and high BSE change scores (Boyatzis, 1998). We will bracket our assumptions of the BSE theory (Fischer, 2009) and allow for themes to emerge as they are related to the concept of maternal experiences with infant feeding in the NICU. Bracketing is a reflexive process that involves preparation, action, evaluation, and systematic feedback (Ahern, 1999) regarding thought processes and data analysis techniques throughout the coding process. Bracketing will be conducted through

acknowledging our assumptions of, and affinity for, the BSE theory and conducting reflexive journaling (Fischer, 2009).

Integration of quantitative and qualitative phases.

Methodologically, the qualitative sample emerges from the quantitative findings and depends entirely on the analysis and sample selection strategy (Creswell & Clark, 2011). The criterion reference for the qualitative sample, BSE, is determined by the quantitative results (Boyatzis, 1998). As such, the qualitative phase of the study is entirely dependent on the analysis of the quantitative BSE results.

To fully benefit from the complementarity of the explanatory sequential design, explicit linkages must be made between the quantitative and qualitative results (Creswell & Clark, 2011). Integration of the qualitative and quantitative results will be conducted in three stages. The first stage of integration will occur at the theoretical level and will relate the findings of the qualitative thematic analysis to the four sources of information in the BSE theory (Dennis, 1999; Kingston, Dennis, & Sword, 2007). The BSE theory forms the theoretical underpinnings of the study and provides a framework from which to integrate the quantitative and qualitative findings. This will provide a comprehensive understanding of how, or if, maternal experiences with infant feeding in the NICU work to inform BSE. The second stage will examine the qualitative findings with respect to the system level. Themes regarding infant feeding experiences in relation to the NICU environment will be used to explain barriers and facilitators to provision of breastmilk or breastfeeding. The final stage of integration will focus on themes that are directly related to the FICare model of care and how these themes can influence infant breastmilk feeding

rates. The second and third stages of integration will occur at the practical level, developing inferences regarding practices and models of care that may impact breastmilk feeding outcomes.

Discussion

Our proposed mixed methods study will assess if FICare is an effective care practice to improve BSE and breastmilk feeding rates in mothers of moderate and late preterm infants. The findings will also contribute evidence to the limited body of knowledge regarding BSE in the moderate and late preterm population. The qualitative data will allow us to elaborate, enhance, and clarify quantitative findings so that inferences can be drawn regarding the FICare intervention and meta-inferences can be made to the broader NICU population (Greene, Caracelli, & Graham, 1989). Hypothetically, these inferences may include structured recommendations regarding care-by parent activities that specifically address maternal BSE or structural modifications to the NICU that make mothers feel more adept at providing breastmilk for their infant(s). Additionally, the explanatory sequential typology will allow us to examine the convergence, corroboration, and correspondence of BSE results from the quantitative and qualitative findings (Greene et al., 1989).

This explanatory sequential study will not only serve to assess the effectiveness of the FICare intervention on BSE but will also provide an in-depth understanding of how the elements of FICare that work to inform BSE and subsequent breastmilk feeding rates. Improving BSE and breastmilk feeding rates will provide increased evidence of the

effectiveness of the FICare intervention. If successful, FICare can fundamentally change care delivery methods in Level II NICUs and may serve to improve breastmilk feeding outcomes moderate and late preterm infants.

Chapter 5: Does breastfeeding self-efficacy theory apply to mothers of moderate and late preterm infants? A qualitative exploration

Brockway, M., Benzies, K. M., Carr, E., & Aziz, K. (2019). Does breastfeeding self-efficacy theory apply to mothers of moderate and late preterm infants? A qualitative exploration. Prepared for submission.

Target journal: *Journal of Clinical Nursing*

Note. This chapter presents the qualitative results and further explores the link between maternal experiences with infant feeding in the NICU and reflective properties of BSE theory. This chapter has been prepared as a manuscript for submission to the *Journal of Clinical Nursing* and as such may have formatting styles unique to the journal guidelines.

Introduction

Preterm birth is a leading cause of morbidity and mortality worldwide (Manuck et al., 2016). Globally, one in 10 infants are born preterm (<37 weeks gestational age [GA]), with over 80% of these infants being moderate preterm (32 $^{0/7}$ weeks – 33 $^{6/7}$ weeks) or late preterm (34 $^{0/7}$ weeks – 36 $^{6/7}$ weeks) (Blencowe et al., 2013). Over the first 10 years of life, morbidity related to prematurity translates to an economic burden of $10, 010 (late preterm) to $54, 554 (moderate preterm) per infant (Johnston et al., 2014).

Breastmilk feeding is the ideal and optimal feeding method for preterm infants (American Academy of Pediatrics, 2012; S. Johnson et al., 2015). However, compared to their full-term counterparts, preterm infants have significantly lower breastmilk feeding rates. Additionally, late preterm infants are at even higher risk of reduced breastmilk feeding compared to early preterm infants (Hackman et al., 2016). As this finding is counterintuitive, additional research is needed to better understand barriers and facilitators of breastmilk feeding outcomes in moderate and late preterm infants. One such facilitator may be through exploring and improving maternal breastfeeding self-efficacy (BSE) theory in this unique population. Although demonstrated to be effective in the full term population (Brockway et al., 2018), there is limited evidence about the application of BSE theory to mothers of preterm infants. This paper explores maternal experiences with infant feeding while in the neonatal intensive care unit (NICU) and seeks to identify elements of BSE theory in these experiences.

Background

It has been well documented that breastmilk feeding reduces morbidity and mortality in preterm infants (Cleminson, Zalewski, & Embleton, 2016). However,

prematurity often presents multiple barriers to establishing and maintaining breastmilk feeding (Ayton, Hansen, Quinn, & Nelson, 2012; Hackman et al., 2016). Biological factors such as neurodevelopmental immaturity (Walsh et al., 2017), the inability to coordinate a suck-swallow-breathe pattern (Engle et al., 2007), and immaturity of the digestive tract (Lucas & Smith, 2015; Nyqvist, 2012), may impact establishment of breastmilk feeding. Additionally, mothers who have preterm infants, may themselves be ill, leading to additional barriers to breastfeeding (De Bortoli & Amir, 2016). Further, institutional barriers imposed by hospitalization in the NICU, such as strict feeding protocols, maternal-infant separation, and healthcare provider centered care may also detract from successfully establishing breastfeeding.

Study aims.

The purpose of this study was to explore maternal experiences with feeding preterm infants while in the NICU and to describe sources of information that are reflective of BSE theory. To this end, we sought to explore the question: Is BSE theory applicable to mothers of moderate and late preterm infants?

Breastfeeding self-efficacy theory.

BSE is a social change theory that has been used extensively in breastfeeding research and practice (Tuthill et al., 2015). BSE is influenced through four sources of information: (a) performance accomplishments, such as previous experiences and successes with breastfeeding behavior, (b) vicarious experience, such as seeing other women breastfeeding successfully, (c) verbal persuasion, such as breastfeeding encouragement from influential others, and (d) physiologic/affective responses, such as depression, anxiety, and fatigue (Bandura, 1977; Dennis, 1999; Dennis & Faux, 1999).

While BSE is predictive of breastmilk feeding outcomes in mothers of full term infants (Brockway et al., 2017), minimal research has explored this theory in mothers of moderate and late preterm infants (Gerhardsson et al., 2018; Wang et al., 2018).

Methods

Study design.

This qualitative descriptive exploration (Sandelowski, 2000, 2010) is a sub-analysis of a larger infant feeding sub-study of the Alberta Family Integrated Care (FICare) cluster randomized controlled trial (cRCT) in level II NICUs (Benzies et al., 2017; Brockway et al., 2018). The overall model of Alberta FICare involves parents, coaches (healthcare providers and family mentors), a structured curriculum, and implementation strategies focused on actively involving parents in the care of their infant while in the NICU. For this sub-analysis, we explored infant feeding experiences of mothers enrolled in the intervention arm of the Alberta FICare cRCT, while their infants were admitted to the level II NICU.

Setting and participants.

We recruited mothers from five level II NICUs located throughout Alberta, a province in western Canada. Alberta, has over 4 million residents, with over 56,000 births in 2018 (Alberta Government, 2019). Generally, preterm infants born after 32 weeks and weighing more than 1500g are admitted to level II NICUs (Barfield et al., 2012). We excluded infants with congenital anomalies or requiring palliative care, leaving us with mother-baby dyads whose main therapeutic goal was the establishment of oral feeding while maintaining target growth and development. All level II NICUs in this province formally support breastmilk as the primary infant feeding source (Alberta

Health Services, 2016). While lactation consultants (LCs) are predominantly registered nurses, for the context of this study, they work in a consulting role and therefore do not perform routine bedside care.

Recruitment.

Using purposive, maximum variation sampling (Kuzel, 1999), we selected mothers of preterm infants born from $32^{0/7} – 34^{6/7}$ weeks, enrolled in the intervention arm of the Alberta FICare trial, who experienced high mean differences in their breastfeeding self-efficacy scale scores (BSES) between NICU admission and discharge. Breastfeeding self-efficacy was assessed using the 18-item, modified breastfeeding self-efficacy scale for mothers of ill and preterm infants (Wheeler & Dennis, 2013). Mothers from the Alberta FICare intervention group who scored in the top or bottom quintiles of BSES change scores were invited to participate in a telephone interview. Selecting mothers based on their BSES change scores, situated BSE as the criterion reference (Boyatzis, 1998).

Data collection.

M.B. conducted semi-structured telephone interviews (Interview guide listed in Appendix D) until informational redundancy was achieved and no new topics or concepts emerged (Sandelowski, 2008). M. B encouraged participants to guide the conversation, with minimal probing and redirection to maintain the content of the interview within the context of the themes requiring verification. M. B digitally recorded interviews, which were then transcribed verbatim by a professional transcriptionist to ensure inclusion of all data and to enhance rigour.

Data analysis.

We used NVivo qualitative data analysis software (QSR International Pty Ltd. Version 11, 2015) to manage and organize the transcribed interviews. We conducted thematic analysis within a constructionist framework, focusing on the sociocultural context (such as NICU policies and relationships with practitioners) that inform infant feeding experiences. Using an inductive approach to thematic analysis (Boyatzis, 1998; Braun & Clarke, 2006) allowed us to develop final themes that were linked to the data and not to a previously determined theory.

Coding occurred through a three-step process. First, we read through transcripts to sense the themes, or find codes that emerged from patterns in the data (Boyatzis, 1998). Second, we classified patterns by giving those codes labels. Finally, we organized codes into potential themes, defined them and assigned names to each theme based on key concepts presented in each theme (Braun & Clarke, 2006). We then mapped out themes schematically to develop a thematic network, to better understand how the themes related to each other in the greater context of infant feeding experiences. To explore and describe BSE within the context of the NICU, we super-imposed the four sources of information from the BSE theory onto the defined themes.

Reflexivity statement.

While we approached maternal interviews from the standpoint of practitioners, we were confident that theming was driven by the data and that there was minimal interpretation. Further, we were cognizant to place self-efficacy to the side while allowing themes to emerge from the data inductively. Any codes that did emerge, which were blatant sources of BSE information, were labelled as such, memoed, and scrutinized for other potential meanings. As codes began to emerge and were developed into themes,

the preliminary qualitative findings were presented to practicing NICU nurses and neonatologists, soliciting feedback about their perceptions regarding the veracity of the theming. The themes resonated with clinicians and were consistent with their experiences. Further, codes and themes were reviewed amongst the authors to ensure rigor of the thematic analytical process and goodness of fit with their understanding of the data. This process enabled us to proceed with building a thematic network.

Ethical considerations.

Ethical approval for the study was granted by the Conjoint Health Research Ethics Board (CHREB ID REB15-0067), the University of Alberta, Health Research Ethics Board (Pro00060324), and the Covenant Health Research Ethics Board (ID 1762).

Findings

Overall, 61 mothers met the criteria to participate in interviews (31 with negative BSES change scores and 30 with positive scores) and 33 were approached for an interview; 16 mothers responded and 14 completed interviews. Interviews were between 15 and 45 minutes long, depending on the level of detail the mother wanted to share. Of note, we had to approach 20 mothers with negative change scores, compared to only 13 mothers with positive change scores in order to achieve a sample with sufficient balance of positive and negative change scores.

Fourteen mothers, (mean age = 29.71, *SD* = 6.23 years) of infants ranging from $32^{3/7}$ – $34^{6/7}$ weeks GA completed interviews from February 2017 to March 2018. The majority of mothers were primiparous (64.29%, *n* = 9), had a post-secondary education (64.29%, *n* = 9) with a household income > $80,000 per year (71.43%, *n* = 10). By

comparison, 53.49% of mothers in the overall FICare study intervention group were primiparous, 52.9% had a post-secondary education and 58.9% had a household income > $80,000. BSES change scores ranged from -9 to 40 points; six mothers with negative change scores and eight mothers with positive change scores were interviewed. Upon discharge from the NICU, 12 mothers were providing exclusive breastmilk to their infants, and two were feeding formula, yet still attempting to produce breastmilk by pumping. At the time of interview, infant ages ranged from 2- to 7 months corrected age; and 10 mothers were still breastfeeding. Two mothers weaned their infant after the 2-month check-up, and two were unsuccessful in producing any breastmilk.

Three major themes describing infant feeding experiences were identified: institutional influences, relationship with the pump, and establishing breastfeeding. Although the purpose of this study was to explore maternal infant feeding experiences while in the NICU, some themes straddled the home context. Thus, themes were fitted into either the NICU context, the home context, or both (Figure. 5.1).

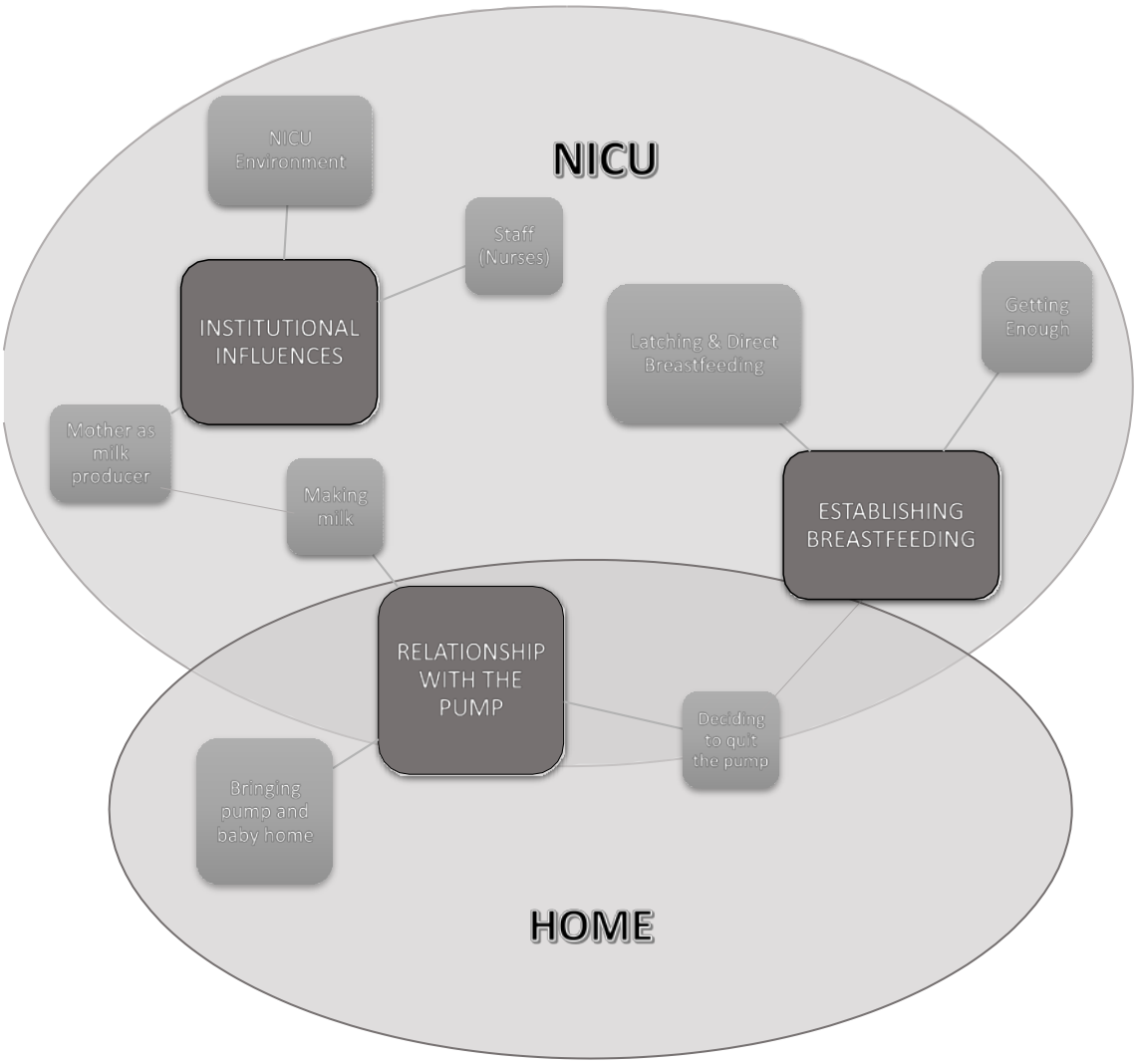

Figure 5.1. Thematic network of maternal experiences with infant feeding while in the NICU.

