ABSTRACT

Title of dissertation: BREASTFEEDING WITHOUT NURSING: THE INFORMATION BEHAVIOR OF THOSE WHO EXCLUSIVELY PUMP HUMAN MILK

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This proposal outlines a research study examining the information behavior, that is, the information needs, seeking, and use, of those who exclusively pump human milk. Rather than feeding their children by nursing at the breast, exclusive pumpers express the entirety of their milk and feed that milk by bottle. Utilizing an ecological framework whereby the systems of the individual and their close network, community, and society are considered, qualitative and quantitative data were collected through an initial retrospective, cross-sectional survey about the lived experiences of exclusive pumpers. Longitudinal data are still being collected from those who answered the initial survey by way of monthly follow-up surveys.

This proposal first defines the language used as well as introducing my own perspective on this topic. It then sets out the ecological framework and research questions. Chapter 2 examines various aspects breastfeeding in detail, setting out existing literature about the benefits of human milk, the factors affecting breastfeeding, human milk expression, and formula. Chapter 3 lays out the theoretical framework in more detail, examines what is meant by IB, particularly on the topics of health, parenting, and infant feeding, and also explores the topic of support and social networks. Chapter 4—Methodology—describes the study design, how data were collected, and how they will be analyzed. This proposal concludes in Chapter 5 by reviewing the limitations of this research and summarizing future work to be completed.

BREASTFEEDING WITHOUT NURSING: THE INFORMATION BEHAVIOR OF THOSE WHO EXCLUSIVELY PUMP HUMAN MILK

by

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Proposal submitted to the College of Information Studies of the
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Dissertation Proposal Committee:

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Dedication

This work is dedicated to all those who have the discipline, determination, and dedication to exclusively pump their milk to give babies, be they their own or others', the best possible start in life.

Acknowledgements

Pumpingly, I would like to thank admins of various online exclusive pumping groups that allowed me to post invitations to participate in their groups. My survey pilot testers, Holly Chapman, Katrina Dizon Mariategue, Amanda Glenn, and Caroline Niziol, gave me great feedback and improved the initial survey in ways I would never have thought of: thank you. I can't thank those of you in my tribe—the mamas in the Facebook groups Breastfeeding Without Nursing and BWN: Off Topic—enough for the enthusiasm, support, and advice that you continue to give me even though I weaned off the pump over 18 months ago. I hope that you never get sick of my advice and my nerdy evidence-based posts.

Academically, my diligent, patient, and forever-affable advisor, Dr. Beth St. Jean, has gone above and beyond to support me throughout this research and writing process. I am grateful beyond measure. I am very thankful to Dr. Shannon Leigh Jette for agreeing to be the Dean's Representative on my committee, even though I'm not really sure what that entails. I am exceptionally appreciative of the support of Dr. Paul Jaeger, who agreed to continue to be on my committee despite a drastic change in research topic, and Dr. Jen Golbeck, whose expertise in social media will seem more relevant once I've analyzed my data. As breastfeeding experts go, Dr. Karin Cadwell is at the top of her field, and I am as humbled as I am grateful for her willingness to share her knowledge, advance maternal and child health, and give her time so generously to my research.

Personally, I must thank "Nana" and "Finny," AKA my mums, AKA Yvonne and Kirsti, for unquestioningly looking after Georgie during the last major writing push on this proposal. Jaini, our best friend, and Georgie's auntie-ma, is owed bigtime for the Georgie help and delicious meals that got me through this process. Thank you. There is no way to thank my indescribably supportive and loving wife, Jo Arnone enough. I know that you're super sick and tired of hearing about breastfeeding, but you still listen (or at least pretend to) most of the time, and always when it matters. Lastly, without my daughter, Georgette Jardine, this research would never have come to be. Thank you for being.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

AAP	American Academy of Pediatrics
ABM	Academy of Breastfeeding Medicine
BF	Breastfeed/breastfed
BFer	Breastfeeder
BFHI	Baby-Friendly Hospital Initiative
BFing	Breastfeeding
BMI	Body mass index
BSE	Breastfeeding self-efficacy
C-section	Cesarean section
CDC	Centers for Disease Control and Prevention
CLC	Certified Lactation Counselor
D-MER	Dysphoric milk ejection reflex
DIT	Diffusion of Innovations Theory
ELIS	Everyday Life Information Seeking
EP	Exclusively pump
EPer	Exclusive pumper
EPing	Exclusive pumping
FDA	United States Food and Drug Administration
FF	Formula feed/fed
FFer	Formula feeder
FFing	Formula feeding
FAO	Food and Agriculture Organization of the United Nations
HISB	Health information seeking behavior
HM	Human milk
IB	Information behavior
IBCLC	International Board Certified Lactation Consultant
IFPS II	Infant Feeding Practice Study II
IN	Information need
IQ	Intelligence quotient
IS	Information seeking
IU	Information use
L&D	Labor and delivery
LBW	Low birth weight

