4-21-2017 12:00 AM

Breastfeeding resources for mothers of preterm infants in Canadian neonatal intensive care units (NICUs): An environmental scan

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Graduate Program in Health and Rehabilitation Sciences
A thesis submitted in partial fulfillment of the requirements for the degree in Master of Science

Abstract

Supportive breastfeeding resources are needed in neonatal intensive care units (NICUs) to effectively promote breastfeeding among mothers of preterm infants, yet researchers have not examined the existence of such support in a Canadian context. The purpose of this study was to determine, using an environmental scan, the types and frequencies of breastfeeding resources available to mothers of preterm infants in Canadian NICUs. Semi-structured interviews were conducted with 33 key informants from 29 level 3 NICUs across Canada. Six categories of resources were identified via content analysis: breastfeeding-friendly layout, breastfeeding support personnel, breastfeeding education for mothers, breast pump-related resources, coordination of post-discharge breastfeeding support, and breastfeeding-related policies. Several resources were reported by informants to exist in a high proportion of NICUs, such as privacy measures and breast pump availability, whereas other resources were reported in lower frequencies, such as the presence of peer counsellors and breastfeeding-related policies.

Keywords: breastfeeding, human milk, preterm infant, neonatal intensive care unit, resources, support, mothers, environmental scan

To my baby brother, Jake Scime Visca, who was born preterm in May of 1996 – your presence on this earth lasted only eight hours, yet you have inspired my life's work. There is not one moment where I don't imagine what life would be like if your prematurity did not impede your survival. With my research, I endeavour to help tiny fighters like you to lead a thriving life, and to provide mothers like ours with the support needed to nurture their precious newborns. I love you infinitely and dedicate this work to you.

Acknowledgements

My journey through the MSc program would not have been possible without numerous important parties. I would like to acknowledge the financial support received throughout my graduate studies: a CIHR Canada Graduate Scholarship (2015–2016) and an Ontario Graduate Scholarship (2016–2017). Such support has afforded me the valuable opportunity to focus wholly on my research and professional development.

To my supervisor – Dr. Shauna Burke – a sincere thank you for your guidance and mentorship throughout the duration of both my undergraduate and graduate studies here at Western. From sitting in your first year class to sitting in your office finalizing thesis edits six years later, you have been a pivotal individual in stimulating my research career and intellectual growth. I would also like to thank my advisory committee – Dr. Marilyn Evans and Dr. Michelle Mottola – for their direction and insight towards strengthening this research.

To my interview participants – my most heartfelt thank you to the health care providers in NICUs across Canada who graciously offered their time and expertise to participate in my research. The positive response and enthusiasm I received from so many of you has truly served as a motivator to maximize the impact and creative dissemination of this study.

To my extraordinary family – my mother and stepfather – Charlene Scime and John Fallis – and my brother and sister – Robert and Marie Visca – I would truly be lost without your fierce love and support. Thank you for believing in me, inspiring me, and standing by me each and every day. Thank you to my father and stepmother – Robert and Lucy Visca – as well as my friends (both old and new), colleagues, and mentors for your ongoing encouragement and support. An enormous thank you to my partner – Jason Ribeiro – your unwavering and loving presence means the world to me. These last two years have shown me just how incredible my support system is and I feel so fortunate to have had so many strong, kind, and wonderful people cheering me on to the finish line.

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Chapter 1: Introduction and Literature Review

The World Health Organization (WHO; 2016a) recommends that all human infants should be exclusively breastfed from birth until six months of age. Exclusive breastfeeding is defined as the consumption of human milk[1] only, with no additional food or drink (e.g., infant formula, water, and complementary foods) provided, excluding vitamins, minerals, and medicines (WHO, 2016a). After six months, the WHO recommends that infants receive healthy complementary foods while continuing to breastfeed for up to two years of age or beyond (WHO, 2016a). These recommendations have been adopted and endorsed by a number of international health authorities including Health Canada (Health Canada, 2015), the U.S. Office of the Surgeon General (Office of the Surgeon General, Centers for Disease Control and Prevention, & Office on Women's Health, 2011), and the European Commission (European Commission, 2008).

Benefits of Breastfeeding

Human breast milk (herein referred to as *human milk*) is the optimal form of nourishment for infants because it is uniquely tailored to meet their nutrition needs (James & Lessen, 2005). Human milk is composed of carbohydrates, fatty acids, protein, cholesterol, minerals, and several other compounds that are highly bioavailable for infants in the precise amounts needed for growth over time (James & Lessen, 2005; Spatz, 2014). The precision of human milk composition is also evident during individual feeding sessions, where the caloric and lipid composition is biologically adjusted according to the amount of milk that infants consume during each feed (Spatz, 2014). Further, gestational age of the infant at birth appears to be an important

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[1]The breastfeeding and lactation-related language used throughout this thesis adheres to the preferred language outlined in the *International Lactation Consultant Association (ILCA) Style Guidelines for Written Professional Resources* (ILCA, 2017).

predictor of maternal milk content, as human milk produced by mothers of preterm infants has been found to be higher in protein and immune components than that produced by mothers of full-term infants (Gidrewicz & Fenton, 2014; Trend et al., 2016).

The personalized and dynamic nature of human milk composition during the time an infant is breastfed represents one of the several benefits associated with breastfeeding. Many profound benefits of breastfeeding for both infants and mothers have been well established, and several have been found to occur in a dose-response relationship (Eidelman & Schanler, 2012). These benefits are explained below, with specific reference to both full-term and preterm infants and their mothers.

Full-Term Infant-Mother Dyads

Benefits of breastfeeding for full-term infants. Breastfeeding has been studied in association with numerous short- and long-term health outcomes for healthy, full-term infants. Reviews of studies have shown that the benefits of breastfeeding extend throughout infancy and early childhood, and include a decreased risk of sudden infant death syndrome (Hauck, Thompson, Tanabe, Moon, & Vennemann, 2011; Ip et al., 2007), respiratory tract infections (Bachrach, Schwarz, & Bachrach, 2003; Duijts, Ramadhani, & Moll, 2009), otitis media (i.e., ear infections; Bowatte et al., 2015; Ip et al., 2007), and gastrointestinal infections (Duijts et al., 2009; Ip et al., 2007). Reviews and meta-analyses have also examined the relationship between breastfeeding and the risk of specific diseases during childhood, providing evidence to support the protective role of breastfeeding in relation to the development of type 1 diabetes (Ip et al., 2007; Patelarou et al., 2012) and leukemia (Amitay & Keinan-Boker, 2015; Ip et al., 2007). Despite some concerns regarding confounding variables such as birth weight (Kramer, 2000), studies have also demonstrated that breastfeeding is associated with a reduction in the risk of

type 2 diabetes during both childhood and adulthood (Horta, Bahl, Martines, & Victora, 2007; Owen, Martin, Whincup, Smith, & Cook, 2006), as well as cardiovascular and metabolic diseases in adulthood (McDade et al., 2014).

Conflicting evidence exists surrounding the potential role that breastfeeding plays in relation to neurodevelopment, as measured using validated, age-appropriate tools at various stages of life (also referred to as cognitive development or performance; Ip et al., 2007; Walfisch, Sermer, Cressman, & Koren, 2013). For example, Ip et al. (2007) conducted a comprehensive review (n = 11 studies) containing two systematic reviews and one meta-analysis and found no strong evidence of an association between breastfeeding (in any amount or duration) and neurodevelopment (measured at any stage of life). The authors noted inconsistencies between studies and concerns regarding maternal intelligence as a confounding variable (Ip et al., 2007). Subsequently, Walfisch and colleagues (2013) conducted a systematic review (n = 84 studies) to examine the association between any breastfeeding and neurodevelopment across the lifespan and arrived at a similar conclusion. Specifically, they found that of the 84 included studies, 28 demonstrated a positive and significant association between breastfeeding and neurodevelopment, 17 had a positive association that weakened but remained statistically significant after the original study authors adjusted for confounders (e.g., birth order, maternal smoking status), 18 showed a positive association that became negative after adjustment, and 21 had no association (Walfisch et al., 2013). Similar to Ip et al. (2007), Walfisch et al. (2013) noted that the majority of positive associations reported in studies were likely attributable to confounding variables, namely maternal intelligence scores and socioeconomic status.

The association between breastfeeding and obesity has also been widely studied, with

important implications for addressing the globally rising trends in both childhood and adulthood obesity (WHO, 2016b). Concerns related to research examining the relationship between breastfeeding and obesity have arisen due to the presence of, and lack of accounting for, several confounding variables including parental weight and diet patterns, socioeconomic status, birth order, and numerous other factors (Ip et al., 2007). Nonetheless, a series of three scientific reviews regarding breastfeeding and obesity have been conducted to critically examine this association (Horta et al., 2007; Horta, de Mola, & Victora, 2015; Horta & Victora, 2013). The initial systematic review (Horta et al., 2007; n = 33 studies) and second systematic review (Horta & Victoria, 2013; n = 71 studies) showed that individuals breastfed any amount were 22% and 24% less likely to be considered obese or overweight later in life (i.e., into childhood and adulthood), respectively (pooled odds ratios [*ORs*] = 0.78, 0.76, respectively; 95% confidence intervals [CIs] [0.72, 0.84], [0.71, 0.81], respectively). A meta-analysis that included 16 high quality studies was also conducted as part of the second review, in which Horta and Victora (2013) found that the protective effect of any breastfeeding on obesity and overweight in later life reduced slightly, but remained significant (pooled *OR* = 0.88; 95% CI [0.83, 0.93]). The third review was conducted by Horta, de Mola, and Victora (2015) and included a meta-analysis containing data from 11 high quality, demographically diverse studies. On the basis of these data, the authors found that any breastfeeding during infancy was associated with a 13% reduction in obesity and overweight later in life (pooled *OR* = 0.87; 95% CI [0.76, 0.99]; Horta et al., 2015). Taken together, the evidence from these three scientific reviews provides support for the protective effect of breastfeeding on obesity and overweight. Plausible biological mechanisms for this relationship have been advanced by researchers, and may relate to improvements in the metabolic and hormonal regulation of infant food intake, satiation, energy

expenditure, and numerous other factors (Spatz, 2014).

The bodies of literature regarding breastfeeding and its potential association with some infant health outcomes are fraught with inconsistencies. For example, several primary studies examining the relationship between breastfeeding and allergic disorders such as eczema, allergies, and asthma, have shown statistically significant risk reductions (Ehlayel & Bener, 2008; Kull, Wickman, Lilja, Nordvall, & Pershagen, 2002; Matheson et al., 2007). However, the authors of a recent meta-analysis (n = 89 studies) including the aforementioned studies suggested that the overall literature base in this area is low in methodological quality, and that there is little evidence of breastfeeding-related protection against allergic disorders when strict control over confounding variables (e.g., family history of such disorders, socioeconomic status) is employed (Lodge et al., 2015). Similarly, the consensus regarding breastfeeding and its potential protective role against celiac disease has changed over time. In 2006, a meta-analysis conducted by Akobeng, Ramanan, Buchan, and Heller (n = 4 case control studies) showed that infants who were breastfed at the time of gluten introduction had a significantly lower risk of developing celiac disease compared to their non-breastfed counterparts (pooled OR = 0.48; 95% CI [0.40, 0.59]). Ten years later, the authors of a systematic review containing the results of 16 studies concluded that neither the duration of breastfeeding nor breastfeeding at the time of gluten introduction were related to the development of celiac disease, with more recent and higher quality primary studies supporting this conclusion (Silano, Agostoni, Sanz, & Guandalini, 2016). Comparing their findings to that of the previous meta-analysis (Akobeng, Ramanan, Buchan, & Heller, 2006), Silano, Agostoni, Sanz, and Guandalini (2016) suggested that breastfeeding may in fact delay the onset of celiac disease into later childhood rather than prevent it.

Benefits of breastfeeding for mothers of full-term infants. Mothers also experience a

wide range of breastfeeding-related health benefits. For example, reviews and meta-analyses have demonstrated that lifetime breastfeeding (i.e., the duration of breastfeeding over a woman's lifetime) serves a protective role against several forms of cancer among women, including breast (Bernier, Bossard, Ayzac, & Thalabard, 2000; Collaborative Group on Hormonal Factors in Breast Cancer, 2002), endometrial (Wang, Li, & Shi, 2015), and ovarian (Ip et al., 2007; Li et al., 2014), with longer breastfeeding durations associated with stronger protective effects. Breastfeeding has also been found to protect against, in a dose-response fashion, the onset of hypertension, hyperlipidemia, cardiovascular disease (Schwarz, Ray, et al., 2010), and type 2 diabetes among women (Schwarz, Brown, et al., 2010; Schwarz, Ray, et al., 2010; Stuebe, Rich-Edwards, Willett, Manson, & Michels, 2005).

Researchers have also investigated the association between breastfeeding and depressive symptoms as well as clinical postpartum depression diagnoses (PPD; Dias & Figueiredo, 2015). In a literature review conducted to examine the potential biological and psychological mechanisms underlying the association between breastfeeding and PPD, Figueiredo, Dias, Brandao, Canario, and Nunes-Costa (2013) found that one of the hormonal actions of breastfeeding includes attenuating the cortisol response to stress which may protect against PPD. Further, on the basis of the studies reviewed, these authors indicated that breastfeeding may serve to regulate sleep and wake patterns among mother-infant dyads, as well as improve a mother's self efficacy for parenting and emotional involvement with her child (Figueiredo, Dias, Brandao, Canario, & Nunes-Costa, 2013). In their systematic review, Dias and Figueiredo (2015) found that 16 of the 18 included studies reported an association between shorter exclusive or non-exclusive breastfeeding duration and higher rates of depressive symptoms and PPD. According to the authors, the order of this relationship (i.e., whether breastfeeding outcomes

predicted depressive symptoms/PPD or vice versa) remains ambiguous (Dias & Figueiredo, 2015). Thus, additional research is needed to clarify the nature, direction, and strength of the complex association between breastfeeding and depressive symptoms or PPD. Research-focused recommendations in this area include measurement (e.g., the use of validated depression measures and cut-off scores) and study design (e.g., the use of prospective or longitudinal designs) considerations, as well as controlling for confounders including a prior history of depression, socioeconomic status, and social support (Pope & Mazmanian, 2016). However, on the basis of current studies, it can be concluded that a relationship between breastfeeding and both depressive symptoms and PPD does exist.

Despite the presence of evidence to support the association between breastfeeding and several important maternal health outcomes (some of which are discussed above), the role of breastfeeding remains unclear in relation to other health conditions. For example, some primary studies have demonstrated significant and beneficial results for both improved bone mineral density (Lenora, Lekamwasam, & Karlsson, 2009; Wiklund et al., 2012) and postpartum weight management among women (Monteiro da Silva et al., 2013; Sámano et al., 2013) as a result of breastfeeding. However, authors of a systematic review and meta-analysis that included the aforementioned primary studies (n = 5 studies related to postpartum weight change and n = 6 studies related to osteoporosis) concluded that the relationship between breastfeeding and these variables is unclear, with conflicting findings and a lack of strong evidence to support a relationship in either direction (Chowdhury et al., 2015). These two examples reveal some noteworthy challenges in the epidemiological breastfeeding literature: identifying, measuring, and controlling for relevant confounding variables is complex and often performed inconsistently. For example, researchers examining the relationship between bone mineral

density and breastfeeding have differentially considered a variety of confounders such as age, body mass index, parity, oral contraceptive use, dietary calcium intake, hormone replacement therapy, and physical activity behaviours (Chowdhury et al., 2015; Ip et al., 2007). Thus, it is plausible that varying levels of accounting for confounding variables among researchers contributes to conflicting findings across studies. This subsequently undermines the ability of review authors to form strong conclusions about the association between breastfeeding and various maternal (and infant) health outcomes.

Preterm Infant-Mother Dyads

Benefits of breastfeeding for preterm infants. Breastfeeding and human milk consumption (via enteral or oral feeding methods) provides several unique and critical benefits for preterm infants (i.e., those born less than 37 weeks completed gestation; Callen & Pinelli, 2005). In fact, given its many benefits toward improving and maintaining the health of preterm infants, some researchers have suggested that clinicians refer to human milk as "medicine" when discussing breastfeeding with mothers of preterm infants (Meier, Patel, Bigger, Rossman, & Engstrom, 2013). Important to note before delving into this literature is the distinction between breastfeeding (i.e., nutritive sucking at the breast) and human milk consumption (i.e., feeding expressed milk to the infant). Whereby full-term infants are capable of breastfeeding immediately after birth, preterm infants are often unable to perform nutritive sucking, sometimes for extended periods of time, due to physiological and developmental immaturity and/or medical complexity (Buckley & Charles, 2006). Thus, they are fed expressed milk initially through enteral nutrition (i.e., feedings delivered directly to the stomach or intestines, also called tube feeding) or oral feeding methods (e.g., bottle, cup, or finger feeding) while working towards readiness to feed at the breast. Expressed milk is typically provided by the infant's mother via

hand expression or through use of a manual or electric breast pump, but can also include donated human milk from other mothers. While some researchers broadly define any stage of this feeding progression continuum as breastfeeding, others opt to make the distinction between breastfeeding and human milk consumption. Further, human milk consumption may be defined broadly as any human milk, or distinguished by the provision of maternal milk versus donor milk. The use or non-use of these distinctions in relevant studies will be reported in this section. Lastly, the method of feeding (i.e., via enteral nutrition, alternative oral feeding methods, or the breast) and amount of expressed milk consumed by the infant is minimally controlled or reported by researchers, given that these details may be dependent on the infant's ongoing nutritional and medical status, developing maturity, or hospital policies (pertaining to feeding progression).