Theme one: Institutional influences.

Institutional influences described the role that the NICU, both socially and physically, had in informing maternal experiences with infant feeding. This theme is comprised of three sub-themes: NICU environment, staff, and mother as milk producer. All three themes worked to form maternal experiences with infant feeding, both from a positive and a negative standpoint. The overarching concept from the NICU environment was the primacy of the infant over the mental and physical health needs of the mother.

NICU environment.

The NICU is a complex environment that places structural and temporal requirements on infant feeding. Policies and procedures are in place to ensure targeted growth of the preterm infant. While some mothers complained about how the structure imposed by these policies interfered with their feeding experiences, others found routine reassuring.

> I felt like they were really big on the routine. You know like changing him and then feeding him. I liked that they…the nurses really, educated you a lot on how to go about that routine. I felt like it was very doable at home as well. (04 - positive)

Mothers found the physical separation from their infant while they were hospitalized in the NICU to be challenging. Some mothers were unable to be physically present at the bedside for feeding times due to their own health conditions or social situations. This separation presented a challenge to initiating and establishing breastmilk feeding. Many mothers highlighted this as a concern when discussing their infant feeding experiences. This separation also existed for mothers who were able to be at the bedside. Despite best practice being to provide skin-to-skin care, some mothers reported that they were not encouraged to hold their infants outside of feeding times.

> There were some nurses who discouraged me from ever holding my babies during that, like over and above feeding. I felt discouraged from holding them because they say that's like the biggest growth week in the womb, so they should just sleep all the time. But I've heard also that there's proven studies that skin-to-skin,

> chest-to-chest was also beneficial. I found that I was discouraged from doing that. I found it kind of disappointing. (03 - positive)

Mothers perceived several barriers, both physical and procedural, imposed by the NICU environment. They also mentioned that many supports were in place with regards to pumping and providing breastmilk for their infant.

Staff (nurses).

The NICU staff, specifically bedside nurses, were consistently identified as the most influential factor in maternal experiences with infant feeding. Mothers said nurses were reassuring, knowledgeable and provided support. Mothers tended to prefer the support of nurses over that of other professionals, even LCs. This appeared to be because the nurses were present around the clock, and they formed relationships with the mothers. "I think in that sense, the support from the nurses was number one, I think because really the lactation consultant is not with you 24/7, the nurses are." (09 - positive)

Mothers often found that the LCs were busy, and their consultations were being slotted into a busy schedule, whereas they found the consistent presence of the nurses helpful.

Additionally, some mothers found the LCs to be "overly enthusiastic" (12 - negative) with regards to breastfeeding and perceived these interactions to be overwhelming adding pressure to provide breastmilk.

> The lactation consultants were very excited if you asked them a question (laughs). They were very, very happy to provide any support they could. The other side of that being though they were so over keen it was a little overwhelming sometimes. (11 - negative)

Some mothers construed the LCs in negative ways; these mothers felt the breastfeeding agenda was placed over and above the health of the mother.

> The lactation consultant at the…NICU was very, very pushy. I heard her talking to other mothers and was very, very pushy with it...[T]here seemed to be no sympathy for what the mother was going through, (crying) at all. I just thought that the mental health of the mother and the stress that it is to pump, to try to get a baby to latch, to pump enough milk for it, to figure everything out that had just happened...that wasn't taken care of. (15 - negative)

Overall, mothers found the support provided by the NICU staff to be very influential in their infant feeding experiences. Mothers found nurses to be knowledgeable about breastfeeding and supportive techniques to help with initiating and establishing breastmilk feeding.

Mother as milk producer.

Several mothers indicated that there was a unit culture present on the NICUs of 'breast is best' and reported that they felt pressured to produce breastmilk. Pressure placed on the mother as the producer of breastmilk was a theme that was present in many interviews. Some mothers perceived this pressure as supportive in an environment that encouraged her not to quit; these tended to be the mothers who were more successful with providing breastmilk. Other mothers viewed this unit culture as an intensely negative experience, some even stated that it tainted the first months with their infant. "That breastfeeding agenda really, really just kind of ruined (crying) the first few months with my daughter. Like looking back on it, I missed the newborn stage with my daughter, I really, really did." (15 -negative)

Pressure to produce breastmilk started as soon as the infant was admitted to the NICU. Some mothers mentioned that the LCs visited them on the postpartum unit while they were recovering from their delivery and had not yet seen or held their infant. One mother stated, “I saw him briefly after 24 hours but then didn’t hold him till 48. But, before I’d even met my baby I had a stranger come and tweak my nipples and show me how to express breastmilk” (11 - negative). This statement highlights the priority that the NICU places on mothers producing breastmilk. Some mothers felt their breastmilk production was more valued than their role or presence at the bedside. Mothers equated their abilities to how much breastmilk they were able to express. They also felt this was reinforced by the staff on the NICU.

I Do you feel like you were evaluated based on what you pumped?

P Oh 100% that just about nailed it on the head. Because I could hear, I was in the space right outside the nurse’s station and it was, “This one’s a good pumper, and this one’s a good pumper, and this one’s not pumping so much.”

I So what’s a good pumper? Is it a producer like is it the amount of milk or how much you try?

P How much you’re producing. (15 - negative)

Despite the effort that mothers put in to pumping and trying to produce breastmilk, often they felt evaluated by their ability to produce. While most mothers were able to produce sufficient breastmilk through pumping, some were not, despite adhering to all of the recommended guidelines. They found their lack of ability to produce breastmilk frustrating. Even mothers who were successfully pumping and expressing

breastmilk felt that the emphasis was placed on how much they were able to produce rather than how much they were trying.

Theme two: The relationship with the pump.

Mothers were supported to produce breastmilk through pumping and rarely spoke about being supported to be with their infant or about developing the breastfeeding relationship. All mothers viewed their breastfeeding experience as a process that began with pumping and, if successful, progressed through to the infant latching and weaning off the pump. Conversely, mothers who viewed their breastfeeding experience as unsuccessful, were generally dependent on the pump to produce breastmilk. In fact, some mothers spoke about how the NICU emphasis on the pump imposed a separation from their infant and this was a barrier to establishing their breastfeeding relationship.

Making milk.

Training and instruction around pumping and producing breastmilk started as soon as the infant was admitted to the NICU. Most mothers found that the emphasis of breastmilk feeding was placed on pumping rather than breastfeeding.

> The lactation consultant in the ICU, or in the hospital was more about pumping than breastfeeding…my assumption was, because the child was in NICU and he needed breastmilk and bottle. There was lots of encouragement to pump and maybe to increase production …and, so it was a lot of attention paid to pumping. (01 - positive)

The action of pumping was so pervasive in the NICU that every mother spoke about her experience with it. Some mothers did not mind pumping and saw it as a way to help their infants.

> I think that's what kept me going kind of and made me happy that I could do that for her. Like, also that initially when I couldn't do anything for either of them, that I could still pump. I just put in my mind, "This is the only thing I can do for them, I'm gonna keep pumping because I wanna be able to feed them." That's kind of what made me happy I'd say. (03 - positive)

Conversely, other mothers struggled with pumping. They found it time consuming, uncomfortable, and overwhelming. While they viewed pumping as necessary to feed their infant, many mothers reflected on their pumping experience with disdain.

> Trying to pump, pumping was awful. Pumping is an awful experience. Breastfeeding is fine, pumping is uncomfortable and sucks, but it is what it is. So, I would say it was one of my biggest stresses while there. (11 - negative)

Every mother in this study, dedicated themselves to pumping and producing breastmilk. For many it was all encompassing; they scheduled their lives and their own nutrition around pumping and producing more breastmilk.

> So, basically, I was doing everything I could. I was pumping every two hours, I was taking the Motilium, I was on the medication, and I was eating oatmeal and eating watermelon and drinking water. It was all encompassing actually. (11 - negative)

Deciding to quit the pump.

Many mothers were continuing to use their pumps at the time of interview. However, this was predominantly for expressing breastmilk, so they could spend time away from their infants and not for additional supplementation. Other mothers spoke about ending their relationship with the pump and quitting pumping. Mothers only spoke

about quitting the pump once their infant had been discharged from the hospital and they were in the context of their home. “There's no way you could quit in the hospital because there was no support for that and I wasn't brave enough” (11 - negative). Mothers had different reasons for quitting the pump. Some mothers just did not have time to continue pumping and felt that their infants were able to receive sufficient breastmilk, directly feeding from the breast.

> Then we got home and we just gradually, well not gradually, I kind of just stopped pumping cuz there wasn’t time in a day for me to pump where I could sit down for half an hour and pump till I was empty. (10 - negative)

This mother was able to feed her infants sufficiently from the breast and did not need to pump to increase her production or supplement her infants. To this mother, quitting the pump was not a major event, because she was not dependent on it to feed her infants.

Conversely, other mothers tended to struggle with producing breastmilk, despite adhering to all the recommended pumping guidelines. Even after transitioning their infants onto formula while in the hospital, some mothers still felt that they needed to attempt to produce breastmilk through pumping until their infants were discharged home. At which point they would quit the pump:

> I still kept trying and I kept trying once I brought her home. Then there was a point where I just kind of said, “Enough is enough; it’s not getting any better,” so I went off the Motilium and just did formula. (13 - negative)

A defining factor for mothers who decided to quit pumping, was their confidence in knowing their infant was getting enough nutrition, either through direct breastfeeding or formula. These mothers did not believe that they were dependent on the pump to feed

their infants and possessed the autonomy to decide about their pumping. Mothers who were dependent on the pump to provide breastmilk to their infants did not express this autonomous decision-making around their pumping. Those mothers quit pumping only when physiologically and emotionally forced to do so. Quitting the pump for these mothers occurred after weeks and months of struggling to produce sufficient breastmilk and happened only once the mother reached a breaking point in her own well-being. These mothers also expressed feelings of failure, disappointment, and grief over their infant feeding experiences.

Bringing pump and baby home.

Taking the pump home proved to be a challenge for mothers. While mothers felt supported in the NICU to continue to pump, the reality of pumping once the infant came home soon led them to quit. The reality of caring for a preterm infant at home, while still trying to feed them and express breastmilk using the pump, was often overwhelming for mothers. One mother ended up discontinuing breastmilk feeding completely because continuing to pump at home was so overwhelming for her.

> I just looked like death because I wasn't sleeping. It was a process of breastfeeding her, topping her with the bottle, pumping and then like trying to [crying] sorry, breastfeed her, topping her up with the bottle, trying to get her to sleep and she would cry for like an hour. Trying to get her to sleep in the middle of the night and then I'd have to pump. Then they recommended like a 3 ½- to 4-hour schedule, so yeah that would be 2 hours and then I would get to sleep for maybe an hour and a half and then get up and have to do it all over again. That

went on for 3 months of me just getting hour and a half bursts of sleep. (15 - negative)

This mother's experience highlights the impact of being discharged from the NICU while still needing to pump breastmilk, and the importance of effective direct breastfeeding for successful continuation of breastmilk feeding. Because her infant was not receiving most of her breastmilk directly from the breast, this mother was having to top-up with her own expressed breastmilk and the workload was not sustainable.

Another mother whose infant was discharged while she still needed to pump found her milk supply decreased significantly after discharge. This mother was instructed at the infant's 2-month physician visit to start supplementing with formula because the infant's growth was not sufficient. At the time of the interview, this infant was no longer receiving breastmilk and was fed formula and solid foods. This mother felt disappointed with her breastmilk feeding outcomes, "The only thing is that I was disappointed in the breastmilk situation because I had wanted her to get enough breastmilk. I didn't want to put her on formula early you know" (12 - negative). Early cessation of breastmilk feeding led to feelings of disappointment and regret.

Theme three: Establishing breastfeeding.

In the NICU, breastfeeding started with pumping and then moved on to latching. It was constructed by accomplishments attained by both mother and infant. The mother was the sole producer of breastmilk, and many mothers viewed this as their primary role in the NICU. Maternal success of infant feeding was often gauged by the infant getting enough breastmilk. The emphasis on pumping in the NICU however, did not incorporate the role of the infant in the breastfeeding relationship.

Getting enough.

Mothers consistently used the term ‘getting enough’ as a measure of success in their infant feeding experience, and the first step in establishing breastfeeding. Getting enough generally referred to indicators that the infant was receiving sufficient breastmilk. Indicators included the amount of expressed breastmilk the infant drank or infant weight gain. One mother simply stated her biggest concern while her infant was in the NICU was, “How do you know if she is getting enough?” (15 - negative). Many mothers reflected this concern and spoke about how they were unsure if they would be able to produce enough breastmilk for their preterm infant.

> You just worry that they’re not eating properly…with M he didn’t always eat properly, he had a harder time getting the amount that he always needed. He only ever drank half of what he was supposed to be drinking from me...I was worried…that he wasn’t getting enough. (03 - positive)

Indications that their infants were getting enough were often pinnacle to mothers in their infant feeding experiences. When mothers believed their infants were getting enough, they also felt they would be successful with breastfeeding; especially when the infant began receiving sufficient nutrition from breastmilk and no longer required supplementation to grow.

> [I knew I would be successful] when I was able to keep that tube feed out and be able to solely breastfeed her and see that she was gaining weight. Seeing that she was content and sleeping. I would say that was the most rewarding and most positive experience for me. (06 - positive)

Latching and direct breastfeeding.

While a mother can continue to produce breastmilk via a pump, to some, it was not synonymous with breastfeeding. Pumping is labour and time intensive for mothers, whereas the infant successfully latching at the breast can be a much easier and more satisfying experience. Many mothers viewed their infant latching as a measure of their breastfeeding success. Having the infant successfully latch at the breast was routinely noted as a joyful experience for many mothers. When latching was successful, mothers reported this to be a turning point for them, knowing that breastfeeding would succeed.

> Once I was able to get her to the breast, once she was showing that she was able to suck, I felt like that was how I was going to feed her was through breastmilk. I never really thought that formula was going to have to be an option. (06 - positive)

Mothers found it distressing when their infant could not latch, “And when he…wasn’t latching properly that really, it was discouraging for me because I didn’t think that I was gonna be able to breastfeed” (07 - positive). Effective latching was an imperative step in developing a breastfeeding relationship. Latching was also imperative so that the mothers could wean off using a pump and move towards directly breastfeeding their infants.

To some mothers, having their infant receive their whole feed, directly from their breast was a pinnacle moment in their infant feeding experience. “[My greatest joy] I guess it would be like the very first time for the full feed through my breast and didn’t have to be touched up with the gavage [tube feed]” (09 - positive). While all mothers needed to start off by pumping their breasts to produce breastmilk, most were able to

move their infants over to predominantly direct breastfeeding prior to discharge. This appeared to be a distinguishing factor in breastfeeding duration and how mothers perceived breastfeeding success. Mothers who were still pumping at discharge and whose infants were not directly breastfeeding, tended to view their infant feeding experiences negatively.

> Yeah it upset me like cuz I saw it like not only for her to get like food and stuff but like as a bonding thing. I was worried if she was gonna go straight to the bottle then we were gonna miss out on that bonding time. (13 - negative)

This sub-theme also links back to the sub-theme of *bringing pump and baby home*; if the infant was not directly breastfeeding, the mother was dependent on the pump to produce breastmilk.

All mothers who were still providing breastmilk at the time of the interview were discharged from hospital predominantly directly breastfeeding their infants. These mothers spoke confidently about their breastfeeding and reflected positively on their NICU feeding experiences. “Right now, I know if I was to put my girls to the breast now, they can get their full feeding, there would be no questions asked.” (10 - negative). None of these mothers spoke of imminent plans to wean their infants and some even spoke about extending their breastfeeding goals because their infant feeding experiences were so positive. As such, the ability to effectively feed directly from the breast, appeared to be a defining point of continued breastfeeding after discharge from the NICU.