LCP	Lactation care provider
NEC	Necrotizing enterocolitis
NICU	Neonatal intensive care unit
PIMS	Perceived insufficient milk supply
PKU	Phenylketonuria
PPD	Postpartum depression
PROBIT	Promotion of Breastfeeding Intervention Trial
PTSD	Post-traumatic stress disorder
RQ	Research question
SES	Socio-economic status
SIDS	Sudden infant death syndrome
SR/MA	Systematic review and meta-analysis
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
WHO Code	WHO's International Code of Marketing of Breast-milk Substitutes
WWK	Women's Ways of Knowing

Chapter 1. Introduction

Human milk (HM) is regarded by parents, health care providers, and public health organizations as optimal nutrition for infants and the perfect version of milk for the first years of life. However, a variety of barriers to providing HM by breastfeeding exist, such as problems establishing a latch, getting milk to flow, or poor weight gain by the child. Parental perception that HM alone will not satisfy their infant and a desire for others to be involved in feeding also affect breastfeeding rates. While the overwhelming majority of parents initiate breastfeeding at birth, most do not breastfeed for as long as they initially desired, despite the negative health and emotional consequences associated with early breastfeeding cessation (Victora et al., 2016). Exclusively pumping or expressing human milk (EPing) may provide a solution for some of these problems, while still providing most of the benefits of HM.

Motivated by a lack of data on EPing, my research entails online surveys that collect qualitative and quantitative data from exclusive pumpers (EPers), as both a snapshot in time and longitudinally through a series of follow-up surveys. While the surveys cover a wide range of topics, my thesis focuses on EPers' information behavior (IB) surrounding feeding their child milk (HM and formula): their information needs, how they seek this information, where they ultimately find it, how useful that information is, whether and how they use it, and the effect of this information (or lack thereof). Since IB in this context may be inextricably linked with needing, finding, and being part of a support network, this thesis also examines these connections.

This chapter introduces my use of language and personal perspective and provides some background on the topic of breastfeeding and what is meant by EPing. It then introduces my theoretical framework and research questions (RQs), together with a brief overview of the study

methodology. It concludes discussion of the significance of this research.

1.1. Use of Terms and Language

Gender-neutral language has been used throughout this proposal wherever possible: to assume that only women and mothers breastfeed ignores gender and bodily diversity and fails to recognize parents who do not identify as women or mothers, yet feed their own milk to their child. These caregivers may breastfeed, chestfeed, and/or express milk; they may call themselves mothers, fathers, parent, or something else entirely. In addition, there are those who lactate to feed children other than their own legal or genetic child: grief donors express milk to donate to others (individuals or milk banks) after the loss of a child; those acting as a gestational surrogate may express milk to feed the child or to donate; others induce lactation to feed a child in an emergency, an adopted or fostered child, or a child carried and delivered by another family member. Therefore, unless a different term was used in specific literature or by a respondent, or it is necessary to specify a legal and/or genetic bond, use of "parent" is avoided and is replaced with terms such as "lactating person," "breastfeeder" (BFer) "gestational carrier," "respondent," or simply, "person." Lastly, "they" will be used as a singular pronoun (instead of he and/or she), unless specifically referring to someone whose pronouns are known to me.

Conforming with journals in this field, "human milk" (HM) is used instead of breast milk. Given its ubiquitous use, recognition in this field of research, and comprehensive meaning, "breastfeeding" (BFing) is used herein as a catchall term for lactating and/or feeding HM regardless of the mode of delivery. "Exclusive breastfeeding" (exclusive BFing) applies to those feeding or being fed only HM as their source of nutrition; the only other substances that could be ingested by a child to retain BFing exclusivity are prescribed medications. Likewise, "exclusive formula feeding" (exclusive FFing) applies to those feeding or being fed only formula.

"Nursing" is used to denote feeding directly at the breast or chest. "Expression," meaning extracting milk from the lactating person by all means except nursing, has been used wherever possible; however, the commonly used term for those who express all of their milk is "exclusive pumper" (EPer), whether they hand express or use a breast pump. "Grief pumpers" express HM to donate after the loss of their child (either prenatally or postpartum). The term "weaned" is usually used to denote the cessation of nursing by a child being exclusively nursed; EPers instead talk of "weaning from the pump."