One critical benefit of human milk is its positive impact on the development of the preterm infant's immature immune system. Preterm infants that are fed human maternal milk demonstrate lower rates of sepsis (when consuming at least 50 mL/kg of human milk per day; Furman, Taylor, Minich, & Hack, 2003) and meningitis (Hylander, Strobino, & Ramasubbareddy, 1998) than formula-fed counterparts. Preterm infants fed a human milk-based diet (maternal and/or donor) also display lower rates of necrotizing enterocolitis (NEC) compared to infants fed or even exposed to formula (Ip et al., 2007; Sullivan et al., 2010). Decreased incidence of NEC is particularly noteworthy given its high case fatality and long-term medical complications in afflicted patients (Hintz et al., 2005). Exclusive and non-exclusive human maternal milk consumption is also associated with a reduced risk of complications in preterm infants such as retinopathy of prematurity (Hylander, Strobino, & Pezzullo, 2001; Manzoni et al., 2013) and chronic lung disease (Schanler, Lau, Hurst, & Smith, 2005).

The underdeveloped gastrointestinal system of the preterm infant also benefits

profoundly from human milk given that it contains many components that promote maturation of the small intestine (Callen & Pinelli, 2005). This has important implications for an infant's feeding progression. The consumption of human maternal milk is associated with significantly more rapid gastric emptying (Ewer, Durbin, Morgan, & Booth, 1994) and less feeding intolerance (Dritsakou, Liosis, Valsami, Polychronopoulos, & Skouroliakou, 2016), the latter of which can be defined as the inability to digest enteral feedings (Moore & Wilson, 2011), in comparison to the consumption of formula (and donor milk in the case of Dritsakou et al. [2016]). Human maternal milk-fed preterm infants are also able to initiate feeding at the breast earlier than those fed donor milk or formula (Dritsakou et al., 2016). Further, preterm infants are born with a less favourable gut microbiome compared to full-term infants, and breastfeeding and human milk consumption are important mechanisms for establishing the colonization of healthy gut bacteria in these infants (Scime, 2016; Unger, Stintzi, Shah, Mack, & O'Connor, 2015).

Despite the medical fragility of some preterm infants, placing them at their mother's breast for direct breastfeeding provides numerous benefits to infant physiology. Infants fed at the breast experience significantly higher oxygen saturation, increased body temperature, fewer episodes of apnea and bradycardia (Chen, Wang, Chang, & Chi, 2000), and better coordination of sucking, swallowing, and breathing (Dowling, 1999) during feeds in comparison to bottle-fed counterparts.

In addition to the direct physiological benefits, breastfeeding and human milk consumption have been shown to improve other aspects of preterm infants' ongoing health status. For example, preterm infants receiving exclusively human maternal milk have been shown to have significantly shorter hospital stays and lower rates of nosocomial infection compared to preterm infants fed either donor milk or formula (Schanler et al., 2005). Further,

preterm infants' ingestion of some human maternal milk as opposed to no human maternal milk has been associated with significantly fewer re-hospitalizations at both 18 weeks (Vohr et al., 2006) and 30 weeks post-discharge (Vohr et al., 2007).

Breastfeeding and human milk consumption also play a role in alleviating procedural pain in preterm infants. This is a particularly important benefit as preterm infants in the neonatal intensive care unit (NICU) undergo several routine procedures, many of which are painful, as part of their medical care. In fact, one study conducted in France showed that preterm infants undergo a median of 10 painful procedures (e.g., nasal or tracheal aspiration, heel stick, or adhesive removal) per day of NICU hospitalization (Carbajal et al., 2008). Further, inappropriate management of preterm infant pain during such procedures has been noted to lead to several short- and long-term adverse cognitive, motor, and behavioural outcomes (Ranger & Grunau, 2014). In 2012, a Cochrane review containing 20 studies was conducted to separately examine breastfeeding (n = 10 studies) and human milk consumption (n = 10 studies) as mechanisms of pain relief for both full-term and preterm infants in comparison to other pain relief methods such as oral sucrose, massaging, or pacifiers (Shah, Aliwalas, & Shah, 2012). Although sub-group analyses based on gestational age could not be performed due to the limited number of studies, overall, both breastfeeding and human milk consumption were found to be effective in alleviating procedural pain as evidenced via physiological (e.g., changes in heart rate) and behavioural (e.g., percentage of time crying) indicators (Shah et al., 2012). Subsequent to the implementation of this Cochrane review, several primary studies have examined human milk consumption versus oral sucrose for pain alleviation in preterm infants (Bueno et al., 2012; Sahoo, Rao, Ranjit, Ashok, & Bhat, 2013; Simonse, Mulder, & van Beek, 2012). Generally speaking, findings have shown that while human milk remains superior to placebo treatments for

managing infant pain, it does not appear to be a superior pain relief method compared to oral sucrose (Bueno et al., 2012; Sahoo et al., 2013; Simonse et al., 2012). Despite these results, concerns exist regarding the true effectiveness and long-term safety of using oral sucrose as an analgesic among preterm infants, leading researchers to recommend the use of other non-pharmacological techniques, such as breastfeeding, for pain management in this population (McPherson & Grunau, 2014; Slater et al., 2010). Additional research is therefore warranted to understand the optimal use of human milk in alleviating preterm infant pain. This may be particularly relevant in Canada given the fact that pain management practices in many Canadian NICUs are improving, but still appearing to fall short of the Canadian Pediatric Society's recommended guidelines (Johnston, Barrington, Taddio, Carbajal, & Filion, 2011).

Lastly, the consumption of human milk has been studied in association with childhood neurodevelopment among infants who were born preterm. In this context, researchers have studied preterm infants who consumed any human maternal milk from birth to 18 months (Vohr et al., 2006) and 30 months of age (Vohr et al., 2007). Results revealed significantly higher scores on neurodevelopmental outcomes at both time points for preterm infants who consumed any human maternal milk in comparison to infants who did not consume any human maternal milk after controlling for confounders (e.g., maternal age and education, infant's gestational age, and NEC diagnosis; Vohr et al., 2006, 2007). Authors of a subsequent systematic review containing seven observational studies reported that any human milk (maternal and/or donor) is associated with a beneficial effect on neurodevelopment among preterm infants (Koo, Tank, Martin, & Shi, 2014). Further, Koo, Tank, Martin, and Shi (2014) suggested that the effect of human milk consumption can be best described as *protective*, in the sense that it enables children born preterm who received human milk to achieve normal neurodevelopment assessment scores

(that is, on par with their full-term peers) as opposed to the subnormal scores demonstrated by children born preterm who received formula. In further support of such an association, MRI scans of adolescents who were born preterm have shown a dose-response relationship between early human maternal milk intake and whole brain volume, particularly through white matter growth (Isaacs, Fischl, Quinn, Chong, & Gadian, 2011).

Benefits of breastfeeding for mothers of preterm infants. In addition to the general maternal benefits of lactation, breastfeeding (which, throughout this section, includes the provision of expressed milk) has a role in supporting the psychological health of mothers of preterm infants. This is particularly important to consider given that mothers of preterm infants are at a higher risk for psychological distress, including PPD (Vigod, Villegas, Dennis, & Ross, 2010), post-traumatic stress symptoms (Kersting et al., 2004), and anxiety (Helle et al., 2016), than their full-term counterparts. Qualitative studies have shown that breastfeeding appears to provide mothers of preterm infants with a sense of purpose and worth, particularly following what are often difficult and emotionally vulnerable deliveries as well as physical separation when infants are admitted to the NICU (Boucher, Brazal, Graham-Certosini, Carnaghan-Sherrard, & Feeley, 2011; Kavanaugh, Meier, Zimmermann, & Mead, 1997; Swanson et al., 2012). Breastfeeding is viewed as an act that only mothers can do (Kavanaugh et al., 1997); as such, this maternal behaviour contributes largely to establishing a woman's role as a mother (Flacking, Ewald, & Starrin, 2007; Lupton & Fenwick, 2001; Rie & Keiko, 2012; Sweet, 2008). Breastfeeding allows mothers of preterm infants in particular to feel actively involved in the care of their infant and in contributing to infant growth and well-being (Boucher et al., 2011; Rossman, Kratovil, Greene, Engstrom, & Meier, 2013). Research has also shown that many mothers value opportunities to experience a physical connection with their preterm infant while

breastfeeding, where and when possible, as most infants are under the continuous care of medical staff in an isolated bed (Boucher et al., 2011; Flacking, Ewald, Nyqvist, & Starrin, 2006; Sweet, 2008). Unfortunately, no studies could be located that have quantified the association between breastfeeding and maternal psychological health in the preterm population. However, findings from the large body of qualitative literature discussed above underscore the importance of considering mothers of preterm infant's breastfeeding experiences and the perceived beneficial impact on psychological health.

Breastfeeding Rates Among Preterm Infant-Mother Dyads

Despite the many benefits of breastfeeding, global breastfeeding initiation, duration, and exclusivity rates among mothers of preterm infants are consistently lower than that among mothers of full-term infants, with the lowest rates evident among mothers of infants of the earliest gestational ages (Bonet et al., 2011; Callen & Pinelli, 2005; Donath & Amir, 2008; Goyal, Attanasio, & Kozhimannil, 2014; Merewood, Brooks, Bauchner, MacAuley, & Mehta, 2006; Rayfield, Oakley, & Quigley, 2015). However, challenges exist when comparing breastfeeding rates and behaviours in preterm versus full-term infant populations. Presently, there are no agreed upon definitions for breastfeeding in the context of neonatal care as existing definitions in studies of human milk feeding among preterm infants are limited and inconsistent (Meier et al., 2010). Thus, cross-study comparisons or aggregations of breastfeeding data in preterm versus full-term infants are often difficult, as the definitions of breastfeeding for each infant population, and often each study, vary widely (Callen & Pinelli, 2005).

Comparisons drawn within a single study are more acceptable given that the definitions of breastfeeding, regardless of whether they are reported or how they are operationalized, are more likely to be applied uniformly across the study sample. In a study examining the feeding

outcomes of 67,884 infants born in Massachusetts, U.S., Merewood and colleagues (2006) found that breastfeeding initiation (i.e., the yes or no response to the question "are you breastfeeding, or do you intend to breastfeed?") was 76.8% among mothers of full-term infants born at 37 to 42 weeks gestation, 70.1% among mothers of preterm infants born at 32 to 36 weeks gestation, and 62.9% among mothers of preterm infants born at 24 to 31 weeks gestation.

A study conducted in Australia included a comparison of breastfeeding initiation (definition not reported) and duration (defined as the consumption of any human milk at six months of age) rates among mothers of 3,600 infants born at various gestational ages (Donath & Amir, 2008). The authors found that the rate of breastfeeding initiation was lowest among mothers of preterm infants born at 35 to 36 weeks gestation (88.2%), followed by mothers of early term infants born at 37 to 39 weeks gestation (92.0%), and mothers of full-term infants born at 40 weeks gestation or over (93.9%). After adjusting for confounders (e.g., maternal smoking, caesarean birth), the differences were not statistically significant. With respect to breastfeeding duration, 41.2% of the preterm infants were breastfeeding at six months compared to 54.5% of the early term infants and 60.5% of the full-term infants. These differences were statistically significant; mothers of infants born less than 37 weeks gestation were 42% less likely to be breastfeeding at six months compared to mothers of infants born at 37 weeks gestation or more (adjusted *OR* = 0.58; 95% CI [0.42-0.81]; Donath & Amir, 2008).

More recently, a study of 1,860 mother-infant pairs in the United States found that mothers of late preterm infants born at 34 to 36 weeks gestation were 62% less likely to be breastfeeding exclusively (definition not reported) at one week postpartum compared to mothers of full-term infants born at 39 weeks gestation or more (adjusted *OR* = 0.38; 95% CI [0.23–0.65]; Goyal et al., 2014). After using multivariable logistic regression to adjust for high hospital

support, the negative relationship between late preterm gestational age and breastfeeding exclusivity at one week persisted (adjusted *OR* = 0.40; 95%CI [0.24–0.68]; Goyal et al., 2014).

Cohort studies conducted in Canada have shown similar trends. In particular, a study of 1,227 mothers in Alberta found that, in comparison to mothers of full-term infants born at 38 weeks gestation or more, mothers of late preterm infants born at 34 to 36 weeks gestation were significantly less likely to have initiated breastfeeding (no definition reported) within 24 hours after birth (97.5% versus 78.7%, respectively) as well as before leaving the hospital (90.8% vs. 78.1%; McDonald et al., 2013). This pattern persisted after discharge, where mothers of late preterm infants were less likely to be breastfeeding at four months in comparison to mothers of full-term infants (69.3% versus 81.7 %, respectively; McDonald et al., 2013). Similarly, a Canadian study of 5,615 women showed that 14.6% of mothers whose infants were not admitted to the NICU were breastfeeding exclusively at six months (as per the WHO definition), compared to 8.6% of mothers whose infants were admitted to the NICU for prematurity or other medical reasons (Al-Sahab, Lanes, Feldman, & Tamim, 2010). Further analyses revealed that mothers of infants who were not admitted to the NICU were 51% more likely to be breastfeeding exclusively at six months compared to mothers of infants admitted to the NICU (adjusted *OR* = 1.51; 95% CI [1.12-2.03]; Al-Sahab et al., 2010).

Despite the challenges associated with interpreting and comparing breastfeeding data across studies, particularly in the absence or inconsistent use of definitions, findings from international and Canadian studies have provided evidence that breastfeeding rates among mothers of preterm infants are lower than that among mothers of full-term infants. As such, and given the health benefits outlined above, the importance of research and knowledge translation focused on enhancing breastfeeding outcomes for mothers and their preterm infants is critical.

Breastfeeding Barriers and Facilitators for Mothers of Preterm Infants

To understand and explore the underlying mechanisms and potential solutions to the lower breastfeeding rates documented in the preterm infant population, consideration must be given to mothers' perceived barriers and facilitators related to breastfeeding. Alves, Rodrigues, Fraga, Barros, and Silva (2013) conducted a systematic review (n = 7 qualitative and mixed methods studies) that examined such issues in relation to human milk provision to preterm infants in the NICU setting. Several barriers were identified that pertained to characteristics of the NICU; namely, the stressful nature of the NICU environment (including lack of privacy), physical separation from the infant, and structured feeding routines that impeded the mother's ability to be present for all of her infant's feeds. Factors associated with the relationship between mothers and health care providers in the NICU were also identified as barriers, including mothers receiving inconsistent information or conflicting advice from NICU staff, as well as a general lack of staff availability and/or expertise to address mothers' inquiries. The most commonly cited barriers noted in Alves et al.'s (2013) review were difficulties with expressing milk and concerns regarding perceived inadequate milk supply. Some of the identified breastfeeding-related facilitators pertained to maternal caretaking and role attainment, such as viewing breastfeeding and/or providing expressed milk as opportunities to contribute to the infant's growth and well-being, hold and connect with the infant, and experience a sense of normality. Facilitators related to breastfeeding knowledge were identified as well, including having accurate knowledge of human milk benefits, breastfeeding techniques, and infant feeding behaviours (e.g., hunger and satiation cues). Lastly, constructive parent-provider dynamics, such as positive reinforcement and feedback from health care providers, were also identified by mothers as facilitators related to human milk provision in the NICU (Alves, Rodrigues, Fraga,

Barros, & Silva, 2013).

Other studies have explored additional breastfeeding-related barriers experienced by mothers of preterm infants. Psychological barriers that have been identified include mothers' perceptions of a physically compromised infant as well as maternal stress and fatigue, all of which have been shown to persist during breastfeeding efforts after discharge from hospital (Callen, Pinelli, Atkinson, & Saigal, 2005). In addition, authors of an integrative review (n = 45 studies) regarding mothers' needs when using a breast pump in the NICU documented several pumping-related barriers including nipple and breast soreness, pain while pumping, and general discomfort (Lucas, Paquette, Briere, & McGrath, 2014).

Important to note is the potential and likely combination of various barriers, which can create a uniquely challenging breastfeeding experience for mothers of preterm infants. For example, high levels of maternal stress, nipple and breast soreness, and physical separation from the infant may all contribute to inhibiting the release of lactation hormones, consequently resulting in challenges related to maintaining adequate milk supply (Callen et al., 2005). It is evident that, despite the presence and perception of various breastfeeding-related facilitators, the many NICU-, maternal-, and pumping-specific barriers that have been identified in the literature by mothers of preterm infants can create significant challenges when attempting to engage in this behaviour.

Breastfeeding Promotion Interventions in Neonatal Intensive Care Units (NICUs)

Several interventions have been introduced into NICU settings in an attempt to alleviate the range of breastfeeding and milk expression barriers that mothers face, and to increase the number of preterm infant-mother dyads who experience the profound benefits of breastfeeding. Some of the interventions that are more commonly cited and studied by researchers are described

in this section.

Skin-to-skin care, also called kangaroo care, is defined as the infant being held vertically between the mother's breasts, allowing for direct physical contact between the dyad for intermittent periods of time; the infant is unclothed except for the diaper and often a warm hat and socks (Nyqvist et al., 2015). This practice has a positive impact on breastfeeding by means of various biological mechanisms such as stimulating innate breastfeeding reflexes and self-regulation behaviours in infants (Widström et al., 2011), as well as increasing maternal milk supply (Hurst, Valentine, Renfro, Burns, & Ferlic, 1997).

Galactogogues include any substance that aims to increase maternal milk production, and may include pharmaceuticals or herbal/food products. Domperidone is the most commonly studied galactogogue, and others include milk thistle, growth hormone, oxytocin, and metoclopramide (Forinash, Yancey, Barnes, & Myles, 2012). Galactogogues are often recommended for mothers experiencing insufficient milk supply after appropriate lactation counselling has been sought to assess modifiable factors such as infant latch and milk expression technique (Gabay, 2002).