Breastfeeding self-efficacy theory.

Overlaying the four sources of information from the BSE theory onto the inductively coded themes (Table 5.1) indicated the presence of three of the four sources

of information (verbal persuasion, performance accomplishment, vicarious experience and physiologic/affective responses). First, verbal persuasion was evident in the institutional influences and relationship with the pump themes. Verbal persuasion as a source of information was highlighted both by mothers with positive and negative change BSES scores. Most mothers felt the support from nurses and the pro-breastfeeding environment were influential in their breastfeeding success. However, verbal persuasion was also deemed as a negative source for those mothers who struggled to produce or effectively latch their infants. They found the 'breast is best' messaging to be overwhelming and guilt-inducing.

Table 5.1. *Themes Overlaid with Breastfeeding Self-Efficacy Theory Sources of Information.*

THEME/ SUB-THEME	EXEMPLAR QUOTES	BSE SOURCES OF INFORMATION
INSTITUTIONAL INFLUENCES		
NICU ENVIRONMENT	I found limiting the fact that they um, what system of feeding, the feeding routine that they have, I found that very limiting and very frustrating…yeah they had to feed every three hours no matter what (02) [a]	None identified
STAFF (NURSES)	Honestly, the most support I got aside from my husband would have been the nurses in the NICU. They were absolutely phenomenal and still to this day I will hands down fight until I'm blue in the face, that if it was not for the nurses in the NICU I probably would not have been able to do this [breastfeed] (10) [a]	Verbal Persuasion
MOTHER AS MILK PRODUCER	I saw him briefly after 24 hours but then didn't hold him till 48. But, before I'd even met my baby I had a stranger come and tweak my nipples and show me how to express breastmilk (11)[a]	Verbal Persuasion

THE RELATIONSHIP WITH THE PUMP		
MAKING MILK	The lactation consultant in the ICU, or in the hospital was more about pumping than breastfeeding…there was lots of encouragement to pump and maybe to increase production or what-have-you…so it was a lot of attention paid to pumping (01)[b]	Verbal Persuasion
	It almost becomes a game in your head. "How much can I pump this time, how much can I get, can I get more, more, more, more. (15)[a]	Performance Accomplishment
DECIDING TO QUIT THE PUMP	Then we got home and we just gradually, well not gradually, I kind of just stopped pumping cuz there wasn't time in a day for me to pump where I could sit down for half an hour and pump till I was empty. (10) [a]	
BRINGING PUMP AND BABY HOME	I stopped breastfeeding her, I pumped, I weaned myself off the pump and we switched her to formula because I was done. I was an absolute mess. (15) [a]	Physiologic/Affective
ESTABLISHING BREASTFEEDING		
GETTING ENOUGH	When I was able to keep that tube feed out and be able to solely breastfeed her and see that she was gaining weight. Seeing that she was content and sleeping. I would say that was the most rewarding and most positive experience for me. (06) [b]	Performance Accomplishment
LATCHING AND DIRECT BREASTFEEDING	When she start to suck my breast, taking the milk that was one of the greatest thing. Because I was uncomfortable for her to get donor milk…so, I had to work with that so when I realize that she can actually get my breast and sucking from the breast that was it yes (12) [a]	Performance Accomplishment

Note. [a] Denotes quote taken from participants with negative Breastfeeding Self-Efficacy Scale (BSES) change scores.[b] Denotes quote taken from participants with positive BSES change scores.

Performance accomplishment was the second source of information that was present in the identified themes. This source of information was identified in the relationship with the pump and establishing breastfeeding themes, and was present in the making milk sub-theme, and the latching and getting enough sub-themes, respectively.

Finally, the physiologic/affective source of information did not emerge until mothers reflected upon their feeding experiences within the context of the home, once their infants were discharged from the NICU. The relationship with the pump theme included sub-themes where mothers were able to reflect upon the impact of pumping and time investments on their own well-being. Those who felt they were not coping or were overburdened by pumping, soon quit and switched to formula. Additionally, the physiologic/affective source of information was only identified in sub-themes that were represented exclusively with quotes from mothers who had negative BSES change scores. Some mothers pointed out that the pressure to provide breastmilk in the NICU was placed above maternal health and well-being, reiterating how the NICU environment placed the primacy of the infant over the well-being of the mother. This may have resulted in mothers not addressing their own needs until their infant was discharged from hospital.

Notably absent in the NICU was the BSE source of information, vicarious experience. Despite being asked specifically about their interactions with other breastfeeding mothers and seeing other women breastfeed or pump on the unit, no participants identified other mothers as influential to their infant feeding experience.

Discussion

The purpose of this qualitative descriptive study was to explore maternal experiences with infant feeding in a FICare NICU and to describe sources of information

that are reflective of BSE theory. Our findings indicate that the infant feeding experiences of mothers with moderate and late preterm infants were informed by institutional influences, their relationship with the pump, and the process of establishing breastfeeding in addition to breastmilk feeding. Mothers identified that overall, the NICU environment was very supportive to breastmilk feeding. However, emphasis was placed on the provision of breastmilk and not the holistic relationship of breastfeeding. While the NICU environment physically supported mothers to provide breastmilk through access to pumps, privacy screens, and pumping rooms, there was no mention of any institutional supports to help mothers establish direct breastfeeding with their infant. Policy makers should consider additional supports, such as mandatory 20-hour breastfeeding education for staff (World Health Organization & UNICEF, 2018) to better support mothers in establishing direct breastfeeding prior to discharge. Additionally, supporting families to remain in the NICU until direct breastfeeding, rather than oral feeding, is established may help to mitigate early cessation of breastmilk feeding.

The NICU environment was highly influential for mothers' infant feeding experiences. While many mothers felt constrained by the policies, procedures, and technological environment, most appreciated the supportive role that nurses played in informing their infant feeding experiences. However, mothers believed their role in the NICU was primarily as milk producer. The role of mother as the milk producer aligns with other exploratory studies of maternal experiences with feeding in the NICU (Sweet, 2008). Many mothers viewed their job in the NICU as that of making milk (Bower, Burnette, Lewis, Wright, & Kavanagh, 2017) and often viewed their breastmilk as a connection (Sweet, 2008) providing closeness with their preterm infant (Bujold, Feeley,

Axelin, & Cinquino, 2018). Practitioners in the NICU should be aware of this perception of mother as milk producer and facilitate other maternal role attainment strategies such as bathing, diapering, and holding their infant outside of feeding times.

The relationship with the pump featured heavily in all mothers' infant feeding experiences. Mothers accepted that they needed to pump to establish their breastmilk supply. This aligns with Bower et al. (2017) who reported that mothers found pumping for a preterm infant to be a full-time job. Mothers were well supported to pump while their infants were in hospital, but the reality of continuing to pump after discharge was overwhelming for many. Niela-Vilén et al. (2015) found that mothers often experienced a reality check when they brought their infant home and needed to balance caring for their infant with lack of skills and information around breastfeeding. In a qualitative content analysis of barriers to breastfeeding very low birth weight infants, mothers reported that the compromised health of their infant and their own compromised emotional health, were barriers to continuing to breastfeed upon discharge from the NICU (Callen et al., 2005). Further, many mothers perceived that the support provided to them in the NICU did not extend to home after infant discharge (Briere, McGrath, et al., 2015). Similar to our study, mothers who were discharged home still dependent on the pump soon discontinued pumping due to the added time constraints and workload. Providing anticipatory guidance around infant feeding after discharge, including strategies to wean from the pump, referrals to community-based breastfeeding support, and education around maternal self-care and infant feeding, may help to mitigate early discontinuation of pumping and cessation of breastmilk feeding.

The emphasis on producing breastmilk, rather than on establishing direct breastfeeding informed many mothers' feeding experiences. However, the progression from pumping, to latching, and then to direct breastfeeding appeared to be linked with breastfeeding success once these mothers returned home. This was despite the emphasis on pumping and producing breastmilk that mothers perceived from NICU staff and environment. This emphasis on pumping over direct breastfeeding has been noted in other studies (Briere, McGrath, et al., 2015; Niela-Vilén et al., 2015), indicating that the influence of direct breastfeeding on breastfeeding continuation may not be valued by staff in the NICU environment. However, direct breastfeeding at discharge from the NICU has previously been associated with longer breastfeeding duration in preterm infants (Pinchevski-Kadir et al., 2017). Further, placing the additional work of pumping on the already heavy workload of caring for and feeding an infant, often overwhelms mothers and can lead to early discontinuation of breastmilk feeding (Niela-Vilén et al., 2015). Mothers who were able to provide the majority of feeds directly from the breast did not speak of this additional workload and stress and were able to continue their breastfeeding relationship with their infant successfully. This is an important distinction to make in care provision when supporting mothers in the NICU to establish breastfeeding, and further supports the need for care providers to support mothers to establish direct breastfeeding prior to discharge from the NICU.

Breastfeeding self-efficacy.

The findings from this study indicate that BSE is likely an applicable theory to mothers of moderate and late preterm infants. While not all sources of BSE information were identified in the inductively coded themes, three important influences were noted

repeatedly. Verbal persuasion was evident in the support provided by staff and messaging around the unit. Verbal persuasion is particularly important in the early stages of breastfeeding when mothers are mastering their skills (Bandura, 2012; Kingston et al., 2007); the impact of which depends on how the mother perceives the provider's level of expertise and knowledge. The highly technological and medical environment of the NICU situates healthcare providers as experts and mothers as novices. All mothers in this study viewed the nurses as expert, especially within the context of providing breastfeeding support. Further, the high-tech and isolating environment of the NICU may have impacted the lack of vicarious experience identified in the themes. Kingston et al. (2007) found that vicarious experience was a significant predictor of maternal BSE. However, this influence was not overtly identified in our study, despite direct questioning about this topic. It can be posited that the physical layout and the emphasis on privacy in the NICU, may influence maternal interactions with other families. Many of the NICUs in the province where this study was conducted have single rooms or small pods and those that do not, have physical barriers in place to enhance family privacy and to support extended parental presence. While the impact of this separation is still being investigated, some studies have found that mothers may be isolated and have minimal interaction with other families in the NICU (Pineda et al., 2011). Thus, it may be important to consider the physical layout of the NICU when considering sources of information and increasing BSE in mothers of preterm infants. Further research should evaluate the impact of NICU layout on maternal psychosocial outcomes and BSE.

Performance accomplishments are arguably the most impactful influence on BSE in mothers of full-term infants (Dennis, 1999; Kingston et al., 2007). Achieving

milestones such as full breastmilk feeds, latching, and eliminating supplementation, provide affirming messages to mothers regarding their breastmilk feeding capabilities. Our findings also indicate that performance accomplishments may be highly influential to BSE in mothers of preterm infants. This source of information was identified as an efficacy enhancer in themes that were dominated by mothers with positive BSE change scores, such as establishing breastfeeding, and as a detractor in themes that were dominated by mothers with negative BSE change scores, such as relationship with the pump.

The influence of maternal physiologic and affective status was identified only after mothers had reflected on their infant feeding experiences after discharge from the NICU. Because the NICU environment places the primacy of the infant over the well-being and mental health of the mother, maternal health is not prioritized in the NICU. Further, mothers are focused on the survival and growth of their preterm infant, and mothers of infants admitted to the NICU do not typically demonstrate a clear hierarchy of needs as outlined by Maslow (Bialoskurski, Cox, & Wiggins, 2002). As such, mothers placed their needs as secondary to their infant (Maher & Souter, 2006), and physiologic and affective status may not cognitively be recognized by these mothers until they are discharged home and able to reflect upon their own health. Viewing the mother as an integral component of the mother-infant dyad, rather than just placing the primacy of the infant over the well-being of the mother may help to encourage mothers to consider their own well-being while their infant is in hospital. Enabling healthcare providers to offer appropriate time and resources to consider and accommodate maternal well-being may help to enhance maternal breastfeeding self-efficacy and overall health.

Strengths and Limitations

The use of semi-structured interviews allowed mothers to explore their own infant feeding experiences without leading questioning and with minimal influence from the interviewer. A potential limitation of this study was the time that had elapsed between hospital discharge and the interview. Interviews were conducted between 4 weeks and 7 months corrected age; the time elapsed may have resulted in different maternal perceptions of their infant feeding experiences because infants were at different stages of growth and development. However, previous research indicates that maternal recall regarding infant feeding is valid up to 6 years post-birth (Amissah, Kancherla, Ko, & Li, 2017).

Situating participant sampling within BSES change scores, allowed researchers to capture experiences of both mothers with high and low BSE. The limitation of using inductive thematic analysis includes risk of theoretical contamination. Braun and Clarke (2006) state that “researchers cannot code data in an epistemological vacuum” (p. 84). A potential limitation of this design was the risk of BSE theory influencing the coding items. The primary author (MB) bracketed by disclosing any knowledge of and affinity for the BSE theory (Fischer, 2009) to her supervisor and second author (KB). Additionally, MB conducted reflexive memoing and sought feedback from KB regarding potential theoretical contamination in the coding process. Further, representative quotes, directly from the data, were provided to ensure accuracy and credibility. Finally, MB maintained an audit trail of raw data records, transcripts, and reflexive memos to better enhance the trustworthiness of the thematic analysis (Nowell et al., 2017).

To our knowledge, this is the first study to qualitatively explore how BSE theory applies to mothers of preterm infants. Future research should include a quantitative assessment to determine if BSE is predictive of breastfeeding outcomes in mothers of moderate and late preterm infants.

Conclusion

Maternal experiences with infant feeding while in the NICU fundamentally inform the sequalae of infant feeding choices and provision of breastmilk that occurs after discharge. Mothers who were successful in establishing full and direct feeds from the breast prior to discharge tended to still be breastfeeding when interviews were conducted. Conversely, mothers who needed to pump after discharge to supplement their infant with expressed breastmilk weaned their infants from breastmilk soon after discharge. Many of these mothers expressed feelings of sadness and guilt around their experience.

There were three BSE sources of information that were evident in the themes that emerged from inductive coding. Verbal persuasion was apparent in the constant support that nurses provided to mothers while feeding their infants. Also, the ‘breast is best’ messaging that was prevalent in NICUs helped to enhance this verbal persuasion for mothers who were successful. Performance accomplishments were evident in the way mothers spoke about pinnacle moments in their infant feeding experience such as how much milk they pumped, or how their infant was latching . While physiologic/affective state was recognized in the themes, it is important to note that this theme did not emerge until after the infants were discharged and was evident only in mothers with negative BSES change scores.

Vicarious experience was not represented in the emergent themes. This could be due to the expert environment of the NICU and the physical layout of the NICU to enhance family privacy. While not all sources of information were represented in this study, the three that were present are considered to be highly influential in maternal success with breastfeeding and improving BSE (Kingston et al., 2007). Further empirical research needs to be conducted to examine if BSE is predictive of breastmilk feeding outcomes in this population and if BSE is an appropriate social change theory to increase breastmilk feeding rates in mothers of moderate and late preterm infants.

Relevance to Clinical Practice

Care providers, NICU managers, and policy makers need to be aware of the influence that institutional culture and policies may have on maternal BSE and potentially on resultant breastmilk feeding outcomes. Further, emphasis should be placed on transitioning mothers from the pump to direct breastfeeding prior to discharge whenever possible. Sufficient training of staff through the WHO 20-hour breastfeeding training for healthcare professionals may help to better facilitate this transition (World Health Organization & UNICEF, 2018). The findings from this study, in combination with the literature indicate that direct breastfeeding at discharge from the NICU is paramount in continued breastmilk feeding and breastfeeding success.

Chapter 6 – Examining the impact of Alberta Family Integrated Care on maternal breastfeeding self-efficacy and breastmilk feeding in mothers of moderate and late preterm infants: A mixed-methods study.

Introduction

Moderate and late prematurity accounts for over 80% of preterm births; with 12% of preterm infants born moderately preterm ($32^{0/7}$ – $34^{6/7}$ weeks gestation) and 72% of preterm infants born late preterm ($35^{0/7}$ – $36^{6/7}$ weeks gestation) (Shapiro-Mendoza & Lackritz, 2012). While moderate and late preterm infants are at reduced risk for morbidity compared to early preterm infants, they still have numerous short and long-term concomitant issues associated with prematurity (Boyle et al., 2015; Harijan & Boyle, 2012). Breastmilk feeding helps to ameliorate many of these conditions (Victora et al., 2016). However, preterm infants tend to have lower breastmilk feeding rates than their full-term counterparts (Hackman et al., 2016; Ross & Browne, 2013) and may not fully benefit from the protection that breastmilk can provide. As such, there is a need to explore and develop evidence-based interventions that increase breastmilk feeding rates in mothers of moderate and late preterm infants. Family Integrated Care (FICare) is a model of care that may enhance breastfeeding self-efficacy (BSE), thereby improving breastmilk feeding outcomes in mothers of moderate and late preterm infants.