Generally, "child" or "children" is used so as not to perpetuate the myth that breastfeeding should cease when infant- or babyhood does; furthermore, references to a singular "child" is not at the exclusion of multiple "children" where appropriate. However, "infant" is used when specifically referring to a child under the age of 12 months; "newborn" refers to an infant in their first month of life. "Pumplings" are children fed expressed HM. The term "lactation care provider" (LCP) is a catchall term for any person with some level of formal training who provides information, support, advice, and education about breastfeeding, lactation, or expression. LCPs include: Certified Lactation Counsellors (CLCs); International Board Certified Lactation Consultants (IBCLCs); birth and postpartum doulas;[1] peer counsellors with groups such as La Leche League or the Special Supplemental Nutrition Program for Women, Infants, and Children (commonly known as WIC); and medical professionals such as obstetrician-gynecologists, pediatricians, nurses, and midwives. A list of abbreviations is on page vii.

[1] Someone who is trained to assist the laboring parent and their family during childbirth and/or support the family postpartum.

1.2. My Perspective

Researching EPing came to me completely by surprise, given both the circumstances surrounding it and the incredibly circuitous route my life had taken up to that point. I do not think anyone—myself included—thought that an undergraduate and master's degree in law from the Universities of Cambridge and San Francisco respectively together with a Master of Library Science (interspersed with me opening and running a café and practicing law) would lead me to study EPing.

Given this unorthodox background, it is not surprising that my research is a result of my own experience. I had a beautiful baby girl in April 2016 and unfortunately, due to a variety of obstacles and little to no professional support, my baby and I were not able to establish a direct nursing relationship. I was devastated that we would never have the supposed "gold standard" of baby nutrition, bonding, and comfort, but was still determined to give her my milk any way I could. I knew vaguely how to express milk with a breast pump, but little clue how to do it as the sole means of extraction, despite having taken a BFing class, spoken at length about BFing with our doula, and done a great deal of research on the topic. After doing more online research, I discovered the term "exclusive pumping" at about 2 weeks postpartum. Through social media, specifically Facebook groups, I learned how to sustainably EP, received answers to specific questions, and felt understanding and support for my situation.

After an initial search for existing studies on EPing or EPers, I discovered that research about EPing in general is scant; research about the experiences of EPers specifically is even more sparse. Situating my research in the field of Information Studies has provided me with enough latitude to not only ask EPers about their IB, but also about their overall EPing "journey."

I am overwhelmed by the response to my research. Quickly amassing over 2,000 responses to the initial survey is an indication of how passionately EPers want their voices heard: the initial survey is long and has a fair amount of open-ended questions, yet people took their time (approximately 35 minutes on average, but often over an hour) to share their experiences at length. Consequently, I have a huge amount of qualitative data to analyze. However, it has been the support and messages I have received that have truly touched me and made me realize both the critical need for EPing research and that my research has already made a difference. Some respondents have shared with me that they experienced profound catharsis as they finally got to share their BFing/EPing/postpartum journey; others have expressed joy and gratitude that someone is finally taking EPing seriously, getting the word out there, and/or trying to create a world where those who come after them will not face as many challenges or negative reactions as they did.

While the process of PhD research is somewhat disengaged from the real world, the most important impact of my research will be anything that can make experiences of EPing more positive. Before ever embarking on formal research, I anecdotally discovered that a frightening number (read: vast majority) of EPers get no or bad advice from their healthcare providers, including but certainly not limited, to LCPs. This advice does not usually come out of ill intention, but simply ignorance: giving an EPer the same advice about pumping as a nursing parent is usually going to result in failure for the EPer. As EPing grows in popularity and as breast pumps sit on every new parent's side table and continue to offer more technologically advanced features, it is the responsibility of LCPs to provide correct information and appropriate support. One of my primary goals of this research is to discover and disseminate this correct information and provide a model of support that LCPs can employ with EPers.

Finally, I want to make sure that readers are not left with the wrong impression of what I am trying to achieve with my work. Just as no LCP should force someone to nurse (or BF in general) against their wishes, I do not believe that EPing should replace nursing for those who want to do so and are successful. In fact, I obtained my CLC qualification (and will have just taken the Advanced Lactation Consultant course and examination at the time of this proposal's defense) to help as many people be successful at nursing as possible. While there are some EPers who have or could have chosen to nurse successfully but felt that EPing was the right choice for them, there are far more EPers who tried to nurse and, for a variety of reasons (that shall be illuminated by my data), failed and resorted to the frustrating, challenging, but devoted path of EPing so they could still feed their child their milk. It is for all EPers that I do this research, but especially those that felt, as I did, the double letdown of nursing failure together with little to no competent professional support for or advice about the only alternative that can provide them a way to feed their own milk to their child.