Alternative feeding interventions refer to the range of enteral or oral feeding methods that may be used to provide the infant with human milk until feeding directly at the breast is possible. Oral methods include cup, bottle, spoon, finger, or syringe feeding, whereas enteral methods include gavage feeding (Dowling & Thanattherakul, 2001). Alternative feeding interventions also includes the use of nipple shields, which are ultrathin silicone devices placed on the nipple to increase milk transfer for preterm infants feeding at the breast (Meier et al., 2000).

Milk expression strategies are those used by mothers to remove human milk from their breasts. Such strategies have included various combinations, equipment, and techniques for milk

expression, as well as varied timing, frequency, and duration of expression sessions (McInnes & Chambers, 2008; Renfrew et al., 2009). The use of breast massage as a component to milk expression strategies, sometimes referred to as "hands on pumping", has also been studied (Jones, Dimmock, & Spencer, 2001).

Postnatal breastfeeding support broadly encompasses counselling or education offered by health care providers or peers to mothers of preterm infants throughout their breastfeeding experience, and can be delivered one-to-one and/or via group settings through use of oral, audio-visual or written (printed or electronic) communication (McInnes & Chambers, 2008; Renfrew et al., 2009). This may also include the training of NICU staff members to improve their knowledge and skills related to providing postnatal breastfeeding support to mothers (Bernaix, Schmidt, Arrizola, Iovinelli, & Medina-Poelinez, 2008)

Lastly, restructuring of the NICU environment or policies may take place to obtain designation of, or adhere to, the WHO/United Nations Children's Fund (UNICEF) Baby-Friendly Hospital Initiative (BFHI). This global, comprehensive quality improvement initiative focuses on providing the optimal environment to promote breastfeeding through the implementation of 10 steps (WHO & UNICEF, 2009). The BFHI will be discussed in greater detail later in this chapter.

Effectiveness of Breastfeeding Promotion Interventions in NICUs. Two comprehensive systematic reviews have examined the effectiveness of the aforementioned interventions in the promotion of breastfeeding and/or human milk feeding in the NICU (McInnes & Chambers, 2008; Renfrew et al., 2009). The first, conducted by McInnes and Chambers (2008), included 27 studies from developed countries: 15 randomized controlled trials, three randomized crossover studies, and nine classified as "other" controlled interventions (e.g.,

cross-sectional pre-post designs). Due to insufficient data available for some of the interventions (e.g., nipple shields, finger feeding), McInnes and Chambers (2008) analyzed and reported on 18 studies total, focusing only on skin-to-skin care (n = 5 studies), cup feeding (n = 3 studies), milk expression methods (n = 3 studies), galactogogues (n = 4 studies), and postnatal breastfeeding support (n = 3 studies). Overall, the authors concluded that strong evidence exists to suggest that skin-to-skin care and postnatal support interventions are associated with improved breastfeeding outcomes. Specifically, high quality studies have demonstrated that: (a) skin-to-skin care led to a significantly increased likelihood of breastfeeding at hospital discharge and at one month post-discharge, and (b) postnatal professional (i.e., an International Board Certified Lactation Consultant [IBCLC]) and peer breastfeeding support for mothers with infants in the NICU were associated with a significantly increased likelihood of human milk feeding during hospitalization, upon discharge, and at 12 weeks (McInnes & Chambers, 2008).

The second systematic review, conducted by Renfrew and colleagues (2009), also aimed to evaluate the effectiveness of interventions used to promote breastfeeding or human milk feeding for infants in the NICU. Renfrew et al. (2009) included all of the studies examined in the review conducted by McInnes and Chambers (2008), and executed what they deemed to be a more thorough review in that they utilized an expanded search strategy, included a wider range of interventions, and employed more rigourous systematic review methods. In total, the authors identified 48 studies for inclusion: 31 randomized controlled trials, three randomized crossover studies, and 14 classified as "other" controlled interventions. The breastfeeding promotion interventions in the included studies were categorized into: increased mother/infant contact (i.e., skin-to-skin care; n = 12 studies), interim feeding methods (n = 6 studies), milk expression methods (n = 6 studies), interventions to increase milk supply (n = 7 studies), optimal nutritional

intake interventions (*n* = 3 studies), breastfeeding education and support (*n* = 6 studies), staff training (*n* = 2 studies), early hospital discharge and home support (*n* = 2 studies), and organization of care (i.e., restructuring the NICU environment or policies; *n* = 4 studies). Overall, they concluded that skin-to-skin care, postnatal breastfeeding education and support, and breastfeeding-friendly NICU environments were effective at promoting breastfeeding among mothers of infants starting life in the NICU. Periodic skin-to-skin care was associated with an increased duration of any breastfeeding prior to, at, or up to one month after hospital discharge. Postnatal breastfeeding education and skilled support for mothers, which included breastfeeding training for NICU staff, IBCLC counselling, peer support, and group educational sessions, were found to improve breastfeeding initiation (the likelihood of infants ever receiving human milk), duration (both at 12 weeks and 24 weeks), and exclusivity (from birth to six months). Lastly, breastfeeding-friendly NICU environments (i.e., Baby-Friendly designation or introduction of protocol-based care for breastfeeding) were found to increase the number of infants receiving any human milk via enteral feeding in the first week of life, as well as the duration of any or exclusive breastfeeding before and upon hospital discharge (Renfrew et al., 2009).

Despite variations in study methodology, it is noteworthy that both groups of authors arrived at similar conclusions on the basis of their respective reviews (McInnes & Chambers, 2008; Renfrew et al., 2009). Taken together, the results of both reviews suggest that the provision of breastfeeding support, both interpersonal and environmental, as well as the opportunity for skin-to-skin care, represent effective and fundamental interventions aimed at improving breastfeeding success for mothers and preterm infants in NICU settings.

Gaps in the Research

While researchers have been able to identify a range of interventions that are effective at

supporting breastfeeding and the provision of human milk in the NICU, few studies have provided context regarding the existence of these interventions as regular practices or initiatives in clinical environments. To date, researchers have conducted national studies of Danish (Maastrup, Bojesen, Kronborg, & Hallstrom, 2012) and Spanish (Alonso-Díaz et al., 2016) NICU breastfeeding support practices, thus allowing for meaningful comparisons among NICUs in their respective countries pertaining to the most and least frequently reported supports. Such studies have been valuable for providing national "snapshots" of NICU-based breastfeeding promotion. Therefore, conducting a similar study within the context of Canadian NICUs may serve as a means to contribute relevant insight, and ultimately provide an evidence-based foundation for the promotion of breastfeeding in NICUs at a national level.

Study Setting and Context

Recently published statistics suggest that 7.8% of the 388,729 infants born in Canada annually are preterm (Canadian Institute of Health Information, 2015; Statistics Canada, 2015) and this rate has remained fairly stable since 2006 with mild fluctuations over time (Canadian Institute of Health Information, 2015). Most preterm infants are admitted to the NICU after delivery for specialized medical care and monitoring. A 2015 report by the Canadian Neonatal Network reported that 57.6% of infants admitted to level 3 NICUs in Canada were born preterm (with the remaining 42.4% born at 37 weeks gestation or more; Canadian Neonatal Network, 2015).

In Canada, provincial Ministries of Health are responsible for the oversight of designating the tiered provision of neonatal care at four levels. These levels, or definitions of care, closely align with those advanced by the American Academy of Pediatrics (American Academy of Pediatrics-Committee on Fetus and Newborn, 2012; Lee & O'Brien, 2014). Level 1

refers to basic care and monitoring for low-risk healthy infants in a mother-infant unit, whereas level 2 care is provided to infants who are deemed stable or moderately ill (i.e., medical problems that are expected to quickly resolve) and who are born after 32 weeks gestation or more than 1500 grams in birth weight. Level 3 care, also called tertiary care, is provided to critically ill infants (i.e., those with significant medical complexities or surgical conditions) and those who are born before 32 weeks gestation or less than 1500 grams in birth weight. Lastly, Level 4 refers to level 3 care with the additional capability to care for the most complex and critically ill infants, which includes the ongoing availability of pediatric surgical subspecialists. NICUs can be classified with a level of care depending on their medical resources, with more birthing hospitals in Canada providing level 2 care than level 3 care, and a small number of hospitals providing level 4 care. Some level 3 or 4 NICUs also have the capability to provide level 2 care, the latter of which is colloquially referred to as a "step-down nursery" or "intermediate care nursery", with all levels of care typically housed in the same physical unit. The number of beds within a NICU can be separately designated as level 2 or 3 (e.g., 20 NICU beds for level 3 care and 20 intermediate care beds for level 2 care for a total of 40 beds), or can be flexible to accommodate an infant requiring level 2 or 3 care depending on unit needs (e.g., 40 beds in the NICU are able to provide either level 2 or level 3 care).

As mentioned previously, the BFHI is a globally recognized quality improvement program that aims to "protect, promote, and support" breastfeeding through the implementation of 10 evidence-based steps (WHO & UNICEF, 2009, p. 1). This program was recognized by the Breastfeeding Committee for Canada as a primary strategy for promoting and protecting breastfeeding shortly after its inception more than 20 years ago, and was used as the foundation for Canada's Baby-Friendly Initiative (BFI). The BFI is an adaptation of the BFHI that

encompasses a continuum of care from hospital to community and better reflects a Canadian context (Breastfeeding Committee for Canada, 2012). Similar to the global BFHI, Canada's BFI outlines 10 steps to successful breastfeeding that are to be achieved by individual organizations before a BFI designation is granted by an external assessor. The 10 steps for both the global BFHI and Canada's BFI are outlined in Appendix A. As of January 2017 (the date of the most recent list available on the Breastfeeding Committee for Canada website; http://breastfeedingcanada.ca), six hospitals/birthing centres in Canada were noted to have achieved a BFI designation (See Appendix B; Breastfeeding Committee for Canada, 2017).

Recognizing the unique challenges associated with breastfeeding among mothers of preterm and/or sick infants, an international group of experts adapted the global BFHI for use in NICUs around the world (Nyqvist et al., 2013, 2015). For example, step 8 of the global BFHI, "encourage breastfeeding on demand" (WHO & UNICEF, 2009, p. 36), has been adapted in the neo-BFHI to, "encourage demand breastfeeding or, when needed, semi-demand feeding as a transitional strategy for preterm and sick infants" (Nyqvist et al., 2015, p. 38). This adaptation better reflects the feeding abilities and progression among NICU infants. The full 10 steps for the neo-BFHI are also outlined in Appendix A. Despite the publication of these adapted recommendations beginning in 2012, a 2014 status report from the Breastfeeding Committee for Canada shows that expanding Canada's BFI to include NICUs has yet to be achieved (Breastfeeding Committee for Canada, 2014). Collectively, these trends suggest that Canada's shift towards a culture of supporting breastfeeding in the NICU setting is both highly important and a work-in-progress.

Research Purpose and Question

The purpose of this study was to identify, using a comprehensive environmental scan, the

postnatal breastfeeding resources that currently exist in Canadian NICUs. More specifically, this study aimed to answer the research question: what are the *types* and *frequencies* of breastfeeding resources available to mothers of preterm infants in level 3 NICUs across Canada? Given the exploratory nature of this study, no a priori hypotheses were generated.

Authors of previous similar studies have loosely used the terms "breastfeeding support measures" (Alonso-Díaz et al., 2016) and "breastfeeding support" (Maastrup et al., 2012), but have not reported any definitions or parameters pertaining to these terms. Therefore, a new term and operational definition was developed to provide the foundation for what forms of breastfeeding support would be included in this study. A *breastfeeding resource* is any initiative, practice, or strategy (excluding galactogogue use, specific milk expression strategies, and alternative feeding methods) available to mothers in the NICU with the goals of facilitating successful breastfeeding initiation, duration, and exclusivity.

Given the lack of consensus around the definition of *breastfeeding* for mothers of preterm infants, a broad definition will be adopted for this study utilizing the suggestions advanced by Renfrew and colleagues (2009). Specifically, breastfeeding will refer to an infant receiving his or her mother's own milk by any method, and the mother attempting to express milk by any method, working towards and including the mother putting her infant to breast and the infant demonstrating nutritive sucking. This definition is inclusive of NICU resources targeted towards any stage of the feeding progression continuum for preterm infants, such as sustained milk expression to support enteral or alternative oral feedings, and transitioning to at-breast feedings.

Chapter 2: Methods

NICU Selection

All level 3 NICUs across Canada were targeted for participation. The decision to include level 3 NICUs only was made due to the fact that there are over 150 NICUs in Canada that provide level 2 and/or 3 care, and this number was deemed too large given time and resource constraints. As there is no publicly available master list of all Canadian level 3 NICUs, the websites for the Canadian Neonatal Network and Canadian NICU Support Foundation were consulted to generate a listing of all eligible NICUs (Canadian Neonatal Network, 2009; Canadian NICU Support Foundation, n.d.). The final recruitment list contained 31 NICUs (see Appendix C); while this list may not have been exhaustive, the search likely yielded the large majority of eligible hospitals across Canada. Ethical approval was not required for this study as it was classified as a quality assurance and/or improvement study, which fell outside the scope of research ethics board review outlined in Canada's Tri-Council Policy Statement (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council of Canada, 2014). Please see Appendix D for documentation from the Research Ethics Board at Western University related to this study's exemption from the institutional ethics review process.

Key Informant Selection

A key informant was broadly defined as an individual who is very knowledgeable about the breastfeeding resources available in the NICU in which she/he was employed. All types of health care providers and NICU staff members/positions were eligible to serve as informants.

Recruitment. All level 3 NICUs that were on the generated list (n = 31 hospitals) were contacted via telephone by the Master's student researcher (see Appendix C for a full list of

contacted and participating NICUs). Upon connecting with a NICU staff member, the student researcher introduced herself, her institution, and the purpose for calling (i.e., to gather the contact information of a qualified key informant for the purpose of conducting an interview related to breastfeeding support in the NICU). Specifically, a key informant was described to the NICU staff member as "an individual who is most knowledgeable about your NICU's breastfeeding support practices". It was expected that any staff member responsible for answering the telephone within the NICU would be informed about unit staffing such that they could make a reasonable recommendation regarding a potential informant. As such, this staff member was asked to provide the telephone number and/or email address of an individual who they perceived to be best suited to serve as an informant.

Upon receiving the recommended key informant's contact information, the student researcher contacted each informant via telephone using a recruitment script. In brief, the student researcher introduced herself and her institution, explained the purpose of the study, and invited the informant to participate in a 40 to 60 minute telephone interview. If the informant was available to answer their telephone at the time of the call, the interview was then scheduled at the informant's convenience. If a voicemail was reached, a message was recorded and a follow-up email was sent (if an email address was provided by the initial NICU staff member). Upon hearing back from each informant where a voicemail or email was sent, a telephone interview was then scheduled at the informant's convenience. If the originally identified informant recommended a different staff member as better suited for this role, the subsequently recommended informant was then contacted and scheduled for an interview using the aforementioned process. The recruitment scripts used when contacting informants, both via telephone and email, are included in Appendix E.

Research Design and Procedures

An environmental scan was deemed the most appropriate methodology to answer the research question outlined above as it is typically used to gather information with the goal of gaining new knowledge to enable strategic action (Choo, 2001). Despite origins in a business context, environmental scans have been used for research purposes in a multitude of health-related areas including public health (Rowel, Moore, Nowrojee, Memiah, & Bronner, 2005), health information (Marton, 2001), and clinical practices (McPherson et al., 2014). In the absence of set guidelines or recommendations, researchers have utilized reviews of pertinent literature (Donnelly & Thompson, 2015), surveys or interviews with key informants (McPherson et al., 2014), or a combination of the two (Aslakson et al., 2014; Rowel et al., 2005) to conduct environmental scans. Key informant interviews were selected as the primary method of data collection to allow for greater flexibility in informants' reporting of various breastfeeding resources (in comparison to that offered in survey-based studies; Bryman, 2008). Further, interviews provided an opportunity for the research team to more easily establish relationships with stakeholders at various hospitals, the goal of which was to support the knowledge translation of our findings upon study conclusion (Graham et al., 2006; University of California Los Angeles & Center for Health Policy Research, 2012). The number of informants at each hospital depended on the initial informant's preference for whether they wished to invite an additional, knowledgeable staff member to review and/or provide additional information pertaining to the breastfeeding resources available in their NICU. In total, data collection took place between October 2015 and September 2016. Specifically, interviews were conducted from October 2015 to June 2016, and member checking took place from July 2016 to September 2016.

Key informant interviews. All interviews were conducted by the student researcher.

Scheduled interviews were conducted in English, were between 40 to 60 minutes in duration, and followed a semi-structured interview guide (see Appendix F). The interview guide was developed by the research team using both a national survey study of breastfeeding support in Danish NICUs (Maastrup et al., 2012) and two systematic reviews related to breastfeeding promotion interventions in the NICU (McInnes & Chambers, 2008; Renfrew et al., 2009) as foundations for the development of the interview questions. The guide contained approximately 5-7 questions related to general NICU characteristics (e.g., number of beds, Canadian BFI designation status, and unit layout) and approximately 7-11 questions regarding the various types of breastfeeding resources available to mothers of infants within the NICU. Example questions included, "which individuals are available in your NICU to provide breastfeeding support or counselling?" and "how does your NICU support mothers who are expressing milk?". Probes regarding breastfeeding resources that have been studied or mentioned in the literature (e.g., group education, peer support, a skin-to-skin care policy) were included in the guide and utilized by the student researcher as needed during the interview. The interview questions and probes were designed to capture information pertaining to the breastfeeding promotion interventions highlighted as effective in previous research (e.g., breastfeeding support and education, breastfeeding-friendly NICU environments), as well as any others that informants identified as relevant and available to mothers. If at any point during the interview the informant was unsure about a specific resource or question (e.g., the exact number of breast pumps available for in-unit use) or did not have access to certain information at the time of the interview (e.g., breastfeeding data), they were informed that there would be an opportunity to provide any missing information during the subsequent member checking phase of data collection. Interviews were not audiotaped, however responses from each informant were recorded and organized by interview

question in a Word document created for each NICU (herein referred to as each NICU's *data set*) that was saved on a password-protected computer.