The purpose of this chapter was to address the research question: What is the effect of Alberta FICare on maternal BSE and subsequent breastmilk feeding rates at discharge from NICU? Further, this chapter will serve to integrate the qualitative and quantitative findings and aims to address the overall mixed-methods research question:

How does Alberta FICare work to inform maternal BSE and resultant breastmilk feeding rates in mothers of moderate and late preterm infants who were admitted to a level II NICU?

Methods

In this sub-study, I employed a sequential explanatory mixed method design (Fetters, Curry, & Creswell, 2013), in two phases. Using an explanatory sequential design allowed for the convergence of the findings from the qualitative and quantitative phases to corroborate and explain the quantitative results of the study (Greene, Caracelli, & Graham, 1989). In phase one, I explored infant feeding experiences of mothers from the intervention arm of the Alberta FICare trial, relating the findings to the four sources of information in the BSE theory (Chapter 5). Due to a delay in quantitative data collection, I conducted and analysed the interviews prior to the quantitative phase. Conducting the interviews prior to analyzing the quantitative data allowed for me to analyze the data with no preconceptions or assumptions about infant feeding outcomes in this sample. In phase two, I examined group differences in BSE scores and breastmilk feeding at discharge from the NICU to determine if Alberta FICare influenced breastfeeding outcomes. Finally, I integrated results from both phases by merging the data using an integration matrix (Fetters et al., 2013).

Alberta Family Integrated Care (FICare) in Level II NICUs.

Alberta FICare is discussed extensively in Chapters one and four. Briefly, FICare is a culture shift that seeks to integrate parents into the care of their preterm infant as soon as they are able, after admission to the NICU. Healthcare providers become educators and supporters of care, and parents provide non-medical care. Specifically,

Alberta FICare includes three components: (a) parent education; (b) access to parent support through peers and professionals; and (c) information sharing through parent involvement in multidisciplinary rounds and reciprocal communication (Benzies et al., 2017). The theory of change is represented in Figure 6.1.

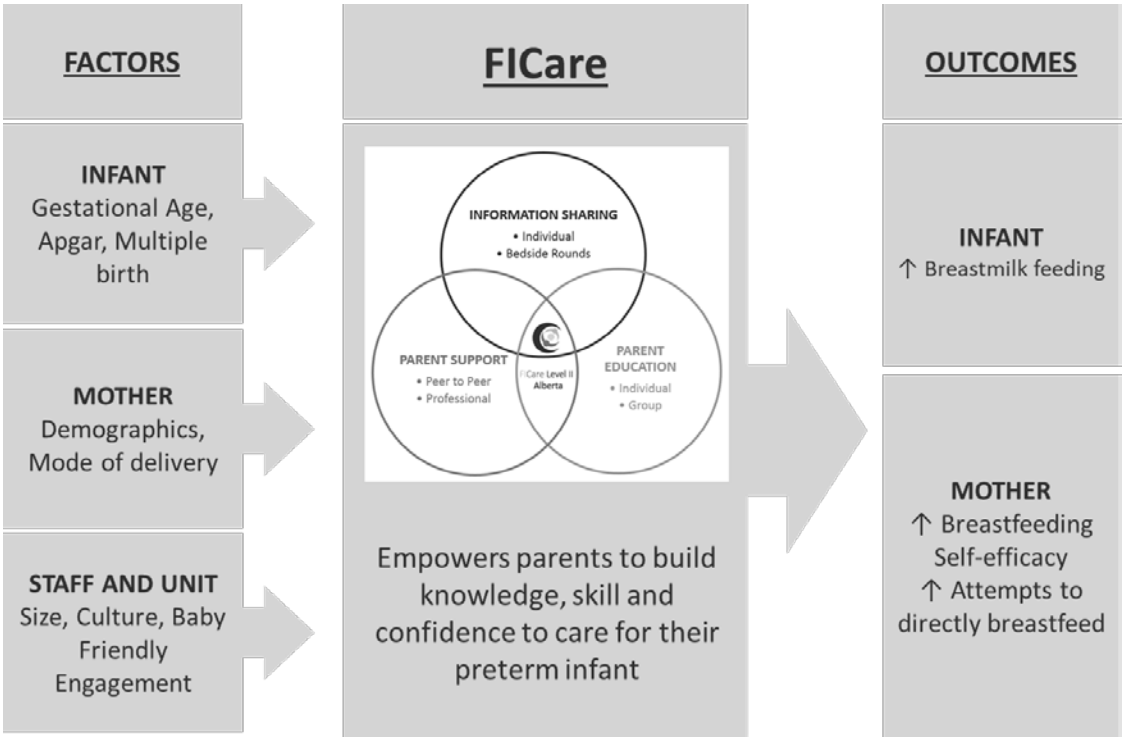

Figure 6.1. Alberta FICare theory of change (adapted for infant feeding outcomes from (Benzies et al., 2017)

Qualitative phase.

Qualitative analysis is described in Chapter 5. Briefly, during quantitative data collection for the FICare trial, I calculated maternal BSE change scores monthly from January 2017 – January 2018. Mothers recruited over this time period, who were enrolled in the intervention arm of the trial with BSE change scores in the top or bottom quintile were invited to participate in semi-structured telephone interviews (interview guide in

Appendix D) to discuss their experiences with infant feeding while in the NICU. I recruited and interviewed mothers until informational redundancy was achieved. Data were transcribed verbatim and analyzed inductively using thematic analysis (Boyatzis, 1998; Braun & Clarke, 2006). Coding occurred in a three-step process. Initially, I read through the interviews to sense high level themes and identify patterns in the data. Next, I classified the codes and provided them with labels. Finally, codes were organized into potential themes and labelled. The final step was an iterative process that occurred between myself and my supervisory committee. Finalized themes were organized into a network map to describe maternal experiences with infant feeding in the NICU (Attride-Stirling, 2001).

Quantitative.

Maternal questionnaires were administered within 7 days of birth of the infant and within 7 days prior to discharge from the NICU. Surveys included demographic information, assessments of maternal social, emotional and mental well-being, maternal stress, and infant feeding (Table 1). BSE was assessed using the modified breastfeeding self-efficacy scale (BSES) for mothers of ill and preterm infants (Wheeler & Dennis, 2013). Breastmilk feeding outcomes were assessed using 24-hour recall and categorized according to the Labbok and Krasovec (1990) classification system. Due to high prevalence of breastmilk feeding at discharge, I collapsed breastmilk feeding outcomes into exclusively breastmilk fed (100% breastmilk in previous 24 hours) and non-exclusively breastmilk fed (all other categories combined). Direct breastfeeding was assessed as number of attempts to bring infant to breast in the past 24 hours. Direct breastfeeding was also collapsed into two categories to align with the outcome measure

of high frequency exclusive breastfeeding (≥ 6 direct breastfeedings per day) as described in the international FICare cRCT (O'Brien et al., 2018).

Table 6.1. *Outcome Measures and Potential Confounding with Breastfeeding Self-efficacy and Breastmilk Feeding outcomes*

Measure	Time Point	Description
Primary Outcome		
Modified Breastfeeding Self-Efficacy Scale - Short Form (Wheeler & Dennis, 2013)	Baseline; Discharge	18-item scale validated for mothers of ill and/or preterm infants. Assesses a mother's confidence in her ability to breastfeed. Internal consistency (0.88) is high. For this study, Cronbach's alpha for the modified BSES-SF was .95 at admission and .93 at discharge from the NICU**.**
Secondary Outcome		
Breastmilk feeding (Labbok & Krasovec, 1990)	Baseline; Discharge	Labbok and Krasovek classification system, modified to include additives and fortification. 24-hour maternal recall.
Co-Variates and Potential Confounders		
Parental Stressor Scale: NICU (Miles et al., 1993)	Baseline; Discharge	50-item scale that captures parental perceptions of stress in the NICU: (1) sights and sounds; (2) appearance and behaviour of the infant; (3) impact on the parental role and relationship with the infant; and (4) parental relationship and communications with staff. Internal consistency (0.89 to 0.94 for the total scale) and test-retest (0.87) reliabilities are high. ***Potential Confounding:*** Decreasing maternal anxiety and stress will have a physiologic impact on breastmilk production (Dewey, 2001; Zanardo et al., 2011).
Edinburgh Postnatal Depression Scale (Cox et al., 1987)	Baseline; Discharge	The most commonly used pre- and post-natal depression screener validated for mothers. Consists of 10 items and has a sensitivity of 0.86 and specificity of 0.78, with a positive predictive value of 73%. ***Potential Confounding:*** Successful breastfeeding is predictive of lower maternal depressive symptomology Depression may be predictive of reduced breastfeeding rates (Hahn-Holbrook et al., 2013)
State-Trait Anxiety Inventory * (Spielberger et al., 1970)	Baseline; Discharge	40-item scale that captures dispositional/trait anxiety (20 items) and current state anxiety (20 items). Internal consistency (0.86 to 0.95) and test-retest (0.73 to 0.86) reliabilities are high. Scores on the STAI and PSS: NICU are correlated (Miles et al., 1993). ***Potential Confounding:*** Mothers with high rates of anxiety or depressive symptomology have lower breastfeeding rates than mothers that do not (Hahn-Holbrook et al., 2013).
Perceived Maternal Parenting Self-Efficacy scale (Barnes & Adamson-Macedo, 2007)	Baseline; Discharge	20-item measure of parenting self-efficacy validated for mothers of preterm infants. Captures maternal perceptions of ability to (1) give basic care; (2) elicit change in infant behaviour; (3) recognize infant behaviour; and (4) judge interactions with her infant. Exploratory factor analysis confirms four factors; internal consistency (0.91) and test-retest (0.96) reliabilities are high. Concurrent validity between general self-efficacy and BSES-SF (Dennis & Faux, 1999). ***Potential Confounding****:* Concurrent validity between general self-efficacy and BSES-SF (Dennis & Faux, 1999).

Note. Adapted from (Brockway et al., 2018).

Data analysis. I conducted analyses in SPSS version 24 (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.). In the case of twins, I only included one twin when assessing for breastmilk feeding. To limit selection bias, I randomly selected either twin A or twin B to be included in the data analysis. Omnibus tests (chi-square and *t*-tests) were used to determine if baseline group differences existed between the FICare and standard care groups. I conducted chi-square analyses on categorical data (breastfeeding outcomes, direct breastfeeding and provision of donor human milk [DHM]) and repeated measures analysis of co-variance (RM-ANCOVA) on BSE scores between admission and discharge. Potential covariates to include in the RM-ANCOVA were identified from the literature review (Chapter 2) and assessed for correlations with BSE scores. Significantly correlated covariates with a *p*-value of $\leq .001$ were moved into the RM-ANCOVA (See Appendix E for correlation table). To align with analyses from O'Brien et al. (2018), I stratified the infants by moderate and late preterm, to determine if outcomes differed by stage of prematurity.

Integration

The Alberta FICare components (parent education, parent support, and information sharing) were overlaid upon the three themes identified in the qualitative findings of this study. An integration matrix was developed and verbatim quotes from maternal interviews were used to support linkages between themes and the Alberta FICare components. In mixed methods research, effective integration leads to inferences which are conclusions and interpretations that are used to answer the research question(s) (Bergman, 2008). Inferences from the above linkages were developed and linked back to care practices within the NICU that work to support or detract from BSE and breastmilk

feeding outcomes. I also used these inferences to pose suggestions for future improvement to the Alberta FICare model, with regards to breastfeeding outcomes.

Phase	Procedure	Outcome
Quantitative Data Collection Jul 2016 – Dec 2018	• Interim analysis of cRCT BSES survey data	• BSES change (Δ) scores
Case selection: Qualitative sample Nov 2016 – Jan 2018	• Maximum variation sample • Top and bottom quintile of BSES change scores	• *n* = 61 met criteria • *n* = 31 negative BSESE Δ • *n* = 30 positive BSES Δ • 28 invited for interviews
Qualitative data collection Jan 2017-Feb 2018	• Telephone interviews • 2-7 months after discharge • Data saturation	• Participants (*n* = 14)
Qualitative data analysis Feb 2018-Sept 2018	• Inductive coding • Thematic analysis	3 Themes o Institutional influences o Relationship with the pump o Establishing breastfeeding
Quantitative Data Collection Jul 2016 – Dec 2018	• Quantitative survey data o 1^0: Breastfeeding self-efficacy o 2^0: Breastmilk feeding rates	• *n* = 457 participants included in analysis
Quantitative Data Analysis Jan – Feb 2019	• Chi Square • RM-ANCOVA	• BSES outcomes • Breastmilk feeding rates • Effectiveness of FICare
Integration of qualitative and quantitative results Feb – April 2019	• Integration of qualitative results (3 themes), quantitative results, and 3 elements of FICare	• Opportunities to enhance BSE and breastmilk feeding in the NICU • Opportunities to examine system influences on BSE and breastmilk feeding • Opportunities to integrate BSE into FICare.

Figure 6.2. Final Mixed Methods Study Flow Diagram

Results

Qualitative results.

Overall, 61 mothers met the criteria to participate in the qualitative phase of the study. Fourteen mothers (six with negative BSES change scores and eight with positive BSES change scores), with a mean age of 29.71 years (SD = 6.23), and whose infants ranged from $32^{3/7} – 34^{6/7}$ weeks GA, completed interviews. BSES change scores ranged from -9 to 40 points. At the time of the interviews, infant ages ranged between 2 months and 7 months corrected age.

Themes.

I identified three major themes: (a) institutional influence, (b) relationship with the pump, and (c) establishing breastfeeding; each with sub-themes that describe maternal experiences with infant feeding while on a FICare NICU. These themes are discussed extensively in Chapter 5.

Quantitative results.

Overall, 457 mother-infant dyads were included in this study (see Figure 6.2 for final study flow diagram). Mean gestational age was $33^{6/7}$ weeks (*SD* = 5.58 days, range $32^{0/7} – 34^{6/7}$ weeks) with a mean length of stay of 18.57 days (*SD* = 8.34 days, range 4 – 61 days). Mean maternal age was 31.09 years (*SD* = 5.47 years). Maternal and infant characteristics are displayed in Table 6.2.

Group differences at baseline.

Baseline characteristics of infants and mothers are shown in Table 6.2. Except that a higher proportion of infants in the standard care group were born late preterm (≥ 34 weeks GA; $\chi^2(1) = 4.01$, $p = .045$), groups were similar at baseline. No baseline

differences for maternal characteristics, intention to breastfeed, mode of delivery, or maternal psychosocial variables were identified.