1.3. Breastfeeding and Exclusive Pumping

HM is more than just calorific sustenance for infants: it contains a complex and ever-changing combination of proteins, fats, carbohydrates, amino acids, antibodies, white cells, and beneficial bacteria. The purported benefits of feeding HM are wide-ranging: one systematic review and meta-analysis found that it increases intelligence by about three IQ points and reduces infectious disease mortality rates, serious diarrhea and other gastrointestinal infections, dental malocclusions, ear infections, and allergic rhinitis (Victora et al., 2016). Other benefits of HM over formula include lower cost, "on tap" availability, and safety, since clean water and supplies are not required. Lactation also plays a preventative role for the lactating person with respect to postpartum depression, cardiovascular disease, breast cancer, ovarian cancer, and

diabetes (Victora et al., 2016). The benefits of HM to children, lactating people, and society, as well as some of the potential issues with formula, are set out in the literature review in Chapter 2.

The majority of gestating parents intend to BF upon the birth of their child, although many will stop BFing before the recommended minimum of 6 months (Bonyata, 2012; Victora et al., 2016). This intention is not only based upon the belief that HM itself is more beneficial than formula, but that nursing promotes bonding, comfort, and closeness. BFing is seen as central to a mothering role (Y. L. Hauck & Irurita, 2003) and when it is hard or impossible, parents feel guilt, a sense of failure, and shame (Dennis & McQueen, 2007; Mozingo, Davis, Droppleman, & Merideth, 2000) as well as inadequacy and isolation (Hegney, Fallon, & O'Brien, 2008).

Despite these negative consequences, the majority do not BF for as long as they initially desired (Victora et al., 2016). Factors affecting BFing initiation, exclusivity, duration, and cessation include physical problems with the lactating person or the child, psychological or emotional issues, lack of preparation or unrealistic expectations, perceptions about milk supply, the influence of and support by partners or family members, the circumstances surrounding the child's birth, the impact of the media, the marketing of formula, the culture within that society, and various demographic characteristics, such as socioeconomic status (SES), race, and ethnicity (Centers for Disease Control and Prevention (CDC), 2014; Victora et al., 2016). These factors are also examined in detail in Chapter 2.

EPing potentially provides a solution to some of these problems negatively affecting BFing initiation, exclusivity, duration, and cessation. EPers express HM through the use of a breast pump (usually electric; but sometimes with a manual pump or hand expression) rather than directly nursing their child at the breast. These parents may or may not supplement with formula: whether HM makes up 1% or 100% of that child's milk intake, if that milk is only

expressed then that parent is an EPer and considered to be BFing.

Literature on EPing is scant but what does exist will be explored in the literature review. There is, however, a glaring gap concerning the lived experiences of EPers. Opinion pieces and advice are slowly appearing online (e.g., Glenn, 2018; Poovey, 2016; Singh, 2017), but there appears to be little data on who EPers are, why they EP, how long they pump for, and their IB and support needs. Given the potential for EPing to solve many problems that lactating people have (or perceive they have), there is a critical need to conduct empirical research to collect accurate data actionable upon by breast pump and accessory manufacturers, LCPs, and, above all, EPers themselves.

1.4. Theoretical Framework

Based on the work of Bronfenbrenner (1977; 1979; 1986), McLeroy, Bibeau, Steckler, and Glanz (1988), and Williamson (1998), my research is situated within an ecological perspective. Through this lens, an individual is seen as the center of multiple layers of interdependent environments—*systems*—that reciprocally interact with and influence one another. In his ecological systems theory, originally developed within the human development field, Bronfenbrenner (1977, 1986) set out five systems within which an individual exists and develops: *microsystem*, *mesosystem*, *exosystem*, *macrosystem*, and *chronosystem*. Bronfenbrenner (emphases original) defines these as follows:

1. "A *microsystem* is the complex of relations between the developing person and environment in an immediate setting containing that person (e.g., home, school, workplace, etc.)" (Bronfenbrenner, 1977, p. 514).
2. "A *mesosystem* comprises the interrelations among major settings containing the developing person at a particular point in his or her life. … A mesosystem is a system

of microsystems" (Bronfenbrenner, 1977, p. 515).