Member checking. To ensure rigour and credibility, a member checking phase was conducted wherein a refined data set for each NICU was sent electronically to key informants to be reviewed for accuracy, comprehensiveness, and completeness (Creswell & Miller, 2010). Upon completion of the interview phase, the data sets were reviewed by the student researcher who distilled and organized the recorded responses into meaning units (this process is described in detail later in this chapter). Any data that were missing or deemed by the student researcher to require additional clarification were highlighted. In some instances, clarification was deemed necessary in order to match the level of detail collected from other NICUs. Further, two additional items pertaining to NICU characteristics were added at the member checking phase as inquiries for informants post-interview: the use of oral immune therapy (i.e., oropharyngeal administration of mother's colostrum, which is antibody-rich human milk secreted shortly after birth, to the infant to bolster immunity; Gephart & Weller, 2014) and the use of donor milk, both of which elicited a yes or no response. These additions were prompted by a brief, informal discussion between the student researcher and one of the informants who suggested that data on the use of these practices were important NICU characteristics to consider in relation to breastfeeding. Each informant was then emailed this refined data set with instructions for the member checking process. In short, the informants were instructed to review their data set to ensure information accuracy and completeness, and to fill in any missing information that was left out during the interview or that they or their colleagues had thought to include after the interview. Thus, informants were permitted to add, modify, and/or remove information at their discretion as part of the member checking process. A refined data set template and member

checking email script is attached in Appendix G.

Data Analyses

Content analysis was utilized given that it is a systematic and objective means in order to describe and quantify phenomena, and allows text of a similar meaning or nature to be classified into distinct categories (Downe-Wamboldt, 1992). Content analysis is typically conducted in three phases: (1) preparation (i.e., delineating meaning units and becoming immersed in the data through several repetitive readings), (2) organizing (using an inductive, deductive, or a combined approach), and (3) reporting (Elo & Kyngäs, 2008). A combination of inductive and deductive content analyses procedures was used in this study. Inductive content analysis is largely data driven as the researcher openly codes fragments of text using no particular framework, and then organizes these codes into higher order categories (Elo & Kyngäs, 2008). By contrast, deductive content analysis is used to test the fit of preconceived categories, models, or hypotheses onto a data set, the origins of which are often based on earlier works such as mind maps or literature reviews (Elo & Kyngäs, 2008). Despite critiques regarding the simplicity of this process (Morgan, 1993), content analysis is widely used, particularly in the nursing and health literature, given its flexibility and applicability in a multitude of research designs (Cavanagh, 1997). Further, content analysis was selected over other forms of qualitative analysis (such as thematic analysis) because it allows for a mixed methods approach in that it can involve the quantification of data by measuring the frequencies of codes and categories (Vaismoradi, Turunen, & Bondas, 2013).

Researchers utilizing content analysis procedures are encouraged to evaluate and describe the *trustworthiness* of their findings (Graneheim & Lundman, 2004). Elements of trustworthiness include credibility (i.e., confidence in how well the collected data and analysis procedures

address the research question), dependability (i.e., accounting for inconsistencies and evolving insights in the data collection and analysis process), and transferability (i.e., the degree to which findings can be applied or transferred across different populations and settings; Graneheim & Lundman, 2004). Therefore, a robust assessment of trustworthiness involves continuous monitoring and evaluating on the part of the researcher during all phases of content analysis (Elo et al., 2014). Expanding on this concept, Elo et al. (2014) developed a trustworthiness improvement checklist containing a series of questions for the researcher to consider at each content analysis phase. As such, questions pertaining to preparation (e.g., is the meaning unit too narrow or too broad?), organizing (e.g., is there any overlap between categories?), and reporting (e.g., can the reader evaluate the transferability of the results?) were used as a guiding framework for assessing and improving the trustworthiness of the content analysis procedures in our study (Elo et al., 2014).

To summarize, both inductive and deductive content analyses, as well as frequency measuring, were used and are outlined in detail below. In addition, trustworthiness was scrutinized and considered at every phase of content analysis (Elo et al., 2014). The full process of data analysis took place from October 2016 to January 2017.

Breastfeeding resource types. The preparation phase of data analysis began after all interviews had been completed. At this time, the student researcher comprehensively and thoroughly reviewed the interview notes and organized the data into succinct meaning units (formatted as bullet points). A meaning unit has been defined as "words, sentences, or paragraphs containing aspects related to each other through their content and context" (Graneheim & Lundman, 2004, p. 106). The meaning unit for this study was characterized as the description of a discrete breastfeeding resource (e.g., group breastfeeding classes) including

relevant resource context (e.g., classes ran on a biweekly basis and focused on managing common milk expression challenges). Following completion of the member checking process (described above), each NICU's member checked data set was electronically imported into NVivo (Verison 10; QSR International Pty Ltd., 2014). All of the data sets were again read several times by the student researcher in order to re-familiarize herself with the depth and breadth of the data and to obtain a sense of the whole, as per the latter part of the preparation phase (Elo & Kyngäs, 2008; Graneheim & Lundman, 2004).

In accordance with the deductive content analysis process outlined by Elo and Kyngäs (2008), the organizing phase began with the development of an unconstrained categorization matrix. This matrix was created based on the interview guide questions, which were informed by a comprehensive literature review, and included the following preliminary categories of breastfeeding resources: (a) layout, (b) staff or peer support, (c) education, (d) printed handout topics, (e) milk expression, (f) rooming in, (g) discharge support, and (h) policies. The meaning units (i.e., bullet points) within each data set were then coded using this categorization matrix, whilst allowing for the inductive creation of new sub-categories within the preliminary categories (Elo & Kyngäs, 2008). For example, codes were generated for *smartphone apps, websites,* and *videos;* these codes collectively fit into the *education* category, but were also coded inductively into an *electronic resources* sub-category. In another instance, codes developed for various printed handout topics (e.g., *plugged ducts, breast engorgement,* and *mastitis)* were inductively coded into a *breastfeeding challenges* sub-category. After coding all 29 data sets, the student researcher reviewed and refined the coding labels and reflected on the reliability of both the preliminary categories and identified sub-categories to produce the final results (Elo & Kyngäs, 2008; Pyett, 2003).

Prior to the writing of this thesis, this research was purposefully presented at various field-specific conferences such as the Canadian Association of Perinatal and Women's Health Nurses Annual Conference (Scime & Burke, 2016) and the Canadian National Perinatal Research Meeting (Scime & Burke, 2017), both of which were attended by researchers and health care providers (e.g., nurses, physicians, and IBCLCs). The ensuing and plentiful discussions about the completeness and appropriateness of our early-stage findings with conference delegates, including Canadian NICU staff and field experts, lent further to the face validity (and by extension, trustworthiness) of our findings (Downe-Wamboldt, 1992). The last phase of content analysis, reporting, is represented in the Results chapter of this thesis. Taken together, this content analysis process allowed for the identification of the many types of breastfeeding resources available in NICUs across Canada.

Breastfeeding resource frequencies. Resource frequencies were manually calculated by the student researcher using numerical data from NVivo. Specifically, the number of individual NICU data sets coded in each resource category, sub-category, and code, which were automatically tallied in NVivo, served as the numerator for each resource frequency calculation.

Chapter 3: Results

Key Informant Characteristics

A total of 33 key informants from 29 NICUs across Canada participated in this study. Informants from four NICUs recommended an additional informant to participate during either the telephone interview phase (n = 2) or the member checking phase (n = 2) to verify, modify, and/or add relevant information pertaining to breastfeeding resources available in their NICU. Informants ranged in self-reported qualifications including IBCLCs (n = 14), nurse educators (n = 4), nurse managers (n = 3), neonatologists (n = 2), clinical nurse leaders (n = 2), clinical nurse specialists (n = 2), as well as a nurse practitioner, a clinical practice coordinator, a registered nurse, a dietitian, a clinical resource nurse, and an occupational therapist (n = 1 of each).

NICU Characteristics

Table 1 contains descriptive characteristics of the NICUs that are represented in this study. In total, key informants provided data for 29 level 3 NICUs across Canada. Of the two (out of 31) NICUs that we did not obtain data on, language barriers prevented the identification of an informant for one NICU (that was French-speaking, located in Quebec), and a lack of follow-up response from the recommended informant prevented the collection of data for the other NICU. Our representative sample contained NICUs located in all of Canada's 10 provinces, with the greatest number located in Ontario (31%; n = 9) and British Columbia (14%; n = 4). In addition to level 3 care, informants reported that two NICUs (7%) also provided level 4 care and 22 NICUs (76%) also provided level 2 care. With regard to the number of beds in each NICU that are funded by the provincial Ministries of Health, informants reported that 24% (n = 7) of NICUs had 1-20 funded beds, 38% (n = 11) had 21-40 funded beds, and another 38% (n = 11) had over 40 funded beds. It should be noted that the number of beds reported is inclusive of

all levels of NICU care (i.e., level 2, 3, and 4 NICU beds are included in this count). The majority of NICUs were reported to utilize an open concept, pod-based design (66%; *n* = 19), while only five NICUs (17%) were reported to have single bed rooms for each infant. With respect to parent visitation practices, informants reported that 76% (*n* = 22) of NICUs allowed parents to be in the unit 24 hours a day seven days a week, whereas 24% (*n* = 7) of NICUs had rules which did not permit parents in the unit during medical rounds, shift changes, or quiet hours. Informants noted that 79% (*n* = 22) of NICUs used donor milk, and that 82% (*n* = 23) routinely used oral immune therapy. Only one NICU (3%) was reported to be situated in a Baby-Friendly (BFI-designated) hospital.

Of the 27 NICUs from which informants provided information about the collection of breastfeeding data upon discharge, only seven NICUs (26%) were reported to have collected such information, six of which provided an actual statistic. Breastfeeding rates upon NICU discharge were reported to range from 65% to 92%. It is important to note, however, that the operational definition of breastfeeding at discharge appeared to differ among NICUs (or was not specified). For example, one NICU informant reported that 78% of infants in their unit were receiving any human milk upon discharge, whereas another NICU informant reported that 71% of infants in their unit were breastfed exclusively upon discharge.

Table 1

Descriptive Characteristics of the Represented Canadian Level 3 Neonatal Intensive Care Units (N = 29)

NICU Characteristic	*n,* NICUs (%)
Location (Province)	
British Columbia	4 (14)
Alberta	2 (7)
Saskatchewan	2 (7)
Manitoba	2 (7)
Ontario	9 (31)
Quebec	3 (10)
New Brunswick	3 (10)
Nova Scotia	2 (7)
Prince Edward Island	1 (3)
Newfoundland	1 (3)
Additional Levels of Care	
Level 2	22 (76)
Level 4	2 (7)
No. of Beds Funded by Provincial MOH[a]	
1-20 beds	7 (24)
21-40 beds	11 (38)
>40 beds	11 (38)
NICU Design	
Fully open concept	3 (10)
Open concept, pod-based	19 (66)
Combination (single beds and pods)	2 (7)
Single bed rooms	5 (17)
Parent Visitation Rules	
Welcome 24/7	22 (76)
Welcome 24/7 with exceptions	7 (24)
Use of Donor Milk	22 (79[b])
Use of Oral Immune Therapy	23 (82[b])
Baby-Friendly (BFI) Designated	1 (3)
Collection of Breastfeeding Data at NICU Discharge	7 (26[c])

Notes. NICU = neonatal intensive care unit. MOH = Ministry of Health. BFI = Baby-Friendly Initiative. All data pertaining to NICU characteristics were provided by key informants in each NICU.

[a]Combined for all levels of care

[b]*N* = 28 (data missing from one hospital)

[c]*N* = 27 (data missing from two hospitals)

Breastfeeding Resource Findings and Member Checking Outcomes

Information collected from key informants pertaining to the types and frequencies of breastfeeding resources available in level 3 NICUs across Canada are presented in the sections and tables below. With regard to the accuracy and credibility of the data, informants from 28 NICUs (97% of represented units) participated in the member checking process. The informant representing the remaining one NICU did not respond to the student researcher's member checking email requests. Of the 28 NICU data sets that underwent member checking, all of them (100%) had information added by informants, 14 (50%) had information modified or updated by informants, and three (11%) had information deleted by informants (to remove resources that were no longer available). Twenty-five (89%) NICU data sets were deemed "completely" member checked, while three (11%) were deemed "partially" member checked. In the instances of partial member checking, the informants could not be reached (i.e., did not respond to follow up emails) to provide overlooked, outstanding information.

Types and frequencies of breastfeeding resources. Six overarching categories of breastfeeding resources were identified (via content analysis) to represent the types of resources that key informants reported as available in Canadian NICUs. The categories are as follows, each of which is discussed further below: (a) breastfeeding-friendly layout, (b) breastfeeding support personnel, (c) breastfeeding education for mothers, (d) breast pump-related resources, (e) coordination of post-discharge breastfeeding support, and (f) breastfeeding-related policies. These categories are also outlined in Table 2 along with their respective sub-categories and frequencies.

Breastfeeding-friendly layout. Privacy measures were reportedly provided by 93% (n = 27) of NICUs and included visual barriers such as curtains and portable screens around infant

bedsides. Similarly, informants reported that rooming-in or "care by parent" opportunities (i.e., the ability for parents and infants to stay overnight in the same room) were provided in 93% of NICUs (n = 27). Generally speaking, rooming-in was reported to take place in a private room (unless the NICU was designed as a single bed unit) and during the last few days before infant discharge from the NICU. Specialized chairs included those designed to facilitate comfortable breastfeeding, milk expression, and skin-to-skin care, such as recliners and rocking chairs; informants noted that 83% (n = 24) of NICUs provided access to such chairs. Milk expression rooms (i.e., pumping rooms) were reported to be available for use in 69% (n = 20) of NICUs and consisted of a private room designated for mothers to express their milk, often equipped with stationary electric breast pumps. The layout of milk expression rooms ranged from single-mother use to multi-mother use with curtains separating the stations. A parent bed by the infant's bedside was reportedly available in 14% (n = 4) of NICUs and included the presence of a portable cot and/or convertible chair.

Breastfeeding support personnel. Informants at all 29 NICUs (100%) reported that bedside nurses were involved in providing direct breastfeeding support to mothers. With regard to training for nurses in particular, informants reported that nurses received mandatory breastfeeding-related training at 93% (n = 27) of NICUs. This training varied across NICUs in terms of format (e.g., classroom, hands-on, or online), duration (e.g., a few hours to multiple full-days), and content (e.g., general breastfeeding support versus preterm/NICU infant-specific breastfeeding support).

Informants reported that IBCLCs were available in 86% (n = 25) of NICUs to provide direct breastfeeding support. The scope of practice and consultation procedures for IBCLCs varied; it was reported that 41% (n = 12) of NICUs had an IBCLC that was dedicated to the

NICU, whereas 45% (*n* = 13) of NICUs had an IBCLC that was available but serviced the entire hospital. Informants at over half of the NICUs (52%; *n* = 15) reported that IBCLCs provided consultations to mothers that met specific criteria (e.g., mothers who experienced persistent feeding or milk expression challenges, mothers of multiples, or mothers whose infants were born earlier than 32 weeks gestation). It was also reported that approximately one third (34%; *n* = 10) of NICUs had an IBCLC that provided a consultation to each mother, regardless of her feeding situation.

Peer counsellors (i.e., previous NICU mothers who have offered to provide support and counselling to current NICU mothers) were also reported by informants to be a source of direct breastfeeding support in 17% (*n* = 5) of NICUs through the implementation of formal peer support programs. Additional professional personnel that were reported to provide direct breastfeeding support to mothers included occupational therapists (17% of NICUs; *n* = 5), breastfeeding resource nurses (typically described as nurses with additional breastfeeding training but no IBCLC certification; 10%; *n* = 3), dietitians (7%; *n* = 2), social workers (3%; *n* = 1), speech language pathologists (3%; *n* = 1), pharmacists (3%; *n* = 1), and nurse practitioners (3%; *n* = 1).

Breastfeeding education for mothers. Several educational formats were reportedly used by NICUs to deliver breastfeeding information to mothers. Informants from all NICUs (100%; *n* = 29) reported the use of printed handouts such as pamphlets or booklets, some of which were provided to all mothers with infants in the unit and some of which were provided on an as-needed basis. Such handouts were often described as developed "in-house" by NICU staff and pertained to the specific breastfeeding needs of mothers of preterm or sick infants. Informants from two NICUs (7%) reported the use of the "Breastfeeding Matters" booklet, published by the

Best Start Resource Centre of Ontario (2016), which covers a range of breastfeeding topics pertinent to healthy infants.