Table 6.2. *Characteristics of Mothers and Infant*

	Mothers (*N* = 457)			
	FICare (*n* = 258) *n* (%)	Standard (*n* = 199) *n* (%)	χ^2	*p*-value
Maternal Age (years)			12.08	0.06
≤ 20	11 (4.3)	3 (1.5)		
21-25	39 (15.1)	20 (10.1)		
26-30	69 (26.7)	60 (30.)		
31-35	88 (34.1)	69 (34.7)		
36-40	41 (15.9)	34 (17.1)		
41-45	10 (3.9)	8(4.0)		
> 45	0 (0)	5 (2.5)		
Employment			7.20	0.30
Employed Full-time (> 30 hrs/week)	64 (24.8)	53 (26.6)		
Employed Part-time (< 30 hours/week)	11 (4.3)	7 (3.5)		
Student	3 (1.2)	6 (3.0)		
Parental leave	104 (40.3)	92 (46.2)		
Homemaker/At-home parent	37 (14.3)	24 (12.1)		
Unemployed /in-between jobs	15 (5.8)	7 (3.5)		
Other	23 (8.9)	10 (5.0)		
Education			2.82	0.42
Less than high school diploma	19 (7.4)	10 (5.0)		
High school diploma	36 (14.0)	22 (11.1)		
Certificate or diploma after high school	66 (25.6)	48 (24.1)		
College or University degree	136 (52.7)	119 (59.8)		
Ethnicity			16.13	0.09
White (Caucasian)	193 (74.8)	130 (65.3)		
Aboriginal (e.g. First Nations, Inuit, or Metis)	18 (7.0)	8 (4.0)		
Chinese	2 (0.8)	1 (3.33)		
Black	5 (1.9)			
South Asian (e.g. East Indian, Pakistani, Sri Lankan)	6 (2.3)	8 (4.0)		
Latin American	6 (2.3)	7 (3.5)		
Southeast Asian (e.g. Vietnamese, Cambodian, Malaysian)	3 (1.2)	4 (2.0)		
Filipino	20 (7.8)	16 (8.0)		
Arab	2 (0.8)	2 (1.0)		
Korean	0 (0.0)	2 (1.0)		
Other (please specify):	3 (1.2)	10 (5.0)		
Household income			4.17	0.65
< $19,999	6 (2.3)	8 (4.0)		
$20,000-$39,999	12 (4.7)	6 (3.0)		
$40,000-$59,999	23 (8.9)	26 (13.1)		
$60,000-$79,999	25 (9.7)	21 (10.6)		
More than $80,000	152 (58.9)	108 (54.3)		
Don't know	14 (5.4)	10 (5.0)		
Prefer not to answer	25 (9.7)	19 (9.5)		

Parity			0.08	0.79
Primiparous	138 (53.5)	109 (54.8)		
Multiparous	120 (46.5)	90 (45.2)		
Delivery mode			5.26	0.154
Vaginal	124 (48.1)	108 (54.3)		
Caesarean	126 (48.8)	84 (42.2)		
Instrumental	6 (2.3)	2 (1.0)		
Unknown	2 (0.8)	5 (2.5)		

	Infants (*N* = 457)			
	FICare (*n* = 258)	Standard (*n* = 199)	χ^2	*p*-value
Infant Sex			0.027	0.87
Female	116 (45.0)	91 (45.7)	0.07	0.79
Male	142 (55.0)	108 (54.3)		
Multiples			1.36	0.24
Singleton	217 (84.1)	159 (79.9)		
Twins	41 (15.9)	40 (20.1)		
Prematurity			**4.01**	**.045**
Moderate	128 (49.6)	80 (40.2)		
Late	130 (50.4)	119 (59.8)		

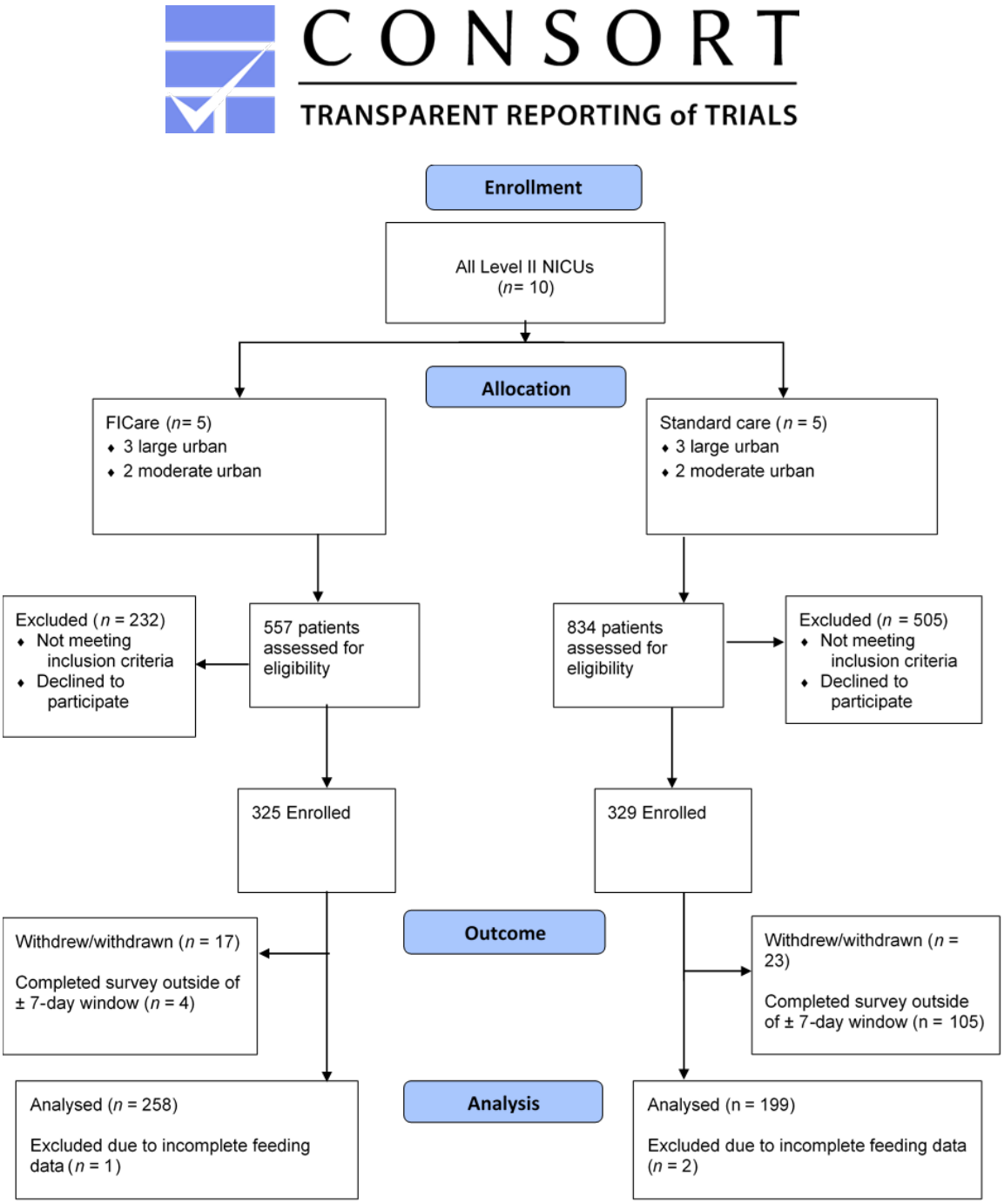

Figure 6.3. CONSORT flow diagram

Breastfeeding outcomes.

Mothers reported successful initiation of breastmilk feeding with 97.6% (*n* = 446) providing any breastmilk to their infant at some point over their NICU stay. At discharge from the NICU (Figure 6.3), the majority of infants were exclusively receiving breastmilk at discharge, 70.2%, *n* = 321, while only 4.2%, *n* = 19, were not receiving any breastmilk. Over 70% of infants (72.2%) received DHM at some point during their NICU stay, with significantly more infants in the Alberta FICare group (76.4%) receiving DHM compared to those in the standard care group, 66.8%, $\chi^2(1) = 5.08$, $p = .024$. While mothers in the Alberta FICare group had higher rates of exclusive breastmilk feeding at discharge, 72.1%, *n* = 186, compared to mothers in the standard care group, 67.8%, *n* = 135, these differences were not statistically significant, $\chi^2(1) = 0.973$, $p = .324$. When I stratified outcomes for moderate ($32^{0/7} – 33^{6/7}$) and late ($34^{0/7} – 34^{6/7}$) preterm infants, I found that

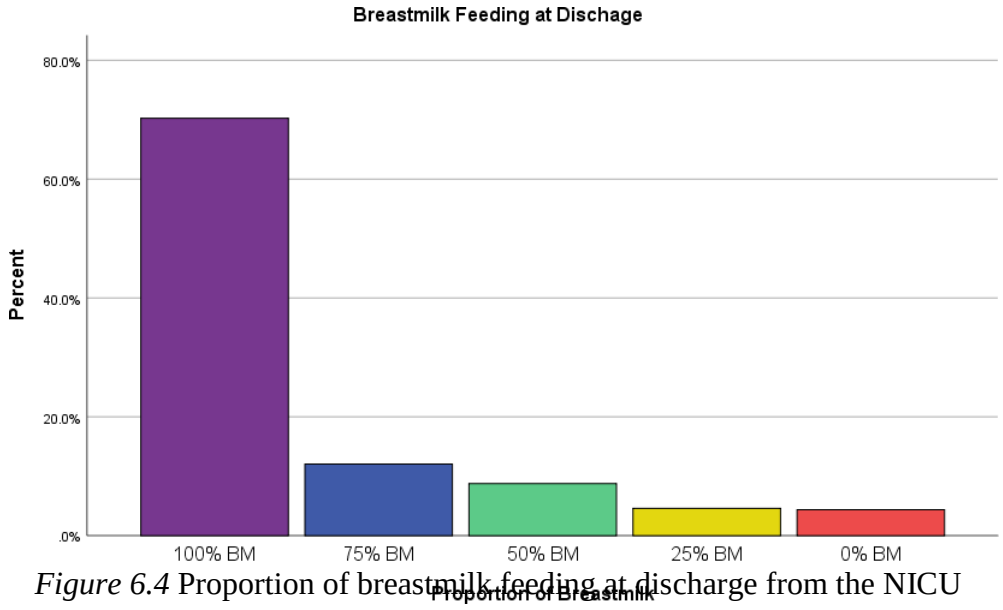

Figure 6.4 Proportion of breastmilk feeding at discharge from the NICU

exclusive breastmilk feeding in late preterm infants enrolled in Alberta FICare group was higher (72.3%), but not significantly higher compared to the standard care group, 62.2%,

$\chi^2(1) = 2.90$, $p = 0.089$; no difference was noted in proportion of breastmilk feeding for moderate preterm infants.

Mothers in the Alberta FICare group had mean direct breastfeeding attempts of 5.03 (*SD* = 3.46, range = 0–16), in the 24 hours prior to completing the discharge questionnaire, whereas mothers in the standard care group had a mean of 4.76 attempts (*SD* = 3.9, range = 0-18). Collapsing these data into low frequency (≤ 5) and high frequency (≥ 6) attempts to directly breastfeed per day (O'Brien et al., 2018), I found that mothers in the Alberta FICare group were significantly more likely (45.1%) to attempt to directly breastfeed their infant 6 or more times per day compared to mothers in the standard care group, 35.2%, $\chi^2(1) = 4.42$, *OR* 1.28, 95% CI [1.01, 1.62], $p = .035$.

Breastfeeding self-efficacy

Data for the BSES were not normally distributed, demonstrating a substantial negative skew. To accommodate for skewness, I conducted a reflected square root transformation of the BSE data. This transformation resulted in a normal distribution. Conducting a repeated measures analysis of co-variance (RM-ANCOVA) on the transformed BSES data resulted in the same results as the RM-ANCOVA on non-transformed data. As such, I chose to work with the original, non-transformed data set as true BSES scores will be more meaningful to clinicians than transformed data.

Overall, Alberta FICare was effective at improving BSES scores in mothers of moderate and late preterm infants. Mothers in the Alberta FICare group had mean admission BSES scores of 66.01 (*SD* = 14.10) and mean discharge BSES scores of 76.52 (*SD* = 12.49). Comparatively, mothers in the standard care group had mean admission BSES scores of 65.65 (*SD* = 14.36) and mean discharge BSE scores of 73.37 (SD =

13.17). Unadjusted models indicated that mothers in the Alberta FICare group had significantly greater improvements in their BSES scores between admission and discharge from the NICU compared to mothers in the standard care group, $F(1, 435) = 5.86$, $p = .016$, partial $\eta^2 = .013$.

Adjusting for co-variates of depression, exclusive breastmilk feeding, additives, and state anxiety at discharge that were significantly correlated with BSES scores at discharge ($p < .001$), a RM-ANCOVA indicated that mothers in the Alberta FICare group experienced significantly larger increases in their BSES scores compared to mothers in the standard care group, $F(1, 435) = 4.05$, $p = .045$, partial $\eta^2 = .009$, but with a negligible effect size (Cohen, 2013; Ferguson, 2009). A post hoc power analysis (Erdfelder, Faul, & Buchner, 1996) demonstrated that this analysis was well powered at 0.99, $n = 435$. As such, when I adjusted for covariates, the impact of FICare on BSES still remained.

Further, when I stratified the sample into moderate ($32^{0/7} – 33^{6/7}$) and late ($34^{0/7} – 34^{6/7}$) preterm infants, I found that mothers of moderate preterm infants enrolled in Alberta FICare no longer had significantly higher increases in their BSES scores when compared to mothers in the standard care group, $F(1, 191) = 0.79$, $p = .375$. Whereas, the effects of Alberta FICare on BSES remained for mothers of late preterm infants, $F(1, 232) = 3.97$, $p = .048$, partial $\eta^2 = .017$, demonstrating a small effect size. A post hoc power analysis (Erdfelder et al., 1996) demonstrated that this analysis was well powered at 0.99, $n = 238$. As such, I can surmise that Alberta FICare is effective for improving BSE in mothers of late preterm infants, but not for mothers of moderate preterm infants.

As stated in the published protocol manuscript (Chapter 4), I indicated that I would conduct hierarchical linear modelling to control for the potential for variance in

care delivery at each of the NICU sites. The intraclass correlation in the empty model for BSE was r = .41 and the intraclass correlation for the group, time and site BSE model was r =.39. This tells us that group and site accounted for a between person variance of 3% versus a blank model. Therefore, addressing site does not significantly improve the model for BSE and should not be included in a model. As such, I relied on the RM-ANCOVA and did not use a hierarchical linear model to explore the effect of Alberta FICare on BSE.

Integration of qualitative and quantitative results.

Mothers of late preterm infants, but not mothers of moderate preterm infants, who participated in Alberta FICare had significantly greater improvements in BSES scores between admission and discharge when compared to mothers in the standard care group. Also, regardless of stage of prematurity, mothers in the Alberta FICare group were more likely to report high frequency direct breastfeeding (≥ 6 attempts per day), than mothers in the standard care group. Finally, while not statistically significant, mothers in the Alberta FICare group had higher proportions of exclusive breastmilk feeding at discharge compared to mothers in the standard care group. Therefore, I can infer that Alberta FICare was effective to improve BSE at discharge, but not actual breastmilk feeding. However, this effect was mediated by stage of prematurity and was only significantly better for mothers of late preterm infants. As such, it is important to consider what elements of the Alberta FICare model may be effective in informing maternal experiences with infant feeding while on the NICU. Table 6.3 integrates the three components of Alberta FICare with the themes identified in our thematic analysis.

Parent support.

Parent support was conceptualized as formal support from professionals and from family mentors who had previous experience with a moderate or late preterm infant admitted to a level II NICU (Benzies et al., 2017). I found substantial interplay between the parent support component and all three primary themes identified from our qualitative analysis. When examined more closely, it was evident that parent support was only manifested as professional support. Despite family mentor or peer support being a distinct element of the parent support component, there was a lack of acknowledgment regarding family mentor support when mothers recalled their infant feeding experiences. This being even though mothers were specifically prompted about interacting with other mothers with infants currently in the NICU or family mentors.

Parent education.

Parent education was conceptualized as one-on-one instruction guided by institutionally supported learning pathways, technology, and group classes (Benzies et al., 2017). While not represented in all subthemes, parent education was evident in each of the primary themes, with both positive and negative experiences. Some mothers were unaware of formalized education sessions and as such did not attend them. Other mothers found these sessions helpful and felt they improved their understanding of feeding their infant. While parent education within the Alberta FICare model was focused on care within the NICU, it appears there was a lack of anticipatory guidance regarding feeding once the infant was discharged home.

Information sharing.

Information sharing was conceptualized within the Alberta FICare model as one-on-one relational communication and parent participation in bedside rounds (Benzies et al., 2017). Information sharing was the least evident component from the Alberta FICare model. Most references to information sharing highlighted instances of healthcare professionals withholding or directing information, rather than exchanging information. Mothers reflected negatively on situations when healthcare providers were directive in their information sharing and did not value the mother's experiences or expertise regarding feeding their infant. Conversely, while some mothers felt respected when their expertise was considered in determining feeding processes for their infants, other mothers felt that they were not prepared to contribute to decision-making.

Table 6.3. *Integration of FICare Model of Care with Qualitative Themes*

Qualitative Themes	**Components of FICare Model**		
	Parent Support	**Parent Education**	**Information Sharing**
INSTITUTIONAL INFLUENCES			
NICU Environment (social environment NOT physical)	Not all aspects of being in the NICU was great but I found feeding was not one of those aspects. I found feeding was one of the most like one of the most positive ones. (Mother of late preterm, positive BSES change score). I've actually seen more negativity with breastfeeding since we've been out of the NICU. In the NICU there was no questions asked.	I think everything that we learned was in the NICU which we learned a lot, but yeah it was…it was really helpful um, but yeah there's always probably more that could be done (Mother of moderate preterm, positive BSES change score). No there was nothing like a pre-scheduled thing to say "Hey we're gonna talk	So, I am not getting the information that I wanted like what happened today. You know give me an outline of what took place today. So, I wasn't getting enough information on her when I went there in the evening. (Mother of late preterm, negative BSES change score).