3. "An *exosystem* is an extension of the mesosystem embracing other specific social structures, both formal and informal, that do not themselves contain the developing person but impinge upon or encompass the immediate settings in which that person is found, and thereby influence, delimit, or even determine what goes on there. … They encompass, among other structures, the world of work, the neighborhood, the mass media, agencies of government (local, state, and national), the distribution of goods and services, communication and transportation facilities, and informal social networks" (Bronfenbrenner, 1977, p. 515).
4. "A *macrosystem* refers to the overarching institutional patterns of the culture or subculture, such as the economic, social, educational, legal, and political systems, of which micro-, meso-, and exosystems are the concrete manifestations" (Bronfenbrenner, 1977, p. 515).
5. A *chronosystem* accounts for "changes over time not only within the person but also in the environment and … the dynamic relation between these two processes" (Bronfenbrenner, 1986, p. 724).

Bronfenbrenner's theory is represented in Figure 1.

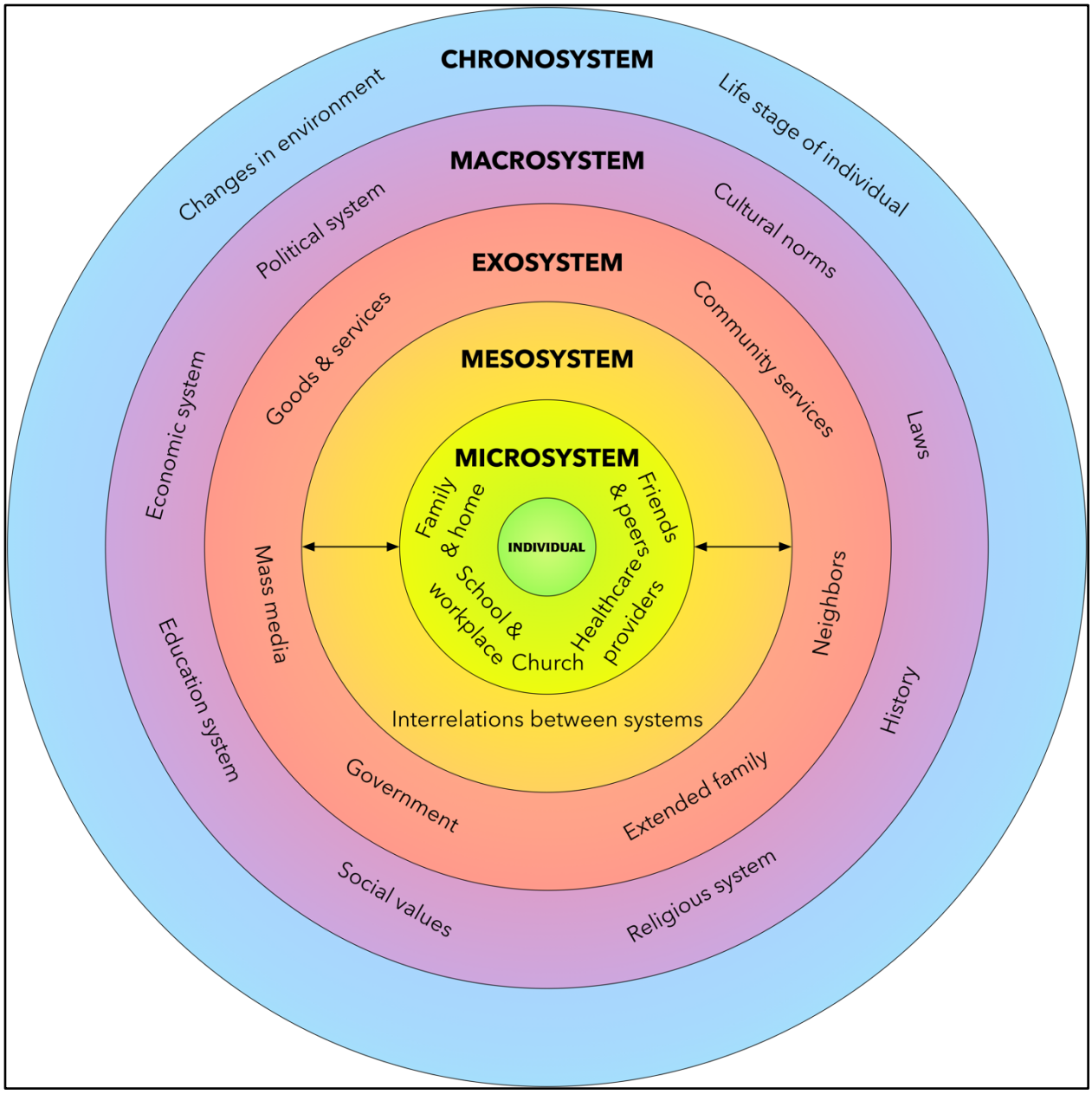

Figure 1. Bronfenbrenner's (1977, 1986) Ecological Systems Theory.