Informants were asked to report on the various topics covered in their unit's printed educational handouts related to breastfeeding. The full range of topic sub-categories and their corresponding frequencies are outlined in Table 3. Expressing milk was the most commonly reported topic (83% of NICUs; $n = 24$), and included information regarding how to use a breast pump, hand expression, and hands-on pumping. The second most commonly reported topic pertained to the management of expressed milk (79% of NICUs; $n = 23$), including storage, transportation, thawing, fortification, and/or labelling of expressed milk. General breastfeeding information was reportedly offered in printed handouts in 76% ($n = 22$) of NICUs, and included reasons to breastfeed (e.g., infant benefits), breast care, contraindications to breastfeeding, and breastfeeding in specific situations or environments (e.g., breastfeeding multiples, in the NICU, or after surgery). Breast pump and kit information was reported to be covered in printed handouts in 69% ($n = 20$) of NICUs. This topic included instructions for cleaning breast pump equipment, breast pump rental and purchasing information, breast pump types, where to find breast pumps in the NICU (i.e., for in-unit use), and breast pump-kit related information. Human milk volume or milk expression tracking sheets were reportedly available in printed format in 69% ($n = 20$) of NICUs. Informants also noted that information pertaining to maternal milk supply, such as establishing, increasing, or maintaining maternal milk supply, as well as the use of galactogogues (i.e., any medication, commonly domperidone, that can be used to increase maternal milk production), was available in printed handouts in 66% ($n = 19$) of NICUs.

The topics of breastfeeding challenges (e.g., nipple problems, mastitis, and breast engorgement) and skin-to-skin care were reported by informants to be available in printed

handouts in 41% (*n* = 12) and 28% (*n* = 8) of NICUs, respectively. Alternative feeding method information (e.g., the use of nipple shields, cup or bottle feeding) was a reported printed handout topic in 24% (*n* = 7) of NICUs, and cue-based feeding information was reportedly available in 21% (*n* = 6) of NICUs. Signs that the infant is getting enough human milk, taking the infant home from the NICU, and donor milk banking and use information were each reported to be included in printed handouts in 17% (*n* = 5) of NICUs. Less commonly reported printed handout topics included oral immune therapy (14% of NICUs; *n* = 4), colostrum (14%; *n* = 4), and self or infant care (7%; *n* = 2). Miscellaneous printed handout topics reported in only one (3%) NICU each included the use of Vitamin D, supplementation, supplemental nursing systems, and hind milk.

Electronic breastfeeding resources were reportedly available in 59% (*n* = 17) of NICUs, including websites (41%; *n* = 12), videos (24%; *n* = 7), smartphone apps (to track milk expression sessions or human milk volumes; 10%; *n* = 3), and DVDs (7%; *n* = 2). Mothers were referred to access these electronic resources on their personal devices or computers, or on parent-use computers within the unit.

Group education sessions were reportedly offered to mothers in 38% (*n* = 11) of NICUs. The frequency of these sessions ranged, but was most commonly reported to take place on a weekly basis. Some group-based NICU parent classes focused exclusively on breastfeeding and milk expression topics, whereas others were designed to cover a range of infant care topics (one of which was breastfeeding). Fourteen percent (*n* = 4) of NICUs had informants reporting the use of posters on display within the unit, the content of which ranged to include photos promoting breastfeeding, pump assembly diagrams, and text information about breastfeeding.

Breast pump-related resources. Informants at all 29 NICUs (100%) reported that

portable breast pumps were available to mothers for in-unit use and that there was adequate fridge and freezer space to store expressed milk. The researcher-calculated ratios of total in-unit breast pumps to infant beds ranged from 1:1 to approximately 1:8. Informants at all NICUs (100%) reported the provision of breast pump kits; these kits were provided either free of charge to mothers (86% of NICUs; *n* = 25), or at a cost in the NICU or hospital (14%; *n* = 4). Breast pump loan programs were reported to exist in 31% (*n* = 9) of NICUs, and were often provided to mothers meeting needs-based criteria (e.g., mothers with social or financial concerns or those who delivered a very preterm infant).

Coordination of post-discharge breastfeeding support. Referral of all mothers with infants in the NICU to the local public health unit was the most commonly reported post-discharge support service, with 79% (*n* = 23) of NICUs providing such referrals. Informants at 45% (*n* = 13) of NICUs reported that mothers were able to access in-hospital clinics after discharge for continued breastfeeding support. Specifically, informants at 38% (*n* = 11) of NICUs reported that mothers were able to access in-hospital breastfeeding clinics after discharge, whereas informants at 21% (*n* = 6) of NICUs reported that mothers could access in-hospital general infant health follow-up clinics after discharge (which, in addition to developmental and medical care, could provide breastfeeding and milk expression support if needed). Providing mothers with information about various community resources (e.g., La Leche League chapters, local peer support groups and/or breastfeeding clinics, and telehealth programs) was a reported practice in 31% (*n* = 9) of NICUs.

Informal post-discharge consultation/follow-up with a hospital-based IBCLC was reportedly available in 17% (*n* = 5) of NICUs, and most often took place over the telephone on an as-needed basis. Lastly, an informant from one NICU (3%) reported the use and availability

of a neonatal transition team, described to be a community-based service that provides follow-up care for low birth weight/preterm infants discharged from the NICU. This team, comprised of dietitians, neonatal nurses, and/or other health care providers, was reportedly designed to assess the infant's ongoing health and development, and to provide breastfeeding and nutrition support to mothers as well as referrals to additional community resources as required.

Breastfeeding-related policies. Policies were openly considered to be any unit- or hospital-wide written document that is classified by the staff as an organizational policy. Of the 28 NICUs for which data were provided regarding breastfeeding-related written policies, 82% (n = 23) were reported to have a skin-to-skin care policy, 61% (n = 17) were reported to have a general breastfeeding policy, and 25% (n = 7) were reported to have a breastfeeding policy specific to preterm infants. Informants also reported that more than half of NICUs had written policies pertaining to the management of expressed milk (e.g., expressed milk collection, handling, storage, thawing, transportation, labeling, and fortification; 61%; n = 17).

Donor milk policies, oral immune therapy policies, and various policies regarding alternative feeding methods (e.g., nipple shields, finger, cup, or bottle feeding, and general feeding devices) were each reportedly present in 32% (n = 9) of NICUs. Breast pump-related policies containing information about breast pump use, cleaning, and proper assembly were reported to be present in 29% (n = 8) of NICUs. Supplementation policies were reported to be available in 21% (n = 6) of NICUs, and incorrect milk administration (i.e., NICU staff erroneously providing a mother's expressed or stored milk to an infant other than her own) policies were reported in 18% (n = 5) of NICUs.

Less commonly reported policies pertained to: supplemental nursing systems (11%; n = 3), enteral nutrition (11%; n = 3), contraindications to breastfeeding (11%; n = 3), mother-infant

togetherness (7%; *n* = 2), hypoglycemia (7%; *n* = 2), galactogogue use (7%; *n* = 2), developmental care (7%; *n* = 2), cue-based feeding (7%; *n* = 2), and breastfeeding standards of practice for health care providers (7%; *n* = 2). Miscellaneous breastfeeding-related policies reported to be present at one NICU (4%) each included candidiasis (i.e., yeast infections) in the breastfeeding dyad, unclaimed expressed milk, infant test weighing, sharing human milk, feeding and hospital discharge, breastfeeding and sucrose for procedural pain, IBCLC responsibilities, hind milk, and human milk adverse events.

Comparison between NICUs in Baby-Friendly and non-Baby-Friendly hospitals. Although only one NICU in the sample was situated in a BFI-designated hospital, it was reported to have a comprehensive profile of breastfeeding resources relative to the trends observed at the national level (i.e., for the complete data set). Specifically this Baby-Friendly NICU was reported to contain: four of the five environmental resources identified in the larger sample (privacy measures, rooming-in opportunities, specialized chair availability, and milk expression room[s]); nurses trained in the management of breastfeeding as well as IBCLCs providing breastfeeding support; three of the four breastfeeding education resources (printed handouts, electronic resources, group education sessions); and three of the four breast pump-related resources (in-unit breast pump availability, fridge/freezer space availability, provision of free breast pump kits). In addition, an informant from the Baby-Friendly NICU reported the post-discharge coordination of two of the four identified breastfeeding supports (referral to a public health unit and in-hospital clinic access). Lastly, the Baby-Friendly NICU was reported to have several policies related to breastfeeding, including the seven most commonly reported policies at the national level (skin-to-skin care, breastfeeding, management of expressed milk, donor milk, oral immune therapy, alternative feeding methods, and breast pump-related).

Table 2

Categories and Frequencies of Breastfeeding Resources Available in Canadian Level 3 Neonatal Intensive Care Units (N = 29)

Category	*n,* NICUS (%)
Breastfeeding-Friendly Layout	
Privacy measures	27 (93)
Rooming-in opportunities	27 (93)
Specialized chair availability	24 (83)
Milk expression room(s)	20 (69)
Parent bed availability	4 (14)
Breastfeeding Support Personnel	
Bedside nurse	29 (100)
IBCLC	25 (86)
Occupational therapist	5 (17)
Peer counsellors	5 (17)
Breastfeeding resource nurse[a]	3 (10)
Dietitian	2 (7)
Social worker	1 (3)
Speech language pathologist	1 (3)
Pharmacist	1 (3)
Nurse practitioner	1 (3)
Breastfeeding Education for Mothers	
Printed handouts	29 (100)
Electronic resources	17 (59)
Group education sessions	11 (38)
Posters displayed within unit	4 (14)
Breast Pump-Related Resources	
Breast pumps available for in-unit use	29 (100)
Availability of fridge and freezer space	29 (100)
Provision of breast pump kits	29 (100)
Breast pump loan program	9 (31)
Coordination of Post-Discharge Breastfeeding Support	
Referral to public health unit	23 (79)
In-hospital clinic access	13 (45)
Provision of information about community resources	9 (31)
Informal follow-up with hospital IBCLC	5 (17)
Neonatal transition team[b]	1 (3)
Breastfeeding-Related Policies[c]	
Skin-to-skin care	23 (82)
Breastfeeding	17 (61)
Management of expressed milk	17 (61)
Donor milk	9 (32)
Oral immune therapy	9 (32)

Alternative feeding methods	9 (32)
Breast pump-related	8 (29)
Supplementation	6 (21)
Incorrect human milk administration	5 (18)

Notes. NICU = neonatal intensive care unit. IBCLC = international board certified lactation consultant. All raw data pertaining to breastfeeding resources were provided by key informants in each NICU. Categories and sub-categories were subsequently determined by researchers using content analysis.

[a]Breastfeeding resource nurse refers to a nurse with additional breastfeeding training but no IBCLC certification

[b]Neonatal transition team refers to a community-based service whereby an interdisciplinary team of health care providers offer follow-up care to low birth weight/preterm infants discharged from the NICU

[c]*N* = 28 (data missing data from one hospital)

Table 3

Breadth and Frequencies of Topics Covered in Printed Breastfeeding Handouts Available in Canadian Level 3 Neonatal Intensive Care Units (N = 29)

Topic Sub-Category	*n,* NICUs (%)
Expressing human milk	24 (83)
Management of expressed milk	23 (79)
General breastfeeding information	22 (76)
Breast pumps and kits	20 (69)
Milk expression tracking sheets	20 (69)
Maternal milk supply	19 (66)
Breastfeeding challenges	12 (41)
Skin-to-skin care	8 (28)
Alternative feeding methods	7 (24)
Cue-based feeding	6 (21)
Signs infant is getting enough	5 (17)
Taking infant home	5 (17)
Donor milk banking	5 (17)
Oral immune therapy	4 (14)
Colostrum	4 (14)
Self or infant care	2 (7)
Use of vitamin D	1 (3)
Supplementation	1 (3)
Supplemental nursing systems	1 (3)
Hind milk	1 (3)

Notes. NICU = neonatal intensive care unit. All raw data pertaining to printed breastfeeding handout topics were provided by key informants in each NICU. Sub-categories were subsequently determined by researchers using content analysis.

Chapter 4: Discussion

The purpose of the present study was to determine the types and frequencies of breastfeeding resources available to mothers of preterm infants in NICUs across Canada. Six overarching categories (types) of breastfeeding resources were identified based on data collected from interviews with key informants from 29 level 3 NICUs. These categories are: breastfeeding-friendly layout, breastfeeding support personnel, breastfeeding education for mothers, breast pump-related resources, coordination of post-discharge breastfeeding support, and breastfeeding-related policies. From a health promotion perspective, research suggests that health education alone is not enough to support or elicit behaviour change in individuals (Glanz, Rimer, & Viswanath, 2008; Macrina, 1999). Therefore, an important and encouraging finding overall is that the breastfeeding resources reported to be available to mothers in Canadian NICUs included not only informational (e.g., printed handouts), but also environmental (e.g., privacy measures), interpersonal (e.g., IBCLC counselling), tangible (e.g., availability of breast pumps for in-unit use), and organizational (e.g., a written breastfeeding policy) forms of support.

Many of the NICU-based breastfeeding resources reported by informants in our study have been identified in previous research, and have been examined with respect to mothers' experiences and/or the effectiveness of such resources in relation to various breastfeeding outcomes. As such, key findings related to each of these six categories will be discussed below within the context of this broader literature.

Breastfeeding-Friendly Layout

Promoting maternal comfort while breastfeeding or expressing milk in the NICU has important implications for breastfeeding success. For example, a lack of privacy in the NICU has been found to inhibit mother-infant interactions and decrease milk expression frequency, which

can result in challenges associated with the milk ejection reflex (Ikonen, Paavilainen, & Kaunonen, 2015). Thus, the breastfeeding-friendliness of a NICU layout can have direct and indirect implications for not only maternal comfort and stress levels, but also for maternal milk supply.

In the present study, several elements of a breastfeeding-friendly NICU layout were identified in high frequencies by informants. Privacy measures, for example, were reported to be present in 93% of NICUs. This is a positive finding given that the provision of visual barriers such as curtains or portable screens around the infant's bedside has been described by mothers as a crucial element to ensure privacy, particularly in open concept or pod-based NICU designs, both for breastfeeding and mother-infant bonding (Nyqvist & Kylberg, 2008). Specialized chairs, reported by informants to exist in 83% of Canadian NICUs, are an additional asset to the breastfeeding-friendliness of a NICU environment. Researchers have suggested that specialized chairs such as recliners and rocking chairs located near the infant's bedside may play an important role in minimizing mother-infant separation and promoting milk expression (Lessen & Crivelli-Kovach, 2007).

Facilitating a rooming-in experience prior to infant discharge from the hospital was reported to exist in 93% of NICUs in our study, and this practice has profound benefits for breastfeeding. Mothers of preterm infants have identified feeding as a primary concern following their infant's discharge from the NICU, citing reasons for this concern to include lack of knowledge regarding general infant feeding (e.g., how to recognize infant hunger) and milk expression (e.g., how to store expressed milk), as well as various breastfeeding challenges (e.g., trouble latching; Boykova, 2016; Burnham, Feeley, & Sherrard, 2013; Mancini & While, 2001; Reyna, Pickler, & Thompson, 2006). This can lead to maternal feelings of anxiety and fear

surrounding the management of the infant's evolving feeding process and nutritional needs (Boykova, 2016; Reyna et al., 2006).

Fortunately, rooming-in provides an opportunity for a mother to assume full caregiving responsibility of her infant with the support of NICU staff close by to assist with challenges. Studies focusing on rooming-in prior to NICU discharge have found that maternal perceptions of this experience include enhanced feeding and caregiving preparedness (Bennett & Sheridan, 2005; Burnham et al., 2013; Costello & Chapman, 1998), increased maternal confidence (Bennett & Sheridan, 2005; Costello & Chapman, 1998), and assistance with breastfeeding efforts (Bennett & Sheridan, 2005). In addition, research has shown that when mothers are offered an individual room to share with their preterm infant during their full stay in the NICU (in comparison to standard maternal NICU visitation), infants experience fewer re-hospitalizations related to feeding difficulties (Erdeve et al., 2008). Lastly, enabling mother-infant togetherness is one of the steps outlined by Nyqvist and colleagues (2015) for expansion of the global BFHI into NICUs; specifically, step 7 of the neo-BFHI states that NICUs should enable mothers and infants to remain together 24 hours a day. Recognizing that this is often a challenge for NICUs equipped with non-single rooms, the reportedly high frequency of rooming-in opportunities offered to mothers prior to infant discharge represents important progress in Canadian NICUs towards both achieving this step and in the promotion of breastfeeding.

Breastfeeding Support Personnel

Informants reported that a number of health care providers were involved in providing breastfeeding support within Canadian NICUs, including bedside nurses (100% of NICUs), IBCLCs (86%), occupational therapists (17%), and dietitians (7%). Importantly, the providers reported in the highest frequencies in our study (i.e., nurses and IBCLCs) had specialized

training in breastfeeding; informants reported that bedside nurses received mandatory breastfeeding training in the vast majority of NICUs (93%), and the nature of an IBCLC certification involves extensive didactic and experiential education on breastfeeding-related topics (International Board of Lactation Consultant Examiners, n.d.). Given Renfrew and colleagues' (2009) systematic review results suggesting that support from individuals trained in the management of breastfeeding is positively associated with improved breastfeeding outcomes, our findings, which show that such personnel are available in most NICUs across Canada, are encouraging.

The training of NICU nurses in Canada is a particularly important element of comprehensive breastfeeding support as they are a continuous and prominent presence in any unit. In their integrative review related to the needs of mothers using breast pumps in the NICU, Lucas, Paquette, Briere, and McGrath (2014) posited that the breastfeeding culture within a NICU is likely influenced by staff, and particularly nurses', perceptions of breastfeeding. They found that a lack of nurse education related to, and experience with, breastfeeding emerged as a common theme in several studies. The authors also noted that nurses who received breastfeeding education were more likely to have a positive attitude towards breastfeeding, which consequently had a positive impact on breastfeeding outcomes in the NICU (Lucas et al., 2014). For example, Bernaix, Schmidt, Arrizola, Iovinelli, and Medina-Poelinez (2008) found that a four hour lactation education intervention (delivered in lecture and discussion format) was associated with significant and sustained improvements in NICU nurses' knowledge, intentions, and attitudes pertaining to breastfeeding. Further, mothers in the aforementioned study perceived significantly greater levels of lactation support from the nurses after the implementation of the program (Bernaix et al., 2008).