	If you wanna breastfeed then that's, that's your goal, you're their mother then that is what we're gonna aim for. (Mother of moderate preterm, negative BSES change score)	about this right now". Not that I was made aware of anyway. (Mother of late preterm, positive BSES change score).	
Staff (nurses)	Honestly, the most support I got aside from my husband would have been the nurses in the NICU. They were absolutely phenomenal and still to this day I will hand down fight until I'm blue in the face, that if it was not for the nurses in the NICU I probably would not have been able to do this [breastfeed]. (Mother of moderate preterm, negative BSES change score) Support from the nurses, the lactation consultants, um, the support to actually keep going even though it was hard, even though it was stressful, even though the baby doesn't latch, even though baby has a tongue tie. It was so I think in that sense the support from the nurses was number 1 I think because really the lactation consultant is not with you 24/7 the nurses are. (Mother of late preterm, positive BSES change score).	You know because many nurses helped me, but there was one nurse – She was amazing too. She showed me how to hear baby swallow, because you know this pattern of suck-swallow-breath?(Mother of late preterm, positive BSES change score).	Some nurses were a little bit more directive I would say in telling me that like, oh, here do this, do that. Then some nurses were more, "What do you like to do?" I see the value in both because at first I don't really know so it was nice to have someone kind of teach me the way. Um, but then after a while I would have, yeah I liked when they just said sort of what do you need, what do you like? (Mother of late preterm, positive BSES change score).

Mother as milk producer	The lactation consultant in the ICU, or in the hospital was more about pumping than breastfeeding…my assumption was, um because the child was in NICU and he needed breastmilk and bottle. There was lots of encouragement to pump and maybe to increase production or what-have-you. I'm not sure if that. And, so it was a lot of attention paid to pumping. (Mother of late preterm, positive BSES change score).	Not represented	She just came in with her agenda, she wasn't even listening she was like "You have to pump 3 hours". "I'm doing all that, I'm doing all that". Like she hardly let me get a word in. It was like I'm not, I'm not neglecting this. She made me feel like I was neglecting it when I knew darn well I was, I was working my ass off. (Mother of moderate preterm, negative BSES change score)
THE RELATIONSHIP WITH THE PUMP			
Making Milk	When we started to introduce the tube feeding with the expressed donor milk and then myself having to pump regularly, it was all just very overwhelming. But I would say at the time I also felt very supported with all of the lactation consultants and the nurses and the doctors (Mother of moderate preterm, positive BSES change score).	There wasn't a lot of information for me on the fact that you know if you don't pump out milk it doesn't necessarily mean that you're drying up or you don't have the milk supply for your children. I did a lot of research and I found out that sometimes it just happens. (Mother of moderate preterm, negative BSES change score)	I had a nurse actually get mad at me not to pump before feeding him. I said "I have to" and when I went to talk to the lactation consultant I was able to make 5 bottles off of one side. That's way too much for a tiny premie, so I have to pump. So, the lactation consultant was finally able to say to the nurse "she needs to or its going everywhere. He is going to choke". So, if it wasn't for the lactation consultant coming and saying

			"yeah, she needs to do this", I probably would have got yelled at every time I had to pump. I know what I'm doing kind of thing, I know I make too much." (Mother of late preterm, positive BSES change score).
Deciding to quit the pump	There's no way you could quit in the hospital because there was no support for that and I wasn't brave enough. (Mother of moderate preterm, negative BSES change score)	Not represented	Not represented
Bringing pump and baby home	Not represented	Not represented	Not represented
ESTABLISHING BREASTFEEDING			
Getting enough	Not represented	I went to the oral feeding [group], one of the first days that I was starting to feed N. It talked about cues and when they want to eat and when they don't wanna eat and when they're trying to tell you to stop. That actually helped me so much, like I didn't realize that those cues were so real I guess. They just really happened. (Mother of late preterm, positive BSES change score). How do you know if she is getting enough?" (Mother of moderate preterm,	A few times I would finish breastfeeding and you know, he wouldn't, he wouldn't take his full total with the test weigh and stuff. And it's like nurses hadn't looked at my chart, at his chart at all and was like "Ok, so what are we doing next, are we gonna bottle feed? (Mother of moderate preterm, negative BSES change score)

		negative BSES change score)	
Latching & Direct Breastfeeding	The nurses at the hospital like, to get her to latch they insisted that I needed to use a nipple shield. …so we were using it, every time she was latching I pretty much had a nipple shield on because the nurses suggested it, the lactation consultant suggested it just for it to be easier for her to latch on to. (Mother of moderate preterm, negative BSES change score) All the nurses got me feeding and nursing confidently before I went home. Like by the time I got home I felt pretty confident in terms of what I was doing." (Mother of late preterm, positive BSES change score).	My big issue is like in the hospital we were told we were never told that she was not gonna be able to, be strong enough to suck enough. Like she was gonna get tired cuz she was small. So that was why she'd top up with the bottle cuz the bottle flows into her faster. I was never told that because she's on the bottle she's gonna get lazy with her suck and not be able to stimulate enough from me. (Mother of moderate preterm, negative BSES change score)	So what was happening we figure was she was just exhausted. She was taking about 40 mls in the bottle after being at the breast but she was just stopping cuz she was so tired of sucking. She was probably just exhausted cuz she had been sucking for an hour. I was never told in the NICU that she would be, that she would probably be, not be strong enough to get a good suck. I was never told that. (Mother of moderate preterm, negative BSES change score)

Discussion

This study investigated the effects of Alberta FICare on maternal BSE and breastmilk feeding outcomes in mothers of moderate and late preterm infants and also explored how FICare influenced maternal infant feeding experiences during admission to a level II NICU. The integration component of this study aimed to interpret and explain results of the study at the individual, system, and study levels respectively (Figure 4.1). From these findings, I proposed to build inferences, suggesting alterations and practice

changes to enhance BSE and breastmilk feeding rates in mothers of moderate and late preterm infants.

Integration at the individual level: Opportunities to enhance breastfeeding self-efficacy and breastmilk feeding rates.

In our study, we found that Alberta FICare was effective to improve BSE in mothers of late, but not moderate, preterm infants. Although not significant, the proportion of exclusive breastmilk feeding was higher in mothers of late preterm infants enrolled in the FICare arm of the trial. These differences were not observed in mothers of moderate preterm infants. When considering the developmental differences between moderate and late preterm infants, our findings are substantiated. As gestational age increases, nutritional requirements and ability to feed at the breast improves (Gouyon et al., 2012). Moderate preterm infants are more likely to require parenteral nutrition, gavage feeding and supplementation than late preterm infants (Gouyon et al., 2012; Walsh et al., 2017). These factors can contribute to delayed initiation of feeding at the breast and decreased perception of performance accomplishments in mothers, thereby impacting self-efficacy. Further, mothers of moderate preterm infants may be more concerned about the overall well-being of their infant because they are less medically stable or have more acute care needs than their late preterm counterparts. As such, mothers of moderate preterm infants may not experience the same improvements in BSE as mothers of late preterm infants. Further, evidence demonstrates that mothers of late preterm infants experience similar barriers to breastfeeding as mothers of full-term infants, such as latching difficulties, concerns about milk supply and limited support in the community (Kair, Flaherman, Newby, & Colaizy, 2015). My qualitative findings

demonstrate that mothers of late preterm infants who are hospitalized in the NICU experience continuous support, particularly from nurses, and viewed this support as a positive part of their infant feeding experience. The combined components of the Alberta FICare model appeared to be particularly effective for mothers of late preterm infants and may leverage the abilities of mother and infant to establish breastmilk feeding. While minimal research has been conducted on breastmilk feeding and the late preterm population (Evans et al., 2019), one study found that admission to the NICU positively influenced continued breastfeeding at 4 weeks in late preterm infants (Colaizy & Morriss, 2008). Conversely, Kair and Colaizy (2016) found no association between NICU hospitalization and breastfeeding duration in late preterm infants at 10 weeks postpartum. Further, Gerhardsson et al. (2018) found that length of hospital stay was inversely correlated with BSE in mothers of late preterm infants. As such, NICU admission may contribute to reduced BSE and potential reductions in breastmilk feeding in mothers of late preterm infants. However, this was not the case for mothers in our study. It is plausible that the increased support described by mothers in the Alberta FICare study may have contributed to enhanced BSE compared to mothers on the standard care units and potentially counteracted the reductions in BSE as noted previously in the literature. Recommending hospitalization for late preterm infants at institutions who do not provide supports similar to the FICare model may not yield these same results.

Compared to mothers in the standard care group, mothers in the Alberta FICare group were 1.28 times more likely to bring their infant to breast at least six times per day. This aligns with O'Brien et al. (2018) who found that compared to mothers receiving standard care, mothers receiving FICare in level III NICUs were significantly more likely

(p = .016) to be feeding their infant from the breast ≥ 6 times per day. An integral component of Alberta FICare is that parents need to be present on the unit for a minimum 6 hours (or three feedings) per day. This increased presence on the unit may have a direct impact on the number of attempts a mother makes to directly breastfeed her infant. However, neither increases in direct breastfeeding nor improvements in BSE translated into statistically significant increases in exclusive breastmilk feeding at discharge. While O'Brien et al. (2018) observed significantly lower rates of any breastmilk feeding (75%) in the FICare group compared to the standard care group (81%, p = .004), it is unclear if they assessed for exclusive breastmilk feeding in their study. Both BSE and direct breastfeeding are predictors of sustained exclusive breastmilk feeding and may positively influence later breastmilk feeding outcomes in mothers of preterm infants (Briere, McGrath, Cong, Brownell, & Cusson, 2016; Gerhardsson et al., 2018; Wang et al., 2018). Gerhardsson et al. (2018) and Wang et al. (2018) both found that BSE was predictive of exclusive breastfeeding in mothers of preterm infants at 3 months (late preterm) and 6 months (moderate and late preterm), respectively. Further, Brier (2015; 2014; 2015; 2016) has done extensive work around the importance of direct breastfeeding at discharge from the NICU and subsequent breastfeeding rates, particularly in late preterm infants. Direct breastfeeding is a significant predictor of any breastfeeding at ages 1 and 4 months (Briere, Lucas, et al., 2015; Briere et al., 2016). Our qualitative findings support the importance of direct breastfeeding in continued provision of breastmilk for moderate and late preterm infants. As such, the effect that Alberta FICare has on improving BSE and increasing direct breastfeeding may be influential in improving later breastmilk feeding outcomes.

Integration at the system level: Opportunities to examine system influences on breastfeeding outcomes.

The healthcare system emerged as a strong influencer of maternal experiences with infant feeding as evidenced by the theme institutional influences. Mothers repeatedly spoke about how the unit culture, such as timed feeding requirements, physical separation from their infant, and emphasis on 'breast is best' informed their infant feeding experiences. It is possible that the unit culture and institutional influences resulted in the high breastmilk feeding rates that were reported at discharge. As some mothers mentioned, they did not feel brave enough or supported to quit pumping while they were on the NICU. This speaks to the system influence that 'breast is best' creates. It is possible that these mothers were reporting breastmilk feeding, even if minimal, as part of a social desirability bias to satisfy their healthcare providers. Additionally, the emphasis on breastmilk feeding appears to have placed the focus on pumping breastmilk rather than breastfeeding (Table 6.3). Findings from the qualitative analysis (Chapter 5) indicate that a dependency on pumping rather than on direct breastfeeding may predict premature cessation of breastmilk feeding. Shifting the emphasis from providing breastmilk to breastfeeding, may help to change the influence that this system culture has on breastfeeding outcomes at discharge and beyond.

Integration at the study level: Future opportunities to integrate breastfeeding self-efficacy within Alberta FICare.

When I examined the three components of Alberta FICare with relation to our qualitative findings, positive elements of parent support emerged in all three themes. It is evident from our findings that support is the most tangible component of Alberta FICare.

However, previous evidence indicates that education based interventions, rather than support based interventions, are most impactful for increasing BSE in mothers of full-term infants (Brockway et al., 2017). Support based interventions provide social support, counselling, or consultation, whereas education-based interventions provide information, demonstration, and discussion (Benzies et al., 2013). Specific to the Alberta FICare model, maternal interactions with nurses emphasized counselling and consultation around infant feeding strategies as well as social support to persevere with pumping and direct breastfeeding. It is likely that support and education were not perceived by mothers as mutually exclusive constructs and were provided simultaneously during interactions between healthcare professionals and mothers. This coincides with Benzies et al. (2013) who found in their systematic review, all interventions contained some form of parent education. Future iterations of Alberta FICare could consider personalizing interventions to address the unique needs of families. For example, structuring formalized parent education around the unique feeding needs of a moderately preterm compared to a late preterm infant may help to alleviate the discrepancies observed in prematurity. Additionally, providing enhanced mental health support for mothers who are experiencing depression or anxiety while in the NICU may also enhance breastfeeding outcomes, as these diagnoses were identified as covariates for BSE in this study. Further, providing anticipatory guidance to mothers who are diagnosed with pre-eclampsia or diabetes regarding breastfeeding and delayed lactogenesis related to their conditions, may help to alleviate some of the emotional distress some of these mothers experience, thereby improving their BSE as well.

Components of parent education did emerge throughout the qualitative interviews. However, maternal perceptions of these components were inconsistent with some mothers recalling a positive experience and others perceiving deficits. While mothers in general believed that nurses provided education around infant feeding, parent education was limited by minimal awareness of formalized educational strategies such as parent classes or the Life's Little Love app (Larocque, 2015). As well, some mothers expressed the need for more anticipatory guidance to help them better understand infant feeding sequalae once they were discharged home. Mothers perceived that education around infant feeding was focused on the NICU setting and did not extend to sustaining breastmilk feeding in the community. While not explored in the context of breastfeeding, previous investigations of interventions that bridge the NICU and community environment have demonstrated significant improvements in cognitive and motor development of children up to 5 years of age (van Wassenaer-Leemhuis et al., 2016). Future research should explore the impact of timing breastfeeding interventions to bridge both the NICU and home environments on breastmilk feeding outcomes in preterm infants.

Information sharing appeared to be the most inconsistent component of FICare with regards to infant feeding. Some mothers felt that they were exposed to didactic instruction from healthcare providers, despite their own knowledge on the topic. Other mothers did not feel equipped to contribute their knowledge to decision making around infant feeding and wanted the nurse to tell them what to do. Traditionally in healthcare settings, holding of information situates healthcare providers in a place of power over patients (A. McQueen, 2000). Information sharing requires healthcare providers to

relinquish power over the patient (Oxelmark, Ulin, Chaboyer, Bucknall, & Ringdal, 2018) and may be inconsistent with the engrained culture that exists in many NICU settings. The component of information sharing requires a substantial cultural shift and disruption to traditionally held beliefs and practices, both by healthcare providers and parents. Some healthcare providers may be unwilling to participate in this cultural shift and to share power with their patients (Henderson, 2003). As such, it is not surprising that information sharing was the most difficult and inconsistent component of FICare to enact.

The foundational underpinning of the FICare model is to *integrate* parents into the care of their preterm infant as soon as possible after admission to the NICU. Because late preterm infants are generally clinically stable and able to feed orally (Engle et al., 2007), it is possible that the actual integration of these mothers was more tangible for healthcare staff in this population. Clinical stability or concerns about medical issues for the infant have been identified as barriers to other models such as kangaroo and skin-to-skin care (Chong Lee, Martin-Anderson, & Dudley, 2012; Seidman et al., 2015). Healthcare providers are more restrictive of care-by-parent when infants are not deemed clinically stable (Chong Lee et al., 2012). It is plausible that FICare is overall more effective in the late preterm population because these infants are more clinically stable and integrating parents into their care is more palatable for healthcare providers. As such, those who implement FICare need to be aware of this reticence towards integrating families into the care of infants who are not clinically stable. Providing increased training and support to healthcare providers to better enact FICare with families whose infants are medically

unstable or who are more premature, may help to mitigate the discrepancy between moderate and late preterm infant outcomes.

The Alberta FICare cRCT was designed to answer the primary research question about length of stay and was not tailored for breastmilk feeding or breastfeeding outcomes. As such, this model of care may not have maximized the potential capacity to improve breastmilk feeding rates. Tailoring the FICare model towards breastfeeding outcomes by enhancing peer-based breastfeeding support (parent support), providing structured breastfeeding education (parent education) and providing a minimum of 20 hours of breastfeeding education to all nurses on the NICU may help to increase breastmilk feeding rates at discharge from the NICU.