Recognizing that health behaviors (including breastfeeding) are heavily influenced by an individual's environment, McLeroy et al. (1988) expanded Bronfenbrenner's theory to the health promotion and disease prevention field. In their model, five factors determine individual behavior:

1. Intrapersonal factors – characteristics of the individual, such as knowledge, attitudes, behavior, self-concept, skills, etc. This includes the developmental history of the individual.
2. Interpersonal processes and primary groups – formal and informal social network and social support systems, including the family, work group, and friendship networks.
3. Institutional factors – social institutions with organizational characteristics, and formal (and informal) rules and regulations for operation.
4. Community factors – relationships among organizations, institutions, and informal networks within defined boundaries.
5. Public policy – local, state, and national laws and policies.
(McLeroy et al., 1988, p. 355)

These five factors can be mapped to Bronfenbrenner's (1977, 1986) systems: intrapersonal factors (1) are at very center of Bronfenbrenner's model; the primary groups in (2) constitute the microsystem, whereas the interpersonal processes can be likened to the mesosystem; institutional factors (3) are represented by the exosystem; and community factors (4) and public policy (5) are both part of Bronfenbrenner's macrosystem.

In the field of information studies, Williamson (1998) developed an ecological model of information use from her research of IB of older individuals (aged 60 and over). She found that particular variables, such as personal characteristics, socio-economic circumstances, values, lifestyles, and physical environments, have an influence on information seeking, acquisition, and use. As in Bronfenbrenner (1977, 1986) and McLeroy et al.'s (1988) frameworks, Williamson identified "layers" of influence ranging from intimate personal networks and wider personal networks to mass media and institutional sources. Williamson's continued application of her ecological model to different populations (e.g., Williamson & Manaszewicz, 2002 (breast cancer patients); Williamson, Schauder, & Bow, 2000 (the blind)) has demonstrated that an ecological model has the "flexibility to include all influences on behavior at any stage of the information-seeking or information-acquisition process" (Williamson, 2005, p. 131).

Combining these ecological approaches provides the theoretical framework for my

research on EPing and EPers. The general structure of Bronfenbrenner's (1977, 1986) theory has been retained, with the exception of splitting the macrosystem into two layers, the *inner macrosystem* ("community & culture," which contains social values, social history, and cultural and religious norms) and the *outer macrosystem* ("policy & law," which contains public policy, laws, and the prevailing economic, political, and healthcare systems). Additionally, McLeroy et al.'s (1988) second of five determining factors (interpersonal processes and primary groups) has been split and assigned to the microsystem ("primary groups") and the mesosystem ("interpersonal processes"). Using the framework set out in Figure 2, Chapter 3 will explore specific theories falling within each system.