As noted above, data from informants in our study also suggest that IBCLCs are integral members of the NICU team. Indeed, comparisons between NICU settings with and without IBCLC support have shown that women with access to an IBCLC have significantly higher rates of ever providing human milk to their infants (Dweck et al., 2008; Gonzalez et al., 2003; Sisk, Lovelady, Dillard, & Gruber, 2006) and of breastfeeding prior to infant discharge (Castrucci, Hoover, Lim, & Maus, 2007; Dweck et al., 2008). Further, IBCLCs have been shown to be the most used resource for breastfeeding advice among mothers of preterm infants (in comparison to other health care providers, books, family, etc.; Pinelli, Atkinson, & Saigal, 2001).

Although our findings suggest that IBCLCs are available in a large proportion of Canadian NICUs, informants reported that their scopes of practice and consultation procedures varied. Specifically, it was reported that 45% of NICUs had an IBCLC that they shared with the entire hospital and 52% of NICUs had IBCLCs providing consultations only to mothers who met various needs-based criteria (e.g., persistent milk expression challenges). These parameters may limit an IBCLC's ability to provide consistent or individualized care to *all* mothers within the NICU, as they may need to balance their time with patients in the general mother-infant unit or may not be accessible to lower risk mothers of preterm infants. Not surprisingly, research has shown that mothers have cited lack of time with an IBCLC as a barrier to breastfeeding (Myers, Rubarth Baas, & Rubarth, 2013). Thus, there is some evidence to support the potential expansion of current IBCLC role parameters in Canadian NICUs to provide early and ongoing support to all mothers of preterm infants regardless of their feeding situation or the infant's medical status.

Few Canadian NICUs (17%) were reported to have utilized peer counsellors as a breastfeeding resource, despite the growing research in support of this strategy. For example, in their systematic review, Renfrew and colleagues (2009) found strong evidence from three studies

that demonstrated the effectiveness of volunteer peer counsellors on improving breastfeeding outcomes. Another study showed that mothers perceived breastfeeding peer counsellors to provide support, knowledge, and sensitive encouragement, and served as role models and motivators for initiating or maintaining breastfeeding (Rossman et al., 2011). The ability to receive support from someone who went through a similar breastfeeding experience can stimulate maternal hope and empowerment, therefore providing a unique dimension of emotional support in addition to informational and practical support (Rossman et al., 2011). Of note is that NICU health care providers who have worked with breastfeeding peer counsellors have expressed acceptance and appreciation towards such a role (Rossman, Engstrom, & Meier, 2012). In fact, NICU nurses themselves have noted that counsellors are able to fill an important void in the NICU setting by providing high quality, individualized breastfeeding support to mothers (Rossman et al., 2012). Accordingly, adding peer counsellors to Canadian NICU teams may not only provide unparalleled breastfeeding support to mothers, but might also address a potential gap or strain in the current provision of care.

Breastfeeding Education for Mothers

It is encouraging to note that informants from all NICUs (100%) reported the availability of printed breastfeeding education handouts to mothers. Parents may feel overwhelmed trying to absorb the large volume of information provided to them during an infant's NICU stay (which not only pertains to breastfeeding, but also the infant's medical status, progress, and evolving routine) and have cited concerns about missing or forgetting important details (Russell et al., 2014). The provision of printed resources by staff in Canadian NICUs not only addresses this concern, but also provides reference materials for parents to reinforce the abundance of information that is delivered verbally (Benoit & Semenic, 2014; Lucas et al., 2014; Raffray,

Semenic, Osorio Galeano, & Ochoa Marín, 2014).

Breastfeeding education for mothers could be enhanced to include additional modes of delivery, as the informants in our study reported a high frequency of printed handouts but lower frequencies of other valuable educational mediums such as group education (38% of NICUs), websites (41%), videos (24%), and smartphone apps (10%). Group education sessions (Ahmed, 2008), websites that provide both information and an electronic milk expression logbook interface (Blatz, Dowling, & Underwood, 2016), and video viewing (Pinelli et al., 2001) have all been shown to be effective methods for supporting breastfeeding in the preterm population. Technology- or web-based educational approaches may represent a particularly opportune means of reaching mothers given the ubiquitous nature of cellphones and electronic devices (e.g., tablets). Interestingly, mothers of preterm infants have reported that websites and smartphone apps are preferred technological mediums for accessing breastfeeding support and information both during pregnancy and in the postpartum period, citing reasons such as convenience and immediacy of information (Demirci, Cohen, Parker, Holmes, & Bogen, 2016). Canadian NICU staff could be encouraged to support this maternal preference and ensure the quality, validity, and safety of web-based information by seeking out credible resources for mothers (e.g., websites, apps, YouTube videos, and/or social media platforms), as well as engage with mothers to learn about common sources of online breastfeeding support.

A breadth of topics was reported to be included in the printed handouts available in Canadian NICUs. The most common topics reported were expressing milk (83% of NICUs) and managing expressed milk (79%). General breastfeeding information (reported by informants at 76% of NICUs), such as evidence regarding the benefits of breastfeeding, is critical to provide to mothers, as such knowledge can serve as a powerful influence over her decision to breastfeed

(Miracle, Meier, & Bennett, 2004). Research supports the use of milk expression logbooks by mothers (reported to be available in 69% of the NICUs in our study), which encourage the recording and tracking of milk expression session frequency, timing, and milk volumes along with other relevant details (Lucas et al., 2014). Lastly, the frequently reported provision of information about maternal milk supply (66% of NICUs) is a positive finding given that mothers' perceptions of inadequate milk production represent one of the most frequently cited breastfeeding-related barriers (Alves et al., 2013; Callen et al., 2005; Myers et al., 2013; Sisk et al., 2006). Taken together, our findings suggest that mothers of preterm infants appear to be receiving fundamental and valuable breastfeeding information via printed handouts available in Canadian NICUs.

There appears to be some less frequently reported printed handout topics in our study that could be of benefit to mothers if such information was provided. Guidance on managing breastfeeding and milk expression challenges (e.g., nipple problems, mastitis) was reported to exist in printed handouts within 41% of NICUs, yet could be assistive information for all mothers of preterm infants who routinely cite these as barriers to ongoing breastfeeding and reasons for discontinuation (Callen et al., 2005; Dowling, Blatz, & Graham, 2012; Wheeler, 2009). Skin-to-skin care (reported to be covered in printed handouts in 28% of NICUs) has been shown to be an effective strategy to promote successful breastfeeding and mother-infant bonding in the NICU (Flacking et al., 2006; Flacking, Ewald, & Wallin, 2011; Giannì et al., 2016; Renfrew et al., 2009); however, the attitudes of NICU nurses towards skin-to-skin care may dictate opportunities for this practice. Although some nurses are champions of skin-to-skin care, others report ambivalence towards this practice, and some generally avoid it given views that it is unsafe or increases workload (Engler et al., 2002; Flynn & Leahy-Warren, 2010; Kymre, 2014).

Therefore, providing mothers in more Canadian NICUs with printed handouts related to the effectiveness (and safety) of engaging in skin-to-skin care with their preterm infant may empower them to engage in this practice, irrespective of whether their infant's nurses routinely encourage them to do so.

Lastly, a notable gap in the reported printed handout topics is the consideration for mothers of preterm infants' emotional and psychological health during breastfeeding. Mothers' emotional distress has been identified as one of the main barriers to breastfeeding, particularly immediately after NICU discharge (Callen et al., 2005; Wheeler, 2009). This has implications not only for a mother's psychological health and well-being, but also her breastfeeding efforts. Maternal distress has an inverse physiological effect on milk output (Dewey, 2001), and has been associated with suboptimal feeding behaviours such as an inability to recognize infant cues and respond sensitively (Park et al., 2016). Hence, researchers suggest that emotional support is a crucial element to promoting breastfeeding in the preterm population (Callen et al., 2005; Ikonen et al., 2015; Lucas et al., 2014; Park et al., 2016). Although interactions with NICU staff, peer counsellors, family, and friends are likely a main contributor to a mother's emotional support system, Canadian NICUs could provide an additional layer of proactive support through written information about the commonality of emotional distress, ways to cope effectively, and management of healthy and realistic breastfeeding expectations.

Breast Pump-Related Resources

The breast pump is an essential piece of equipment in the NICU for mothers who desire to breastfeed their preterm infants. Ideally, milk expression should begin 6-12 hours after birth and occur 8-12 times per day (every two to three hours) to support the establishment of adequate milk supply (Spatz, 2004). Not surprisingly, the absence or presence of breast pumps in the

NICU has been reported by mothers as a barrier or facilitator to breastfeeding, respectively (Giannì et al., 2016; Myers et al., 2013). Our findings that informants from all of the Canadian NICUs (100%) reported the availability of breast pumps for in-unit use, and that pump kits were most often provided to mothers free of charge (86% of NICUs), are encouraging. Important to note is the ratio of breast pumps to infant beds reported in our study, which we calculated to range from 1:1 to 1:8. Given the frequency of milk expression sessions, a breast pump may not always be available to mothers in certain NICUs when needed. Increasing the proportion of NICUs with a more appropriate breast pump-to-infant bed ratio may represent an area for improvement. Nevertheless, the overall presence of breast pumps in Canadian NICUs should be viewed as an asset.

The 31% of NICUs in our study who reportedly implemented a pump loan program cited social and financial issues, as well as delivery of a very preterm infant (i.e., those born less than 32 weeks completed gestation) as needs-based criteria to access this service. Epidemiological studies support these criteria; mothers of low socioeconomic status (Killersreiter, Grimmer, Bührer, Dudenhausen, & Obladen, 2001; Merewood et al., 2006) and of very preterm infants (Ericson, Flacking, Hellström-Westas, & Eriksson, 2016; Merewood et al., 2006) are both at an increased risk for suboptimal breastfeeding outcomes. Interestingly, in examining samples composed of entirely very preterm infants, researchers have found that indicators of low socioeconomic status (e.g., low maternal education, use of social welfare) represent significant risk factors for poor breastfeeding outcomes (Flacking, Wallin, & Ewald, 2007; Zachariassen et al., 2010). This suggests that, within the preterm population, mothers of low socioeconomic status are an exceptionally high-risk group requiring additional breastfeeding support. The fee for purchasing or renting a breast pump (sometimes for months on end) is an added burden to the

existing costs associated with preterm birth for families, such as transportation to and from the NICU, hospital parking, loss of wages, and childcare for other children (Hodek, Schulenburg, & Mittendorf, 2011). Therefore, removing this financial barrier in more Canadian NICUs by providing access to loaned breast pumps for at-home use may be an essential breastfeeding resource to consider for these high-risk mothers.

Coordination of Post-Discharge Breastfeeding Support

The transition from NICU to home can be both a momentous and stressful event for mothers of preterm infants (Adama, Bayes, & Sundin, 2016). As noted previously, feeling unprepared to manage infant feeding has been identified as a primary concern among parents of preterm infants (Boykova, 2016; Burnham et al., 2013; Mancini & While, 2001; Reyna et al., 2006). Further, step 10 of the neo-BFHI suggests that the onus rests with the NICU staff to prepare mothers for continued breastfeeding and ensure access to support services after hospital discharge (Nyqvist et al., 2015).

It is encouraging to note that staff in 79% of NICUs reportedly send a referral for each mother-infant dyad to local public health units, thus providing at least one community resource for breastfeeding counselling. However, lower frequencies were reported for other post-discharge breastfeeding support avenues for mothers, such as in-hospital clinic access (45% of NICUs) and provision of information about community resources (31%). Several breastfeeding resources that exist in a NICU setting may also exist in the community, including breastfeeding classes, IBCLC services, or peer support. With the advancement of technology, additional resources such as telephone counselling or videoconferencing post-discharge are also gradually being introduced into NICU settings (Gray et al., 2000; Lindberg, Axelsson, & Ohrling, 2009), although there were no reports of such resources being available in Canadian NICUs.

The potential need for improvement in coordinating post-discharge breastfeeding support does not appear to be unique to Canadian NICUs; both NICU health care providers and researchers internationally have highlighted a need for establishing and formalizing linkages between NICUs and community-based services (Briere, McGrath, Cong, & Cusson, 2014; Burnham et al., 2013; Niela-Vilén, Axelin, Melender, & Salanterä, 2015; Raffray et al., 2014). One consideration pertinent to Canadian NICUs might be to develop (or refine) a comprehensive community breastfeeding support services handout and implement this as part of the standard discharge process. Studies have shown that mothers of preterm infants who are provided with contact information for breastfeeding support services (e.g., telephone hotlines, support groups) upon infant discharge have significantly longer breastfeeding duration compared to mothers who did not receive this information (Mulready-Ward & Sackoff, 2013; Rayfield et al., 2015). Interesting to note is that providing contact details creates the perception that breastfeeding support exists, but does not necessarily mean that mothers access this support. Recognizing that the quantity and quality of community breastfeeding resources may vary in each Canadian NICU's jurisdiction, sourcing out such resources, providing details to mothers, and facilitating linkages where possible is an essential component to promoting continuity of breastfeeding support.

Breastfeeding-Related Policies

Researchers have recommended that NICUs adopt policies and procedures that are supportive and encouraging of breastfeeding (Lucas et al., 2014; Renfrew et al., 2009). One of the primary purposes of these policies is to standardize breastfeeding-related processes for unit staff. Studies suggest that policies are indeed perceived as beneficial to minimize role confusion and provide clarity and direction for managing various breastfeeding-related processes (e.g., best

practices for storing human milk in the unit; Taylor et al., 2011), but may also be viewed by staff as an impediment to working quickly and efficiently (Cricco-Lizza, 2011). In the present study, a high proportion of NICUs (82%) were reported to have a written skin-to-skin care policy. This partially addresses step 4 of the neo-BFHI, which is to encourage early and consistent mother-infant skin-to-skin contact, as a written skin-to-skin care policy is a requirement for fulfilling this step (Nyqvist et al., 2015). Skin-to-skin care is clearly an integral component to breastfeeding in the NICU (Renfrew et al., 2009), and the reportedly widespread implementation of a skin-to-skin policy within Canadian NICUs seems to demonstrate a commitment to encouraging this practice.

Just over half of NICUs (61%) were reported to have a written breastfeeding policy and one quarter (25%) were reported to have a breastfeeding policy specific to preterm infants. Step 1 of the global BFHI, neo-BFHI, and Canada's BFI state that all facilities should have a written breastfeeding policy that is communicated to all staff, given the evidence that hospitals with comprehensive breastfeeding policies are more likely to have better breastfeeding outcomes among mothers and their infants (Breastfeeding Committee for Canada, 2012; Nyqvist et al., 2015; WHO & UNICEF, 2009). As such, the implementation of a hospital or unit breastfeeding policy that is inclusive of high-risk populations such as preterm infants and that is easily accessible to staff is an important consideration for all Canadian NICUs.

It is important to point out that the absence of an informant-reported NICU policy cannot be interpreted to mean that standardized management of certain breastfeeding-related processes do not exist. An example from our data might include the use of donor milk and oral immune therapy. Informants from 79% of NICUs reported the use of donor milk, but only 32% reported a policy on the matter. Similarly, informants from 82% of NICUs reported the use of oral immune therapy, yet only 32% cited having a policy in place to support this practice. It is reasonable to

expect that various breastfeeding-related processes can be communicated effectively to staff both formally (e.g., during orientation) and informally within the NICU. Further, it is also a possibility that not all informants were aware of all policies in the NICU. Nonetheless, the development and/or refinement of evidence-based, written breastfeeding-related policies could allow for a review and update of current practices, and may serve as a resource for ongoing education of staff with regard to supporting breastfeeding within the unit.

International Comparison

To our knowledge, our study is the first to examine the breastfeeding resources reported to be available in NICUs at a Canada-wide level. Two studies have been conducted previously with a similar aim in other countries (Alonso-Díaz et al., 2016; Maastrup et al., 2012), thus allowing for a general comparison between Canadian and international NICU breastfeeding support practices. It is worth noting that these studies were published subsequent to the development of the neo-BFHI, perhaps reflecting a growing global interest in and momentum towards the creation of breastfeeding-friendly NICUs.

In one study, Maastrup, Bojesen, Kronborg, and Hallstrom (2012) used a survey distributed to head nurses to describe the breastfeeding support available to mothers in all 19 Danish NICUs. On the basis of our findings, it appears that Danish and Canadian NICUs are comparable with respect to rooming-in opportunities prior to discharge (100% of Danish NICUs versus 93% of Canadian NICUs) and use of written breastfeeding education handouts (95% vs. 100%). Maastrup et al. (2012) found that Danish NICUs reported a written breastfeeding policy more often than what we found to be reported in Canadian NICUs (84% vs. 61%). However, frequencies were reported to be lower in Danish NICUs in comparison to those reported in our study for Canadian NICUs with respect to group breastfeeding classes (16% vs. 38%), a skin-to-

skin care policy (53% vs. 82%), and the availability of an IBCLC (26% vs. 86%). Lastly, whereas four Danish NICUs (21%) were reported to be located in a Baby-Friendly Hospital in the Maastrup et al. (2012) study, only one of the Canadian NICUs (3%) in our study was found to be located in such an environment.