One potential mediator of the improved breastfeeding outcomes could be the increased amount of time that mothers were required to stay on the unit (> 6 hours or 3 feedings per day). Increased maternal presence on the unit may have contributed to the improvements in BSE and higher frequency direct breastfeeding attempts that were observed in the FICare group. While there was no evidence of how the expectation of increased presence on the NICU informed infant feeding experiences, it is likely that maternal presence during feeding times could increase BSE and attempts to directly breastfeed. Further exploration of the effect of increased maternal presence on infant feeding experiences is warranted and would help to tease out this concept from the components of FICare.

Limitations

Conducting mixed methods research is time consuming and resource intensive (Ivankova, Creswell, & Stick, 2006). Delays in quantitative data collection necessitated a

deviation from the traditional explanatory sequential design of implementing the quantitative and the qualitative strand in order to complete this research in a timely manner (Creswell & Clark, 2011). However, the original intent to use the qualitative findings to explain or provide complementarity to the quantitative results was achieved. Teddlie and Tashakkori (2012) argued that researchers need to be more imaginative in how they implement and integrate the qualitative and quantitative strands and that emphasis should be placed on answering the research question rather than relying on traditional implementation strategies. By employing this strategy, I was able to analyse the qualitative data with no prior assumptions or understandings as to the effect of Alberta FICare on BSE and breastmilk feeding rates. Further, as the analysis of the qualitative interviews progressed, it became evident that the stories and experiences of the mothers in this study were so informative and meaningful that they superseded the emphasis on the quantitative outcomes. The clarity and context that these interviews offered to the quantitative results, strengthened my understanding of how Alberta FICare is accepted and enacted in the level II NICU environment. However, the emphasis of time and resources on the qualitative phase may have detracted from a more fulsome quantitative analysis of all infant feeding outcomes.

Finally, Teddlie and Tashakkori (2012) identified that researchers may not have all of the skills required to competently conduct a mixed-method study, which may result in findings that are superficial. However, they suggest that mentorship for trainees such as me, by scholars who are “methodologically bilingual” (p. 777) can result in competent and rigorous mixed-methods studies. The representation on my supervisory committee consisted of substantive and methodological experts, particularly in mixed methods

research design. The critique and rigour they applied to this dissertation enhanced the depth and meaning of the integration components for this study.

The FICare model is currently limited to the NICU environment and does not extend to the community. As such, the timing of the interviews may have presented a limitation or resulted in a disconnect between maternal experiences with Alberta FICare and their BSE. Breastfeeding self-efficacy scores were reported at discharge from the NICU, but mothers were asked to recall their infant feeding experiences up to 9 months after their infant was born. Being in the community for several months prior to their interview may have led mothers to be more critical of Alberta FICare, or these mothers may have been even more self-efficacious than when they were discharged. If interviews were conducted in the NICU environment it is possible that mothers may have been more reticent about speaking negatively about their breastmilk feeding experiences and may have provided a more accurate reflection of their interactions with FICare. However, extending the interview time to the community setting likely allowed mothers time to process their infant's hospital stay and become more reflective about their infant feeding experiences. Further, this timing removed the fragility of their infant, which may have superseded the focus of the interviews if they were conducted in hospital.

Mothers who are not successful at breastfeeding or providing breastmilk often view themselves as failures and some may view their experiences negatively (Flacking, Ewald, Nyqvist, & Starrin, 2006). Recruiting mothers with negative BSE change scores proved to be very difficult. It is likely that much of our attrition in this study is due to mothers who had negative experiences with breastfeeding and as such, their experiences may not be represented in this research. Mothers with whom I spoke, were predominantly

still breastfeeding at the time of the interview and I question if these mothers were representative of the moderate and late preterm population. Qualitative research is not about representativeness; however, voices of mothers with more negative breastfeeding experiences may be missing from this study.

Breastmilk feeding is inconsistently defined in the breastfeeding literature (Labbok & Starling, 2012). This is even more complicated in the preterm population due to breastmilk fortification and supplementation. I struggled to force the feeding definitions of preterm infants into a classification system which is structured around healthy full-term infants. As such, some of the questions may have been unclear or misunderstood by the participants. Despite piloting our infant feeding questions with mothers who themselves previously had preterm infants, I was unable to use several questions because they were answered inconsistently. Future work in this area will require a concerted effort to develop infant feeding questions that are better understood by this population of mothers.

A major component of Alberta FICare was the requirement for mothers to be present on the NICU for a minimum of 6 hours per day. This requirement may restrict participation to families who can afford the time and costs associated with accessing the NICU for greater than 6 hours per day, or to primiparous families who do not have older children at home. As such, Alberta FICare may further serve to perpetuate care discrepancies and infant health outcomes that currently exist between privileged and under-privilege families. Future iterations of Alberta FICare need to consider tailoring towards families that may be limited by social supports, finances, or time, to improve accessibility and utility.

While our work indicates that Alberta FICare did not translate into significantly increased exclusive breastmilk feeding rates at discharge, it is possible that these differences will emerge at subsequent follow-up assessments. Projections using BSE theory in full-term infants indicate that improvements in breastfeeding outcomes are not fully realized until 2 months post-partum (Brockway et al., 2017). However, it is also important to consider that BSE may not be a key predictive variable in breastmilk feeding outcomes in mothers of moderate and late preterm infants. As such, it will be important to follow breastmilk feeding outcomes with these families longer-term to fulsomely assess the longevity and sustainability of Alberta FICare as well as the applicability of BSE theory on moderate and late preterm infant feeding outcomes.

Future directions.

The purpose of this dissertation was to examine breastmilk feeding and BSE outcomes of mothers at discharge in the Alberta FICare study. Researchers in the Alberta FICare study have also collected follow-up data at 2 months corrected age. As such, it will be important to examine the breastmilk and BSE outcomes at the 2-month assessment. Additionally, conducting further qualitative research with these mothers about their experiences in the community once their infants were discharged from the NICU would highlight gaps in care that may contribute to early weaning.

Finally, it will be important to consider stage of prematurity when conducting the analysis for the larger Alberta FICare study. Our findings demonstrated that Alberta FICare was effective at improving BSE in mothers of late, but not moderate, preterm infants. Differences in moderate and late preterm infants may not be restricted to infant feeding outcomes. While stage of prematurity will obviously impact the primary outcome

of length of stay, mothers of moderate preterm infants could be at an increased risk for mental health concerns and decreased parenting self-efficacy. Further research needs to be conducted with the moderate preterm population. It would be prudent to conduct focused interviews with mothers of moderate preterm infants to ascertain which components of the FICare model were or would be more impactful to produce meaningful results in this population. These outcomes have not been well investigated in this population and could provide valuable evidence to inform the care of moderate preterm infants and their families.

Conclusion

The aim of this study was to evaluate the effect of Alberta FICare on BSE and resultant breastmilk feeding rates in mothers of moderate and late preterm infants. Our findings demonstrated that Alberta FICare is an effective model of care to increase BSE in mothers of late, but not moderate, preterm infants. Although the group differences were not statistically significant, we found increased exclusive breastmilk feeding in late preterm infants who were cared for under Alberta FICare versus standard care.

Professional support was the most prominent component of FICare that emerged from interviews with mothers. This support was likely most influential on BSE improvements. While parent education and information sharing did emerge, maternal perceptions of these components were not always positive. Further, it appears that information sharing was challenging for both healthcare providers and mothers to embrace.

Chapter 7: Conclusions and Implications

The purpose of this study was to determine if Alberta FICare improved maternal breastfeeding self-efficacy (BSE) and breastmilk feeding rates in mothers of moderate and late preterm infants admitted to a level II NICU. As this was a sequential explanatory, mixed-methods design, I sought to integrate the phases through embedding, whereby the data collection and analysis was linked at multiple points throughout the study (Fetters et al., 2013). The first stage of integration occurred at the theoretical level, where I related the findings of the qualitative thematic analysis to the four sources of information in the BSE theory (Chapter 5). In the second stage, I aimed to examine the qualitative findings with respect to the system level. Finally, in the third stage of integration, I focused on merging the qualitative themes with the Alberta FICare model to explore how implementation of Alberta FICare influenced breastfeeding outcomes (Chapter 6). I also stated that the second and third stages of integration would occur at the practical level, and that I would develop inferences regarding practices and models of care that may influence breastmilk feeding outcomes. In this chapter, I will explore implications for practice and future research.

Integrating Breastfeeding Self-Efficacy Theory into Staff Training

Our proof of concept systematic review and meta-analysis in Chapter 3 demonstrated that BSE is an effective social change theory and is a modifiable factor that can improve breastfeeding outcomes, specifically exclusive breastfeeding, for mothers of full-term infants at age 2 months. A direct implication of the systematic review and meta-analysis was the integration of BSE theory into the new (draft) Alberta Health Services (AHS) 20-hour staff Breastfeeding Education Module. This resource will inform the

practices of most AHS healthcare professionals who work with mothers and infants within Alberta, including mothers of preterm infants. Further, my research can serve as the foundation to examine the modified Breastfeeding Self-efficacy Scale as a clinical screening tool to identify mothers of preterm infants with low self-efficacy who may be at risk for early breastfeeding cessation (Nanishi, Green, Taguri, & Jimba, 2015).

Applying Breastfeeding Self-Efficacy Theory within the Alberta FICare Environment

Demonstrating that BSE is an effective social change theory in mothers of full-term infants provided sufficient evidence to proceed with exploring BSE theory in mothers of moderate and late preterm infants. I found (a) institutional influences, (b) relationship with the pump, and (c) establishing breastfeeding emerged from maternal experiences with feeding moderate and late preterm infants in NICU. When overlaying the three maternal experience themes on the four BSE sources of information (verbal persuasion, performance accomplishments, physiologic/affective responses, and vicarious experience), I found that verbal persuasion and performance accomplishments featured strongly across the themes during the time in NICU. The physiologic/affective source of information did not emerge until infants were discharged home and mothers were able to reflect on their own well-being. Unexpectedly, vicarious experience was notably absent from any of the themes, despite evidence stating that peer support is an effective method to improve breastfeeding outcomes in mothers of preterm infants (Agrasada et al., 2005; Rayfield et al., 2015). This lack of vicarious experience or perceived peer interaction is perhaps a lost opportunity for health practitioners to further establish a supportive breastfeeding environment in the NICU. Developing peer breastfeeding classes or

support groups within the NICU setting, extending on the FICare family mentor role, may be an effective method to influence vicarious experience and further enhance BSE. Despite the lack of vicarious experience, our findings suggest that BSE remains an applicable theory to mothers of hospitalized moderate and late preterm infants, further providing evidence to support integrating BSE theory into practice and research with the preterm population.

How does FICare Inform Maternal Experiences with Infant Feeding?

The Alberta FICare model situates parent support from both a professional and a peer perspective, through family mentors with previous experience of parenting a moderate or late preterm infant in NICU. Professional nursing support of parents emerged very strongly throughout all the themes and was generally viewed positively by mothers. However, evidence of family mentor support was not evident in the qualitative interviews. As such, future iterations of FICare need to have a greater emphasis around family mentor support, which include mentorship around infant feeding. Peer-supported breastfeeding classes, one-on-one sessions (Merewood et al., 2006) and online support groups (Niela-Vilén et al., 2015) are feasible support strategies that could be implemented by the family mentors.

Parent education was also well represented in the qualitative themes, both from a positive and a negative perspective. While most mothers predominantly recalled educational interactions occurring with the nursing staff, some mothers spoke about knowledge deficits and how they were not educated about breastfeeding a preterm infant once they were discharged home. What did not emerge was the formalized education sessions and the Life's Little Love app. It is unclear if formalized education sessions

were not offered at all sites, or if the parents were just not aware of them. Careful consideration should be applied to adult learning and content delivery strategies to ensure increased awareness and utilization of formalized education sessions. Further, the use of smartphone app-based learning in this population is relatively unexplored. While the use of healthcare apps is increasing, it is evident in the literature that effectively integrating these apps into care is still a barrier to their utility (Hussain et al., 2015). When providing apps as an educational tool, healthcare providers need to integrate them into patient teaching on a regular basis in order to increase comfort, usability, and accessibility of these apps (Hussain et al., 2015).

Breast and Human Milk Feeding

Upon initiation of my graduate education journey in 2013, breastmilk feeding support or 'breast is best" in the NICU was just emerging as the dominant messaging for feeding preterm infants. The local milk bank had just opened and was piloting the use of donor human milk (DHM) in one or two NICUs in the province. Now, in 2019, breastmilk is universally accepted as the optimum method and DHM is routinely offered to all families of preterm infants and is now even available for some full-term infants. Our study indicates that over 70% of moderate and late preterm infants received DHM at some point during their NICU stay. DHM is now the preferred alternative when mothers' own milk is not available and has predominantly replaced preterm infant formula in the NICU. The implications of this practice change have yet to be realized; however, it is likely we will see profound long-term improvement in health outcomes for these vulnerable infants. It is unclear why significantly more infants in the FICare group received DHM compared to infants in the standard care group. This could be due to

increased acceptability of DHM on these units, or unit culture as two of the FICare intervention sites were engaged in the Baby Friendly Hospital Initiative (BFHI) certification journey. Practitioners on these units need to be aware of the potential for complacency towards DHM supplementation as an equitable replacement for mother's own milk and the potential risk of decreased breastmilk feeding rates in this population (Williams et al., 2016).

My research indicates that breastfeeding initiation and provision of breastmilk is high in this sample of moderate and late preterm infants at 97.6% and 95.8% respectively. While our study sample may not be fully representative of the Alberta population, our findings indicate that our sample is highly motivated to provide breastmilk to their infants and that breastfeeding may be the accepted norm in our society. Unfortunately, due to poor data capture and information sharing capabilities within our province (i.e., multiple charting platforms that are currently incompatible), we are unable to determine how our results compare to the overall Alberta population and cannot make comparisons with baseline breastfeeding outcomes. While Alberta Health Services is moving towards unifying medical records and sharing of healthcare data, researchers continue to be limited by data access restrictions in this province. There continues to be a need for researchers, policy makers, and bureaucrats to collaborate to improve accessibility of healthcare data, including breastfeeding rates (Renfrew et al., 2010). Improving access to these data will provide opportunities to better evaluate our healthcare practices and to provide feedback to Alberta residents and care providers using population-based outcome measures.

Implications for Practice

The findings from my qualitative exploration found that breastmilk feeding is heavily emphasized in the NICU, almost to the point of being dogmatic. Mothers are repeatedly exposed to the 'breast is best' messaging; and while some mothers found this messaging inspirational, others found it upsetting. As described in Chapter 6, it is unclear if this is due to a cultural shift toward the acceptability of breastmilk feeding, increased evidence supporting the importance of breastmilk in the NICU population, or both. With this shift in emphasis towards breastmilk feeding in the NICU, practitioners and policy makers need to be cognizant of how breastfeeding messaging is perceived and the possible negative influence it may have on maternal and infant feeding experiences, and maternal mental health.

These findings highlight areas where health care can be enhanced to better address the needs of mothers in the NICU. Acceptance and promotion of breastmilk in the NICU is now the primary focus of infant feeding. In healthcare providers' enthusiasm to promote breastmilk and breastfeeding, the needs of mothers who are unable to provide breastmilk or who choose to formula feed may have been overlooked. Nyqvist et al. (2012) expanded the Neonatal Baby Friendly Hospital Initiative (Neo-BFHI) recommendations to include three guiding principles to better support mothers in the NICU environment. Our interviews indicated that practitioners are struggling with guiding principle 1: *The staff attitude toward the mother must focus on the individual mother and her situation*, especially regarding failed lactation or milk insufficiency. Policy makers and care providers should be cognizant of segregating mothers who need to provide formula and develop contingency plans to better support these families. One

such strategy may be to provide informed consent around formula provision. Once parents and care providers have come to a mutual and informed understanding about the provision of formula (including unethical marketing practices), perhaps restrictions around, and hesitancy towards formula provision, can be removed. Further, enhanced staff training to enact guiding principle 1 and allowing for nurses to act autonomously and employ nurse discretion may help to alleviate the emotional dissonance that mothers who are unable to provide breastmilk can experience. These strategies fall within the information sharing component of Alberta FICare, through use of relational communication. Employing circular and triadic questioning, as well as active listening, would allow for nurses to develop an enhanced understanding of maternal perspectives around infant feeding and to better adapt their care around each family's unique needs.