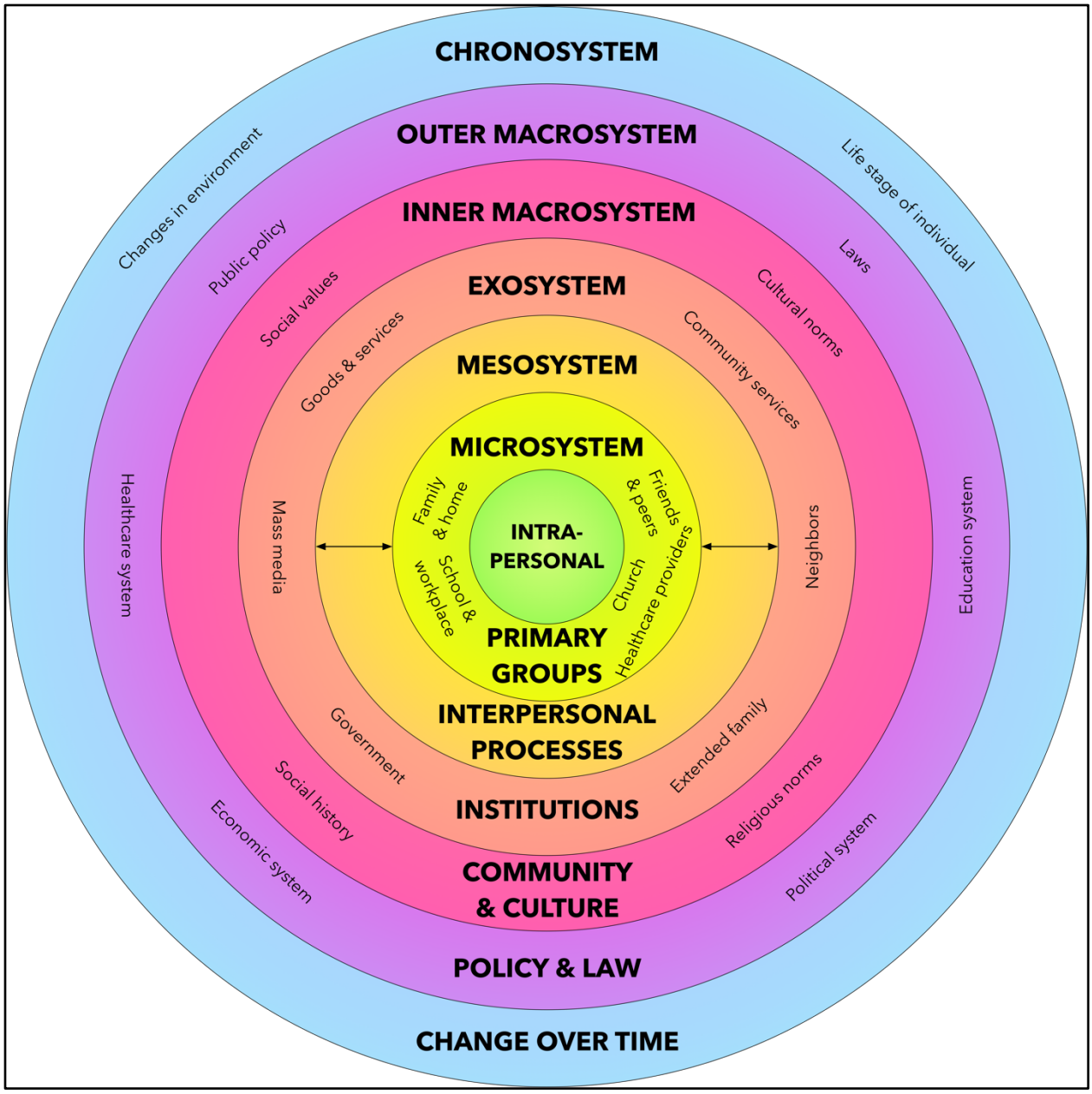

Figure 2. Theoretical framework: Ecological perspective on exclusive pumping.

1.5. Research Questions

The overarching goal of my research is to understand the ecosystem of EPing: the factors that EPers interact with as well as the factors that influence them. To further this goal and the understanding of this topic, my RQs are as follows:

1. Why do EPers exclusively pump?
2. When and from where do EPers first hear about EPing?
3. What are the information and support needs of EPers?
4. Where do EPers get their information and support about breastfeeding and EPing from and how useful are those sources?
5. Does IB and support relate to how EPers feel about EPing and their level of success?
6. Does the experience of EPing change over time?

To answer these RQs, an initial cross-sectional, self-report survey with open- and closed-ended questions was developed. A follow-up survey was subsequently sent out at regular intervals to respondents still actively EPing. This design was chosen so diverse types of data, including longitudinal, could be collected and respondents could conveniently respond in their own time without having to disclose potentially sensitive information face-to-face. Quantitative data will be analyzed to produce descriptive and inferential statistics; qualitative data will be coded to identify trends and common themes.

1.6. Significance of This Research

There is very little existing research solely focused on EPers, yet those BFing without nursing account for a growing proportion of lactating people. Despite this increase and the importance of maximizing BFing rates, data from this study will show that correct information about and support for EPing is sorely lacking. By focusing on IB, my research will identify the knowledge gaps of both lactating people and LCPs, as well as strategies to fill these gaps. The identification of these strategies is vital to creating evidence-based change to both BFing policy and practice; change that will increase the incidence and duration of BFing and therefore promote child and parental wellbeing, as well as improve the lived experiences of EPers and the

practice of EPing more generally.

Having briefly introduced the topic above, Chapter 2 examines various aspects of breastfeeding in detail, setting out existing literature about the benefits of HM, the factors affecting BFing, HM expression, and formula. Chapter 3 lays out the theoretical framework in more detail, examines what is meant by IB, particularly on the topics of health, parenting, and infant feeding, and explores the topic of support and social networks. Chapter 4—Methodology—describes the study design, how data were collected, and how they will be analyzed. This proposal concludes in Chapter 5 by reviewing the limitations of this research and summarizing future work to be completed.