More recently, Alonso-Díaz and colleagues (2016) conducted a study with the aim of examining breastfeeding support for mothers of infants in Spanish NICUs (particularly as it relates to BFHI designation). These authors collected data using an adapted version of the survey developed by Maastrup et al. (2012), and received a response from staff members in 129 level 2 and 3 NICUs. Alonso-Díaz et al.'s (2016) findings, along with the findings of our current study, provide evidence to suggest that Spanish and Canadian NICUs may be comparable with respect to the presence of a written breastfeeding policy (71% of Spanish NICUs versus 61% of Canadian NICUs), a written storing or handling expressed milk policy (71% vs. 61% of Canadian NICUs with expressed milk management policies), and offering of group breastfeeding classes (31% vs. 38%). In comparison to the work of Alonso-Díaz et al. (2016), our results showed that Canadian NICUs had higher reported frequencies in their availability of an IBCLC (11% vs. 86%) and rooming-in opportunities prior to discharge (24% vs. 93%), and to a lesser degree in their availability of a freezer for expressed milk storage (77% vs. 100%) and use of written breastfeeding education handouts (81% vs. 100%). Finally, seven Spanish NICUs (5%) were reported to be located in a Baby-Friendly Hospital versus the one Canadian NICU (3%) in a Baby-Friendly Hospital in our current study.

Although the scope and depth of this comparison is limited, it appears that Canadian NICUs are relatively on par with the breastfeeding resources that are available to mothers of preterm infants in NICUs internationally. Interestingly, a greater number of hospitals in both

Denmark and Spain had achieved global BFHI designation in comparison to the single hospital in our study that had achieved Canada's BFI designation. Therefore, increasing the number of Canadian hospitals containing NICUs with a BFI designation (and working towards a neo-BFI adaptation on a national level) continues to be an important goal.

Strengths of the Study

There are several noteworthy strengths of our study. Key strengths were the high response rates for both the recruitment of NICUs (29 of the 31 contacted units were represented in the study = 94% response rate) and the member checking phase (informants at 28 of the 29 NICUs actively participated in member checking = 97% response rate), which ensured the representativeness and validity in our findings (Bryman, 2008; Creswell & Miller, 2010). Another asset to this study was the method used for data collection. Key informant interviews were deemed advantageous over surveys given the flexibility it afforded to informants in identifying breastfeeding resources, and to the student researcher who was able to probe and ask further questions where appropriate. In addition to the systematic use of member checking in our study, informants were also encouraged to share their hospital's data set with additional knowledgeable staff members in order to fill in any gaps and/or to confirm information. Four NICU informants took advantage of this opportunity formally (e.g., by providing contact details of an additional informant to the student researcher), and several NICU informants mentioned that they would engage in this informally. Such steps also helped to ensure the thoroughness and rigour of our data collection process.

A further strength in our study was the consideration given to the coordination of post-discharge breastfeeding resources. Prior to this study, minimal research has examined the resources that NICU staff provide mothers with during the discharge transition from hospital to

home. For example, neither Maastrup nor Alonso-Díaz and their respective colleagues examined how Danish or Spanish NICUs coordinate or provide post-discharge breastfeeding resources, but rather focused exclusively on practices taking place in the unit (Alonso-Díaz et al., 2016; Maastrup et al., 2012). It is important to consider not only how NICU staff support mothers while their infants are in the unit, but also how they responsibly position mothers for breastfeeding success after the infant is discharged.

Limitations of the Study

A number of limitations should be considered when interpreting the findings from our study. The sample of NICUs was composed of only level 3 units and may not reflect the breastfeeding resources available in exclusively level 2 units, thus limiting the generalizability of our findings. Further, given that two hospitals in Quebec could not be included because the key informants were French-speaking, our findings may underrepresent the NICU-based breastfeeding resources available in that province. In addition, there was potential for a socially desirable response bias from informants in reporting their NICU's breastfeeding resources (Bryman, 2008). It is widely recognized in the Canadian maternal-newborn health care community that breastfeeding should be protected and promoted, and NICU informants may have felt the need to present an overly positive representation of their unit (e.g., by reporting on past practices or resources that have been discussed and/or are in early phases of development). We suspect that this type of bias, however, is minimal; a number of NICU informants were (anecdotally) quite forthcoming about gaps in their NICU with respect to breastfeeding resources or their personal desire to secure additional funding for programs and initiatives in support of breastfeeding (these bits of conversations were not noted or included in the data).

Further limitations were specific to the method and nature of the data collected. The

interviews conducted for this study were not audio-recorded; rather, informant responses were manually noted by the student researcher during the interview. Thus, there is the possibility that some information discussed during the interview was not captured in the interview notes. Further, the depth of data gathered using our interview methodology was intended to provide a general overview (i.e., a scan) of the breastfeeding resources available in Canadian NICUs. However, the lack of specificity for various data items inhibited us from examining some valuable comparisons, such as the varying intensities of NICU nurses' breastfeeding training, the alignment of policy and printed handout content with evidence-based best practices, the extent to which a policy is communicated to staff or enforced, or the types of pumps available within the unit (e.g., brand name, manual versus electric). Although not addressed in our study, each of these factors represent potential areas for future research within this population to complement and further the findings presented in this thesis.

Chapter 5: Conclusions and Future Directions

This study examined the types and frequencies of breastfeeding resources available to mothers of preterm infants in a sample of 29 level 3 NICUs across Canada. Research to date has focused largely on the effectiveness of breastfeeding promotion interventions (i.e., strategies or resources used to promote the behaviour) in NICU settings (McInnes & Chambers, 2008; Renfrew et al., 2009). As such, there is a growing need translate to this knowledge in order to determine whether such resources are currently available in regular NICU settings. Our study is the third of its kind to employ such a focus, with two previous studies focusing on breastfeeding supports available in Danish (Maastrup et al., 2012) and Spanish (Alonso-Díaz et al., 2016) NICUs.

On the basis of our findings, a wide range of breastfeeding resources are currently available in Canadian level 3 NICUs. Overarching resource categories include breastfeeding-friendly layout, breastfeeding support personnel, breastfeeding education for mothers, breast pump-related resources, coordination of post-discharge breastfeeding support, and breastfeeding-related policies. Consistent with previous studies, high and low frequencies of breastfeeding resources in NICUs across Canada were evident based on the information provided by key informants. Several resources were reported to be available in a high proportion of NICUs, including privacy measures and specialized chairs by infant bedsides, trained health care providers (e.g., nurses and IBCLCs) offering breastfeeding support, availability of printed educational handouts and breast pumps/kits, and the presence of skin-to-skin care policies. However, several resources were reported to exist in a low proportion of NICUs, and it appears that there is room for improvement regarding IBCLC counselling for all mothers in the NICU, the limited presence of peer counsellors, breastfeeding education for mothers using various

formats and increased topic coverage, the development of breast pump loan programs, coordination of community or outpatient breastfeeding support after discharge, and the implementation of breastfeeding-related policies. In comparison to international studies, an additional potential area for improvement could be the expansion of Canada's BFI to include NICU adaptations, and continuing to work towards an increase in the number of Baby-Friendly designated hospitals in Canada.

Given that this environmental scan was exploratory in nature, our findings have the potential to serve as an evidence-based foundation for future research and clinical strategic directions. From a research perspective, it would be worthwhile for future studies, conducted in a Canadian context, to examine mothers' or staff experiences and perceptions in relation to the various NICU-based breastfeeding resources identified in this study. Examining the breastfeeding culture within Canadian NICUs, which might include an evaluation of mothers' (and perhaps fathers') and staff attitudes and beliefs towards breastfeeding in the NICU, might also represent an important area for future research. Additionally, a rigorous content analysis of educational handouts and unit policies could be undertaken to further investigate whether the content of such resources aligns with research evidence on the topic(s) as well as with the steps outlined in Canada's BFI or the global neo-BFHI. Lastly, an expansion of our environmental scan to include level 2 Canadian NICUs might allow for a meaningful comparison of the breastfeeding resources available across the country based on location (i.e., province), urban versus rural settings, number of beds, BFI designation status, or levels of care given that the sample size would likely be much higher.

From a clinical perspective, NICU staff are encouraged to reflect on the strengths and weaknesses in relation to the breastfeeding resources available within their own unit. Such

critical reflections might stimulate the formation of action plans to introduce or modify, with the aim of improving, current breastfeeding resources. Further, we encourage staff members in NICUs across Canada to connect with one another to facilitate the exchange of breastfeeding support knowledge, resources, and best practices. In a health care climate of busy clinical practice and potentially limited resources, fostering connections and building capacity among NICUs across the country (for example, through a web-based knowledge network) could represent a promising strategy to optimize the breastfeeding support provided to mothers of preterm infants.

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Appendix A: Ten Steps of the Baby-Friendly Hospital Initiative, Baby-Friendly Initiative, and Neo-Baby-Friendly Hospital Initiative

Baby-Friendly Hospital Initiative (BFHI)	Baby-Friendly Initiative (BFI)	Neo-Baby-Friendly Hospital Initiative (Neo-BFHI)
Step 1. Have a written breastfeeding policy that is routinely communicated to all health care staff.	Step 1. Have a written breastfeeding policy that is routinely communicated to all health care providers and volunteers.	Step 1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
Step 2. Train all health care staff in skills necessary to implement the policy.	Step 2. Ensure all health care providers have the knowledge and skills necessary to implement the breastfeeding policy.	Step 2. Educate and train all staff in the specific knowledge and skills necessary to implement this policy.
Step 3. Inform all pregnant women about the benefits and management of breastfeeding.	Step 3. Inform pregnant women and their families about the importance and process of breastfeeding.	Step 3. Inform hospitalized pregnant women at risk for preterm delivery or birth of a sick infant about the benefits of breastfeeding and the management of lactation and breastfeeding.
Step 4. Place babies in skin-to-skin contact with their mothers immediately following birth for at least an hour. Encourage mothers to recognize when their babies are ready to breastfeed and offer help if needed.	Step 4. Place babies in uninterrupted skin-to-skin contact with their mothers immediately following birth for at least an hour or until completion of the first feeding or as long as the mother wishes: Encourage mothers to recognize when their babies are ready to feed, offering help as needed.	Step 4. Encourage early, continuous and prolonged mother-infant skin-to-skin contact/ Kangaroo Mother Care.
Step 5. Show mothers how to breastfeed and how to maintain lactation, even if they should be separated from their infants.	Step 5. Assist mothers to breastfeed and maintain lactation should they face challenges including separation from their infants.	Step 5. Show mothers how to initiate and maintain lactation, and establish early breastfeeding with infant stability as the only criterion.
Step 6. Give newborn infants no food or drink other than breast milk, unless medically indicated.	Step 6. Support mothers to exclusively breastfeed for the first six months, unless supplements are medically indicated.	Step 6. Give newborn infants no food or drink other than breast milk, unless medically indicated.
Step 7. Practice rooming-in - allow mothers and infants to remain together – 24 hours a	Step 7. Facilitate 24-hour rooming-in for all mother-infant dyads: mothers and	Step 7. Enable mothers and infants to remain together 24 hours a day.

day.	infants remain together.	
Step 8. Encourage breastfeeding on demand.	Step 8. Encourage baby-led or cue-based breastfeeding. Encourage sustained breastfeeding beyond six months with appropriate introduction of complementary foods.	Step 8. Encourage demand breastfeeding or, when needed, semi-demand feeding as a transitional strategy for preterm and sick infants.
Step 9. Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants.	Step 9. Support mothers to feed and care for their breastfeeding babies without the use of artificial teats or pacifiers (dummies or soothers).	Step 9. Use alternatives to bottle feeding at least until breastfeeding is well established, and use pacifiers and nipple shields only for justifiable reasons.
Step 10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.	Step 10. Provide a seamless transition between the services provided by the hospital, community health services and peer support programs. Apply principles of Primary Health Care and Population Health to support the continuum of care and implement strategies that affect the broad determinants that will improve breastfeeding outcomes.	Step 10. Prepare parents for continued breastfeeding and ensure access to support services/groups after hospital discharge

Note. BFHI steps from World Health Organization, & United Nations Children's Fund. (2009). *Baby-friendly hospital initiative: revised, updated and expanded for integrated care.* Retrieved from http://apps.who.int/iris/bitstream/10665/43593/1/9789241594967_eng.pdf. Adapted with permission indicated at http://www.who.int/about/licensing/extracts/en/.
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Neo-BFHI steps from Nyqvist, K., Kylberg, E., Hansen, M., Haggkvist, A., Maastrup, R., Frandsen, A., … Haiek, L. N. (2015). *Neo-BFHI: The Baby-friendly Hospital Initiative for Neonatal Wards*. Retrieved from http://www-conference.slu.se/neobfhi2015/Neo-BFHI_Core_document_2015_Edition.pdf. Adapted with permission indicated in source document.

Appendix B: Baby-Friendly Hospitals and Birthing Centres in Canada

Hospital/Birthing Centre	Designation Date	Re-Assessment Date
St. Joseph's Healthcare Hamilton, Ontario	March 2003 June 2010 September 2016	2021
Toronto East General Hospital Toronto, Ontario	September 2007 November 2012	2017
B.C. Women's Hospital and Health Centre Vancouver, British Columbia	July 2008	2017 (in progress)
Grand River Hospital Kitchener, Ontario	November 2008 December 2013	2018
Bethesda Regional Health Centre, Steinbach, Manitoba	January 2014	2019
Grey Bruce Health Services Owen Sound, Ontario September	September 2015	2020

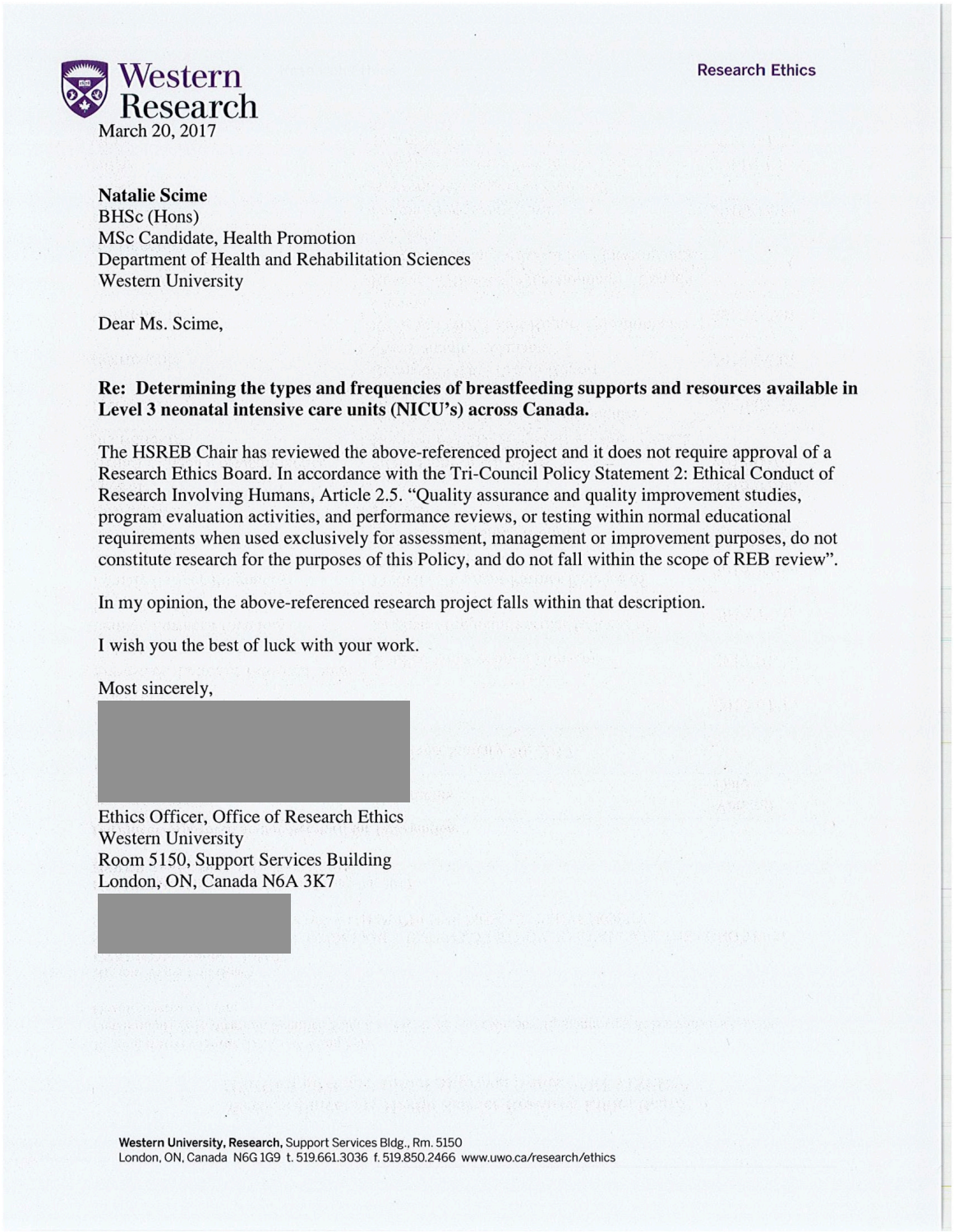
Note. Compiled January 2017. From Breastfeeding Committee for Canada. (2017). Baby-Friendly Facilities in Canada. Retrieved March 6, 2017, from http://breastfeedingcanada.ca/documents/Designated%20faciliti es%20in%20Canada%20(Jan%202017).pdf. In the public domain.