However, both staff and mothers struggled with the information sharing component of Alberta FICare. It is possible that this dissonance arises from balancing the traditional paternalistic structure of medicine with the patient- and family-centered nature of the Alberta FICare model (Gillberg & Jones, 2019). Information sharing requires our view of the patient to move from the paternalistic model where the patient (or parent) has minimal agency, through to, at minimum, the neutral patient model, where the parent is the subjective knower, providing entitlement to the parent to report back on their infant's condition and health outcomes (Gillberg & Jones, 2019). Ideally, to better meet the contemporary patient- and family-centered needs of many parents in the NICU, we need to promote FICare as a model where patients have full agency and are regarded as equitable care providers in the care of their preterm infant (Gillberg & Jones, 2019). The NICU is a highly technical, critical care environment, which situates physicians and

nurses in a power differential over parents and traditionally embodies paternalistic healthcare ideologies (Benzies, Shah, Aziz, Lodha, & Misfeldt, 2019). Information sharing is one component of a much larger strategy to centre the parent in the care model by providing them with agency and including them as active contributors to their infant's care. Shifting the ideology to situate the parent as a partner in the care of their infant requires fundamental paradigmatic shifts in the way healthcare providers view their role and their power in the therapeutic relationship. While these shifts require fundamental changes in the structure and delivery of healthcare from a foundational and system perspective, individual practitioners can work towards modifying their own practice to better situate parents as active participants in the care of their infants. Gillberg and Jones (2019) provide tangible suggestions, such as employing a solution-focused or holistic approach to healthcare problems and seeking feedback from parents about what worked and what did not work. These simple modifications to Alberta FICare may empower parents to feel more involved in their infants' care and allow them the confidence to share their knowledge in future interactions as well.

Nurses' role.

The work of nurses was situated prominently throughout this dissertation. While this prominence may be due to my standpoint as a nurse and lactation consultant and could be viewed as a bias, the role of nurses emerged organically through the inductive coding. Nurses are foundational in the care of families who experience preterm birth. Alberta FICare is an intervention that empowers nurses, physicians, and allied health care staff to integrate and support parents to participate in the care of their infant while in the NICU. The Alberta FICare model encourages nurses to work to their full scope of

practice by broadening the emphasis from a focus on critical care skills to include relational communication, education, and support. While nurses may be limited by existing policies and procedures imposed by the institution, they are not limited in how they engage and interact with families. Employing interactional strategies that seek information and feedback from parents (Gillberg & Jones, 2019), as well as approaching patient care from a perspective of awareness of the individual mother and their situation (Nyqvist et al., 2012) will help to provide agency to each family that will better integrate them into the care of their preterm infant.

Reflecting on BSE theory and the four sources of information, nurses provide verbal persuasion, validate performance accomplishments, and can address maternal physiologic/affective responses. As such, nurses may have a direct impact on enhancing BSE. Incorporating BSE theory into staff breastfeeding education modules and educating nurses about how their actions inform BSE may help to improve infant feeding outcomes in mothers of both full-term and preterm infants. While it remains to be seen if BSE translates into increased breastmilk feeding and duration in the preterm population, it is evident that nurses are foundational in helping mothers to initiate and establish breastmilk feeding in the NICU setting.

As Alberta FICare is scaled up to be implemented in all level II NICUs in Alberta, it will be important to emphasize the vital role that nurses play in facilitating FICare. Specifically, nurses need to be empowered to enact a care model where families have full agency and are regarded as equals in the care of their preterm infant. Further, nurses need to be aware of their role in enhancing BSE sources of information. It is predominantly through the interactions with nurses in the NICU that mothers form their infant feeding

experiences and these interactions can have long lasting impact on breastmilk feeding outcomes and potentially infant health.

While nurses were the dominant healthcare professionals acknowledged throughout the interviews and this dissertation, it is important to note that care in the NICU is provided by a multidisciplinary team. Other healthcare providers emerged intermittently throughout the interviews. One mother mentioned how she viewed the dietician giving her "permission" to feed her infant formula. Another mother discussed how the physicians were concerned about her privacy while she breastfed her infant (while she was not at all concerned). However, many mothers mentioned how the nurses were omnipresent during their NICU experience. While the multidisciplinary team provided expertise and solutions to their concerns, they felt that often the care was reactionary (in the case of lactation consultants) and not anticipatory.

Conclusion

In this dissertation, I demonstrated that (a) BSE is a relevant social change theory in mothers of moderate and late preterm infants, and (b) Alberta FICare is a model of care that enhances BSE in mothers of late preterm infants and increases direct breastfeeding in mothers of moderate and late preterm infants. While FICare did not result in significant improvements in breastmilk feeding at discharge from the NICU, it is possible that enhanced BSE and increased instances of direct breastfeeding in mothers who were exposed to Alberta FICare may result in increased breastmilk feeding rates after discharge. With certain augmentations such as improved advocacy for parent agency to enhance information sharing and more tangible educational strategies, FICare may be

an effective model of care that can increase BSE and direct breastfeeding rates in mothers of moderate and late preterm infants.

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Appendix A: **BREASTFEEDING SELF-EFFICACY SEARCH ANALYSIS**

PsycINFO	**Results**
Self-efficacy / self-concept	238
Self-efficacy / self-concept / competence	268
Self-efficacy / self-concept / competence / self-confidence	272
Self-efficacy / self-concept / competence / self-confidence / confidence	336
Self-efficacy / self-concept / competence / self-confidence / self-perception	276
Self-efficacy / self-concept / competence / self-confidence / confidence / self-perception	344
EMBASE (limited to English)	**Results**
Self-efficacy / self-concept	543
Self-efficacy / self-concept / competence	773
Self-efficacy / self-concept / competence / self-confidence	791
Self-efficacy / self-concept / competence / self-confidence / confidence	3449
Self-efficacy / self-concept / competence / self-confidence / self-perception	792

Why new terms for *self-efficacy:*

- EMBASE uses "self-concept" as the subject heading for: competence, self-efficacy, self-confidence, confidence, self perception
- Confidence, however, retrieves way too many hits in EMBASE. Should not be included in search as too broad.

Why no terms for "intervention":

- The results are not very big and ensuring that all possible terms for "intervention" are searched can be difficult. Potential to miss terms and therefore miss possible relevant studies.

Why no terms for "RCT" and "Quasi-RCT"

- As above, potential to miss relevant studies if results are limited to type of study.

Database(s): PsycINFO 1806 to July Week 4 2016

Search Strategy:

#	Searches	Results
1	exp Breast Feeding/	2935
2	breast feed*.mp.	3446
3	breastfe*.mp.	3296
4	breast fed.mp.	294
5	or/1-4	4655
6	exp Self-Efficacy/	17387
7	self-efficacy.mp.	33517
8	selfefficacy.mp.	84
9	efficacy.mp.	116365
10	exp Self-Concept/	64353
11	self-concept.mp.	47617
12	selfconcept.mp.	35
13	exp COMPETENCE/	18110
14	competence.mp.	54766
15	exp SELF-CONFIDENCE/	2881
16	self-confidence.mp.	7189
17	selfconfidence.mp.	12
18	exp Self-Perception/	21380
19	self-perception.mp.	23665
20	selfperception.mp.	14
21	or/6-20	254994
22	5 and 21	276
23	limit 22 to english language	265
24	limit 23 to yr="1999 -Current"	243

Appendix B: **GRADE QUALITY ASSESSEMENT: SUMMARY OF FINDINGS**

Study, date, country	**Study design**	**Lower**	**Higher**	**Methodological Comment**	**Quality**
ANSARI et al., 2014 Iran	RCT, Simple random sampling of health centres (4)	**Reporting bias** - serious (did not report all outcomes, did not use standardized WHO guidelines for BF outcomes), (-1) **Imprecision risk** - serious (BSES-Persian was not previously published), (-1)		Random sampling of recruitment site, lowers risk of sampling bias. Did not report on all breastfeeding outcomes collected only on exclusive breastfeeding. Risk of reporting bias. BSES-Persian was not previously validated in another study. Did not use WHO standards for breastfeeding classification.	2 - ⊕⊕⊖⊖ Low
AWANO et al, 2010 Japan	Quasi-experimental (3)	Risk of bias related to significant differences in baseline BSES (-2)		Quasi-experimental study; hospital population may not reflect general population. Exclusion of women with no access to technology; significant difference between intervention and control group baseline BSE. One hospital BFHI certified, both hospitals had midwives deliver. Short study period. Did not use WHO standards for breastfeeding classification.	1- ⊕⊖⊖⊖ Very Low

BUNIK et al., 2010 USA	RCT Convenience sample (4)	Serious risk of bias - check allocation concealment (?), single blinded, ITT? reporting bias (-1) (maybe very serious -2 if ITT or allocation is not complete). High attrition (-1)		Self-report rather than direct observation; not generalizable beyond low-income Latinos population. No baseline BSES conducted. High attrition rate (27%).	2 - ⊕⊕⊖⊖ Low

Study, date, country	**Study design**	**Lower**	**Higher**	**Methodological Comment**	**Quality**
Chan Man et al., 2016 Hong Kong, China	RCT Convenience sample (4)	Potential for performance and response bias as could not blind participants and assessment was based on self-report (-1)		ITT, small sample size (although power analysis was conducted), potential for performance and response bias as could not blind participants and assessment was based on self-report.	3 - ⊕⊕⊕⊖ Moderate
Dodt et al., 2015 Brazil	Quasi-experimental (3)	Very serious risk of attrition bias and reporting bias (-2)		High attrition Adjusted the total scores obtained from the BSES-SF so that the minimum value was zero and the maximum value was 100 (pp. 729).	1- ⊕⊖⊖⊖ Very Low
Jackson et al., 2016 Canada	RCT Convenience sample	Compliance - inconsistency (-1), potential for	Suggest spurious effect when	Inconsistent intervention compliance. Potential confounding factors (nipple	3- ⊕⊕⊕⊖ Moderate

		performance and response bias as could not blind participants and assessment was based on self-report (-1)	results show no effect (BFI) (+1).	infection, BFHI). Risk of contamination (12% of control group used lanolin).	
Study, date, country	**Study design**	**Lower**	**Higher**	**Methodological Comment**	**Quality**
Laliberte et al., 2016 Canada	RCT Convenience sample (4)	Potential for performance and response bias as could not blind participants and assessment was based on self-report (-1)		Study may be overpowered (15% may be too high). Not generalizable to other countries with different health systems/maternity leave. 'high-risk' population not accessed.	3- ⊕⊕⊕⊖ Moderate
McQueen et al., 2011 Canada	RCT (Pilot) Convenience sample (4)	Not powered accordingly (-1), no ITT - potential for attrition bias, and performance bias (-1)		pilot study - not sufficiently powered. Uneven group allocation	2 - ⊕⊕⊖⊖ Low

Noell-Weiss et al., 2006 Canada	RCT Convenience sample (4)	Potential for performance and response bias as could not blind participants and assessment was based on self-report (-1), reporting bias - not all outcomes reported (-1). ITT and per-protocol - analyses inconsistent findings.		No description of randomization. Insufficiently powered. Breastfeeding rates were not reported for 4 months – potential for reporting bias	2 - ⊕⊕⊖⊖ Low

Study, date, country	**Study design**	**Lower**	**Higher**	**Methodological Comment**	**Quality**
Otsuka et al., 2014 Japan	Quasi-experimental (3)	Potential for performance and response bias as could not blind participants and assessment was based on self-report (-1). Indirectness - Means were pooled from BFH and non-BFH hospitals (-1)	Suggest spurious effect when results show no effect (BFI) (+1).	Followed ITT. Low intervention compliance. Risk of contamination. Analyses were stratified by BFHI certification.	2 - ⊕⊕⊖⊖ Low

Wu et al., 2014 China	RCT Quasi-random sample (4)	Very serious potential for bias (-2) - performance and response bias as could not blind participants and assessment was based on self-report, reporting bias - not all outcomes reported, detection bias - researchers not blinded.	Multiple imputation methods to account for drop-out (all outcomes consistent).	Weak reporting of outcomes, no description of randomization	2 - ⊕⊕⊖⊖ Low

Appendix C: **SPIRIT 2013 CHECKLIST: RECOMMENDED ITEMS TO ADDRESS IN A CLINICAL TRIAL PROTOCOL**

SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents*

Section/item	Item No	Description	Addressed on page number
Administrative information			
Title	1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	1
Trial registration	2a	Trial identifier and registry name. If not yet registered, name of intended registry	2
	2b	All items from the World Health Organization Trial Registration Data Set	n/a
Protocol version	3	Date and version identifier	2
Funding	4	Sources and types of financial, material, and other support	17

Roles and responsibilities	5a	Names, affiliations, and roles of protocol contributors	1, 18
	5b	Name and contact information for the trial sponsor	1
	5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	17-18
	5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)	n/a
Introduction			
Background and rationale	6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention	4 - 5
	6b	Explanation for choice of comparators	n/a
Objectives	7	Specific objectives or hypotheses	5
Trial design	8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory)	5
Methods: Participants, interventions, and outcomes			

Study setting	9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained	8
Eligibility criteria	10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists)	8
Interventions	11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered	7
	11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving/worsening disease)	n/a
	11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return, laboratory tests)	6
	11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial	n/a
Outcomes	12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended	10
Participant timeline	13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure)	9 - 10
Sample size	14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations	8 - 9

Recruitment	15	Strategies for achieving adequate participant enrolment to reach target sample size	9, 12-13
Methods: Assignment of interventions (for controlled trials)			
Allocation:			
Sequence generation	16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	n/a
Allocation concealment mechanism	16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	n\a
Implementation	16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	n\a
Blinding (masking)	17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	n\a
	17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	n\a
Methods: Data collection, management, and analysis			
Data collection methods	18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol	10

	18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols	n\a
Data management	19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol	11
Statistical methods	20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol	11-12
	20b	Methods for any additional analyses (eg, subgroup and adjusted analyses)	11
	20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation)	n/a
Methods: Monitoring			
Data monitoring	21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed	
	21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial	n/a
Harms	22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct	6
Auditing	23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor	6

Ethics and dissemination

Research ethics approval	24	Plans for seeking research ethics committee/institutional review board (REC/IRB) approval	17
Protocol amendments	25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators)	17
Consent or assent	26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32)	17
	26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable	n/a
Confidentiality	27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial	17
Declaration of interests	28	Financial and other competing interests for principal investigators for the overall trial and each study site	17
Access to data	29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators	17
Ancillary and post-trial care	30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation	n/a
Dissemination policy	31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions	n\a
	31b	Authorship eligibility guidelines and any intended use of professional writers	n/a

	31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code	17
Appendices			
Informed consent materials	32	Model consent form and other related documentation given to participants and authorised surrogates	17
Biological specimens	33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable	n/a

*It is strongly recommended that this checklist be read in conjunction with the SPIRIT 2013 Explanation & Elaboration for important clarification on the items. Amendments to the protocol should be tracked and dated.

Appendix D: **INTERVIEW GUIDE**

Mother Interview Guide – Infant Feeding Experiences in the NICU

1. **Tell me about your experiences with feeding your baby while in the NICU?**

   Prompts:
   - What was your greatest joy while feeding your baby in the NICU?
   - What was your greatest worry while feeding your baby in the NICU?
   - What was most supportive while feeding your baby in the NICU?
   - Who was most supportive while feeding your baby in the NICU?
   - What was least supportive while feeding your baby in the NICU?
   - Tell me about any professional breastfeeding support (IBCLCs, RN) that you received while your baby was in the NICU?
   - How did other breastfeeding women (both in and outside of the NICU) influence your feeding experience while your baby was in the NICU?
   - What would a positive feeding experience in the NICU look like?
   - Tell me about how you envision a safe feeding environment that supports breastmilk feeding in the NICU?

2. **What changes would you like to see in breastfeeding support in the NICU environment?**

3. **Is there anything else you would like to talk about, related to feeding your baby while in NICU that I have not covered?**

Appendix E: **CORRELATION TABLE TO DETERMINE CO-VARIATES FOR REPEATED MEASURES ANCOVA**

Covariate	**BSES_dc_total**
	Pearson Correlation
singleton_twin_ic	-0.03
intend_to_bf	.16**
marital_status	0.07
age_mother	-.133**
educ_mother	-0.051
income	-0.066
born_canada_mother	.122*
epds_total_dc	**-.280****
diabetes	-0.052
pre_eclampsia	-0.041
delivery_mode	-0.09
attempt_bf_24h_twins	.121*
only_bmilk_twins	-0.009
DHM	-0.091
additives_twins_dc	**-.163****
EXCBF_dc	-.414**
STAI_trait_baseline	**-.262****
pss_nicu_dc_mean	**-0.076**
State_dc_total	**-.351****
LOS_combined	-0.028
GA	-0.037
mod_late_GA	-0.01

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

*. Correlation is significant at the 0.05 level (2-tailed).

STAI_trait_baseline was determined to be a problematic measure and was therefore not included in the analysis.