Appendix C: Names and Locations of the Contacted and Participating Canadian Hospitals Containing Level 3 Neonatal Intensive Care Units

n = 31 neonatal intensive care units (NICUs) contacted; *n* = 29 NICUs provided data (indicated by an asterisk)

- BC Women's Hospital & Health Centre (Vancouver, British Columbia)*
- Royal Columbian Hospital (New West Minster, British Columbia)*
- Surrey Memorial Hospital (Surrey, British Columbia)*
- Victoria General Hospital (Victoria, British Columbia)*
- Foothills Medical Centre (Calgary, Alberta)*
- Royal Alexandra Hospital (Edmonton, Alberta)*
- Regina General Hospital (Regina, Saskatchewan)*
- Royal University Hospital (Saskatoon, Saskatchewan)*
- Health Sciences Centre Winnipeg (Winnipeg, Manitoba)*
- St. Boniface General Hospital (Winnipeg, Manitoba)*
- Children's Hospital of Eastern Ontario (Ottawa, Ontario)*
- Children's Hospital London Health Sciences Centre (London, Ontario)*
- Hospital for Sick Children (Toronto, Ontario)*
- Kingston General Hospital (Kingston, Ontario)*
- McMaster Children's Hospital Hamilton Health Sciences Centre (Hamilton, Ontario)*
- Mount Sinai Hospital (Toronto, Ontario)*
- Sunnybrook Health Sciences Centre (Toronto, Ontario)*
- The Ottawa Hospital General Campus (Ottawa, Ontario)*
- Windsor Regional Hospital (Windsor, Ontario)*
- Centre Hospitalier Universitaire de Quebec (Quebec City, Quebec)*
- Centre Hospitalier Universitaire de Sherbrooke (Sherbrooke, Quebec)
- Centre Hospitalier Universitaire Sainte-Justine (Montreal, Quebec)*
- Montreal Children's Hospital (Montreal, Quebec)*
- Jewish General Hospital (Montreal, Quebec)
- Dr. Everett Chalmers Hospital (Fredericton, New Brunswick)*
- Moncton Hospital (Moncton, New Brunswick)*
- Saint John Regional Hospital (Saint John, New Brunswick)*
- Cape Breton Regional Hospital (Sydney, Nova Scotia)*
- IWK Grace Health Centre (Halifax, Nova Scotia)*
- Queen Elizabeth Hospital (Charlottetown, Prince Edward Island)*
- Janeway Children's Health and Rehabilitation Centre (St. John, Newfoundland)*

Appendix D: Letter of Research Ethics Board Review Exemption from Western University



Western Research

Research Ethics

March 20, 2017

Natalie Scime
BHSc (Hons)
MSc Candidate, Health Promotion
Department of Health and Rehabilitation Sciences
Western University

Dear Ms. Scime,

Re: Determining the types and frequencies of breastfeeding supports and resources available in Level 3 neonatal intensive care units (NICU's) across Canada.

The HSREB Chair has reviewed the above-referenced project and it does not require approval of a Research Ethics Board. In accordance with the Tri-Council Policy Statement 2: Ethical Conduct of Research Involving Humans, Article 2.5. "Quality assurance and quality improvement studies, program evaluation activities, and performance reviews, or testing within normal educational requirements when used exclusively for assessment, management or improvement purposes, do not constitute research for the purposes of this Policy, and do not fall within the scope of REB review".

In my opinion, the above-referenced research project falls within that description.

I wish you the best of luck with your work.

Most sincerely,

[redacted]

Ethics Officer, Office of Research Ethics
Western University
Room 5150, Support Services Building
London, ON, Canada N6A 3K7

[redacted]

Western University, Research, Support Services Bldg., Rm. 5150
London, ON, Canada N6G 1G9 t. 519.661.3036 f. 519.850.2466 www.uwo.ca/research/ethics

HSREB: Health Sciences Research Ethics Board; REB: Research Ethics Board

Appendix E: Key Informant Recruitment Script for Telephone and Email

Telephone Script

Hi there, my name is Natalie Scime and I'm a Master's student at Western University. I'm currently pursuing a thesis project that looks at breastfeeding support for mothers of preterm infants in Canadian neonatal intensive care units. This project involves two separate but complementary studies. The first study is an environmental scan of the types of breastfeeding support in level 3 NICUs, *and the second study will involve an online survey of mother's experiences with breastfeeding support in the NICU.* For the first part of this study, I am collecting data by interviewing a key informant at each hospital. I was provided your contact information by <insert general staff member's name> who identified you as the most suitable person to interview about breastfeeding support in your NICU. The interview will take about 40-60 minutes total and can be scheduled at a time most convenient for you.

If leaving a voicemail message: Please let me know if you have any questions and if you would be interested in participating in this study as a key informant. I can be reached by telephone at xxx-xxx-xxxx or by email at natalie.scime@uwo.ca. Thanks and I look forward to connecting with you soon.

If speaking directly with informant: Is participating in this study as a key informant something you might be interested in? When would be best to schedule the interview?

Email Script

Hello <insert informant name>,

My name is Natalie Scime and I am a first year MSc student in Health Promotion at Western University. I am writing to you in regards to my Master's thesis project, which aims to examine breastfeeding support for mothers of preterm infants in neonatal intensive care units (NICUs) across Canada. This thesis project involves two separate, yet interrelated studies. The first is an environmental scan of all level 3 NICUs across Canada in which I will speak to someone from the NICU and ask what types of breastfeeding resources and supports are available to mothers (ex. peer support programs, breast pump rentals, policies, etc). *The second will be an online survey of mothers with preterm infants who have attempted to breastfeed in a Canadian NICU to examine their use, satisfaction, and experiences in using these supports. Given the administrative burden of filling out several ethics applications for each participating hospital, I am considering using social media as our main recruitment tool for the survey as I'm learning that many moms are connected to NICU support groups through Facebook and Twitter. This will remove any direct recruitment effort from the participating hospitals. I have also partnered with the Canadian Premature Babies Foundation for their support in undertaking this survey.*

I am writing to formally invite the NICU at <insert hospital name> to take part in the environmental scan study. I was provided your contact information by <insert general staff

member's name> who identified you as the most suitable person to interview about breastfeeding support in your NICU. I am hoping I can schedule a phone call with you for a brief interview regarding what breastfeeding supports exist at your hospital to create a comprehensive list. This study does not require ethics - which I have verified both within the Tri-Council Policy Statement guidelines and with the ethics board here at Western University. I anticipate the interview will take about 40-60 minutes total. Please let me know if you require any additional information and if you would be willing to schedule a phone interview. I can be reached via email or by telephone at xxx-xxx-xxxx. I look forward to including <insert hospital name> in this national study and hope to hear from you soon.

Many thanks,
Natalie Scime

Italicized text refers to a second study that is no longer part of the Master's thesis project. Given the substantial amount of data collected through the environmental scan, the MSc student, supervisor, and advisory committee collectively agreed that it was most feasible to exclude the survey of mothers from the thesis project and focus exclusively on the environmental scan. This survey will still take place, however, as a separate research project.

Appendix F: Semi-Structured Interview Guide for Key Informant Interviews

Thank you for taking the time to speak with me today, do you have any questions about the study before we begin?

First we're going to gather some information pertaining to your hospital and NICU characteristics:

- [Confirm hospital name and location]
- Is your hospital Baby-Friendly designated?
- What is the number of beds in your NICU? Are there a specific number of beds for level 2 versus level 3 care, or are all of your beds flexible to provide both levels of care depending on need?
- Are parents welcome 24/7 or are there restrictions on when they can visit?
- Does your unit routinely collect breastfeeding data upon discharge?
    - If they say yes: What are some recent statistics?
- Can you please describe the environmental design or layout of your NICU?

Now we'll discuss the initiatives and practices that are available for mothers in your unit to support successful breastfeeding outcomes.

- Which individuals are available in your NICU to provide breastfeeding support or counselling? [Probe for health care providers, peers]
    - Do your NICU nurses undergo any specific breastfeeding training?
- Please tell me about any breastfeeding resources where the goal is education for mothers. [Probe for printed handouts, classes, pamphlets, milk logs, support groups, videos, online resources]
    - If they say that printed handouts are provided: What topics are covered in these printed handouts? [Give the option to provide these verbally or send electronic version]
- How does your NICU support mothers who are expressing milk? [Probe for pumping lounges, number of pumps circulating in unit, freezer/fridge space, provision of supplies]
- Do you offer the opportunity for parents to room-in with their infant (also known as "care by parent") during the infant's stay or prior to discharge?
- Do you have any written policies in your NICU on breastfeeding, breastfeeding-related topics, or skin-to-skin?
    - If they say yes: What are the titles or topics of these written policies? [Prove for breastfeeding, skin-to-skin, expressed milk management, supplementation]
- What is the role of breastfeeding in discharge planning? Do you provide any referrals to community resources for follow-up support?
- Are there any other breastfeeding-related supports that you would like to add that we haven't yet discussed?

Thanks again for taking the time to participate in this interview with me today. In terms of next steps, I will develop a summary of the information we discussed today and send it to you via email for member checking, which gives you a chance to review your NICU's data set for accuracy and completeness. After this step is done, I will begin analysis and be in touch to circulate results when they are available.

Appendix G: Refined Data Set Template and Member Checking Email Script

Refined Data Set Template

Hospital Name
City, Province

General
BFI Designated:
# of Beds:
Parent visitation:
Use of donor milk:
Use of oral immune therapy:
BF rate upon discharge (if available):

NICU Design (e.g., open/closed concept, furniture/equipment by bedside, types of chairs available, privacy measures)

-

Main Individuals Involved in Direct Breastfeeding (BF) Support (e.g., nurses, peers, lactation consultants, social workers, pharmacists, occupational therapists, dietitians)

-

BF Education (e.g., printed materials including topics, electronic materials, digital media, classes, posters)

-

Pump-Related Support (e.g., provision of kits/supplies, pumping rooms, equipment cleaning area, loan/rental programs)

-

Rooming In

-

Coordination of BF Support On/After Discharge (e.g., hospital BF clinic, public health, in-home visits)

-

Policies Relating to BF/Skin-to-skin (e.g., feeding a preterm infant, handling/storage of breast milk, cup feeding, supplementation, oral immune therapy)

-

BFI: Baby-Friendly Initiative; BF: breastfeeding; NICU: neonatal intensive care unit

Member Checking Email Script
Hello <insert informant name>,

I am contacting you in regards to your participation in my thesis study, titled "Breastfeeding support for mothers of preterm infants in Canadian neonatal intensive care units (NICUs): An environmental scan". I have been interviewing key informants (e.g., doctors, nurses, lactation consultants) in NICUs across Canada since October 2015 to gather information on breastfeeding resources in their unit. For the purposes of my study, *breastfeeding resources* encompasses any initiative or practice that is available for mothers in the NICU with the goals of facilitating successful breastfeeding initiation, duration, and exclusivity. Given that I have been completing my MSc coursework while simultaneously conducting interviews, my data collection period has extended much longer than initially anticipated. However, I'm delighted to say that the data collection phase is now complete with 29 of Canada's level 3 NICUs participating.

The next step before data analysis is to have key informants member check the data that I collected during interviews. This is to ensure data accuracy and completeness, and to fill in any missing information either left out of our interview for follow-up or that you or your colleagues have thought to include after the interview.

Attached is a copy of your hospital's data set as per our interview. The information is grouped into categorical sections - the title of each section contains the category of support as well as some examples that fall under this category. I have highlighted specific portions where I would like for you to provide additional information in order to match the level of detail collected from other NICUs and ensure uniformity among all of the data sets. Note that the number of beds refers to funded beds, not physical beds as I realize there is sometimes a difference between the two numbers. Please take your time in reviewing the information on your NICU's data set as, once all member checks have been collected, there will be no further opportunity to modify this information. The use of either track changes or bold-faced text to indicate any additions, modifications, or deletions would be appreciated.

I ask that you please return your member checked data set to me by no later than Tuesday July 19, 2016. Should you have any questions about the member checking process, have trouble meeting this deadline, or if you would like to complete this process over the phone, please do not hesitate to contact me either via email or by telephone at xxx-xxx-xxxx. Thanks very much for your patience during this extended data collection phase and for your ongoing participation in my study. I am grateful to have had such a positive response from several Canadian NICUs and I look forward to sharing my results with you when they are ready to distribute.

Respectfully,
Natalie Scime

Curriculum Vitae

Name: Natalie Visca Scime

Post-Secondary Education and Degrees:

The University of Western Ontario
London, Ontario, Canada
Health and Rehabilitation Sciences
Master of Science (MSc) in Health Promotion
2015–present

The University of Western Ontario
London, Ontario, Canada
School of Health Studies
Bachelor of Health Sciences (BHSc), Honours Specialization in Health Sciences
2011–2015

Honours and Awards:

Ontario Graduate Scholarship (OGS)
2016–2017

Western Graduate Research Scholarship
2015–2016, 2016–2017

Canadian Institutes of Health Research Frederick Banting and Charles Best Canada Graduate Scholarship-Master's (CGS-M)
2015–2016

Dean's Honour List
2012, 2013, 2014, 2015

AER Award in Health Studies
2014–2015

UWO In-Course Scholarship
2014–2015

LIUNA Local 837 Scholarship
2014–2015

Western Scholarship of Excellence
2011–2012

Related Work Experience:

Research Assistant
Centre for Studies in Family Medicine, Western University
2017–present

Research Assistant
Parkwood Institute, St. Joseph's Health Care London
2015–present

Research Assistant
School of Physical Therapy, University of Western Ontario
2014–2015

Refereed Publications:

Scime, N.V. Supporting breastfeeding during humanitarian emergencies. *University of Western Ontario Medical Journal.* Accepted and in press.

Scime, N.V. (2016). Promoting a healthy microbiome in preterm infants. *Health Science Inquiry, 7*(1), 19-20.

Hanna, A.D. & **Scime, N.V**. (2016). Physical activity versus metformin for increasing insulin sensitivity in children and adolescents at-risk for type 2 diabetes. *University of Western Ontario Medical Journal; 85*(2)*,* 26-28 .

Scime, N.V. (2016). Antidepressant use during pregnancy: Current attitudes and knowledge translation efforts. *University of Western Ontario Medical Journal; 85*(1), 11-13.

Scime, N.V., Bartlett D.J., Brunton, L.K., & Palisano R.J. (2016). Parents' experiences and perceptions when classifying their children with cerebral palsy: Recommendations for service providers. *Physical and Occupational Therapy in Pediatrics;* 1-16 [Epub ahead of print].

Conference Presentations:

Brockway, M.* & **Scime, N.V.*** (accepted). Establishing the infant gut microbiome for lifelong health: The role of breastfeeding. 2017 International Lactation Consultants Association Conference. Toronto, Canada, July 19-22, 2017. Oral Presentation.

Flood, S.,* Tomasone, J.R., Ma, J.K., **Scime, N.V.,** Burke, S.M., Sleeth, L., Marrocco, S. & Wolfe, D.L. Use of behaviour change techniques for physical activity self-management among persons with spinal cord injury: a systematic review. Eastern Canada Sport & Exercise Psychology Symposium. Kingston, Canada, March 24-25, 2017. Poster Presentation.

Scime, N.V.* & Burke, S.M. Breastfeeding support in Canadian neonatal intensive care units. Canadian National Perinatal Research Meeting. Montebello, Canada, February 14-17, 2017. Poster Presentation.

Scime, N.V.* & Burke, S.M. Breastfeeding support for mothers of preterm infants in Canadian neonatal intensive care units: An environmental scan. 6th Canadian Association of Perinatal

and Women's Health Nurses (CAPWHN) National Conference. Calgary, Canada, October 21-23, 2016. Poster Presentation.

Scime, N.V.,* Gavarkovs, A.G. & Burke, S.M. The 5Ws of elementary school students' physical education preferences. Child Health Symposium. London, Canada, May 26, 2016. Oral Presentation.

Tomasone, J.R.,* Sleeth, L., Marrocco, S., **Scime, N.V.,** Ma, J.K., Burke, S.M. & Wolfe, D. Use and effectiveness of behaviour change techniques for physical activity self-management among persons with spinal cord injury: a systematic review protocol. Praxis 2016. Vancouver, Canada, April 25-27, 2016. Poster Presentation.

Scime, N.V.* & Burke, S.M. Breastfeeding support for mothers of preterm infants in Canadian neonatal intensive care units: An environmental scan. Faculty of Health Sciences Research Day. London, Canada, March 22, 2016. Poster Presentation

Scime, N.V.* & Burke, S.M. Breastfeeding supports and resources for mothers of preterm infants in Canadian neonatal intensive care units: Mothers' perspectives. 14th Annual Crossroads Interdisciplinary Health Research Conference. Halifax, Canada, March 11-12, 2016. Oral Presentation. WINNER - Runner Up Best Oral Presentation in Room 4

Gavarkovs, A.G., **Scime, N.V.*** & Burke, S.M. The 5Ws of elementary school students' physical education preferences. Canadian Obesity Network Western Research Blitz 2016. London, Canada, February 25, 2016. 1 Minute Oral Presentation.

Scime, N.V.* & Burke, S.M. Breastfeeding support for mothers of preterm infants in Canadian neonatal intensive care units: An environmental scan and survey. Health and Rehabilitation Sciences Graduate Research Conference. London, Canada, February 3, 2016. Oral Presentation. WINNER - Best Oral Presentation in "Contemplate" Category

Scime, N.,* Bartlett D., Brunton, L., & Palisano, R. Parents' experiences and perceptions when classifying their children with cerebral palsy: Advice for service providers.

- Ontario Association of Children's Rehabilitation Services Conference (OACRS) 2015 Conference. Toronto, Canada, November 1-3, 2015. Poster Presentation
- Child Health Symposium. London, Canada, May 22, 2015. Poster Presentation

Scime, N.,* Bartlett D., Brunton, L., & Palisano, R. Parents' experiences and perceptions when classifying their children with cerebral palsy: Advice for service providers [Work in Progress].

- Faculty of Health Sciences Research Day. London, Canada, March 25, 2015. Poster Presentation.
- Western Student Research Conference. London, Canada, March 21, 2015. Poster Presentation.