Chapter 2. Breastfeeding

Human milk (HM), unlike formula, is a live, dynamic substance that differs between individuals and, within individuals, changes over the course of the day and over the course of lactation in response to various environmental changes and cues (Butte, Garza, & Smith, 1988; Karatas, Durmus Aydogdu, Dinleyici, Colak, & Dogruel, 2011). It contains all the macro- and micronutrients a child needs, as well as bioactive components, such as hormones, immune factors and cells, cell-signaling molecules, and pre- and probiotics, all of which "aid in infant digestion, absorption, gastrointestinal functions, growth, immune development, and host defenses, and neurodevelopment" (Young, 2017, p. 26). The composition of HM is also affected by the breastfeeder's (BFer) obesity status, diet, and genetics (Young, 2017).

Few studies to date have distinguished between nursing and bottle-feeding HM: they often use the generic term "breastfeeding" without defining its precise meaning. Therefore, it is impossible to discern whether results of a particular study are derived from the properties of HM or process of lactation, or whether nursing at the breast is required. This has the knock-on effect that is it often impossible to confidently conclude that exclusively pumping (EPing) produces results comparable to nursing. The following literature review clearly highlights those studies where a distinction between consuming/producing HM and nursing has been made; if not stated, the reader is to assume that no distinction was made.

Furthermore, when studies find that there are benefits to breastfeeding (BFing)—higher IQ or lower risk of obesity, for example—there is the implicit assumption that the BF sample is being compared to an exclusively FF (exclusively FF) sample. It will be clearly noted if a study distinguished between exclusive BFing, some BFing, exclusive FFing, and/or mixed feeding methods.

This chapter first examines the benefits of BFing to the BF child, to the BFer, and to society as a whole. Next, the factors affecting whether BFing is initiated and, if so, its duration, exclusivity, and cessation are discussed. The prevalence of, reasons behind, and experiences of HM expression are considered. A discussion of the pros and cons of infant formula and bottle feeding and a brief summary ends the chapter.

2.1. Benefits to the Breastfed Child

Victora's (2016) systematic review/meta-analysis (SR/MA) found that there was conclusive evidence that BFing increases intelligence by about three IQ points and reduces infectious disease mortality rates, serious diarrhea and other gastrointestinal infections, dental malocclusions (imperfect teeth positioning), and ear infections (acute otitis media). However, to leave the discussion of HM benefits here would be a drastic oversimplification: children who are fed HM have a lower infant death risk, improved outcomes if preterm or low birth weight (LBW), an improved microbiome, lifelong protection against certain diseases and ailments, improved developmental outcomes, the benefit of environmentally-responsive food, and superior eating habits.

2.1.1. Lower Infant Death Risk

BFing protects against all forms of infant mortality, predominantly in the first 5 months of life, but protection continues through to 23 months of life (World Health Organisation (WHO), 2000). Sankar et al.'s (2015) SR/MA found that, compared to exclusively BF 0–5 month olds, predominantly BF infants were 1.5 times more likely to die, partially BF 4.8 times more likely, and non-BF 14.4 times more likely. In children 6–11 months old and 12–23 months old, those who were not BF had, respectively, a 1.8- and 2.0-fold higher risk of mortality (Sankar et al., 2015). Many infant deaths are due to gastrointestinal infections and respiratory tract

infections (discussed below): one SR/MA found that non-BF infants between 0–5 months were 10.5 times more likely to die from diarrhea than their exclusively BF counterparts (Lamberti, Fischer Walker, Noiman, Victora, & Black, 2011); another found that risk of pneumonia mortality was 15.0 times higher in non-BF 0–5 month olds than exclusively BF infants of the same age (Lamberti et al., 2013).

It is important to note that many BFing/infant mortality studies are conducted in developing countries; however, Ip et al.'s (2007) report finds that BFing is also protective against infant mortality in developed countries. Of particular note is a 36% reduced risk of Sudden Infant Death Syndrome (SIDS) for those infants receiving any BFing (Ip et al., 2007). A more recent meta-analysis concluded that exclusive BFing was associated with a 73% reduced risk of SIDS (F. R. Hauck, Thompson, Tanabe, Moon, & Vennemann, 2011). One possible explanation for this risk reduction may be attributed to the increased arousability (that is, how easy they are to wake) of BF infants (Horne, Parslow, Ferens, Watts, & Adamson, 2004).

A number of studies have found that the timing of a newborn's first BFing also plays a part in reducing infant mortality. In their SR/MA, Khan, Vessel, Bahl, and Martines (2014) found that newborns who started to BF only after the first hour of life had twice (2.02) the risk of dying in their first month than those who BF within an hour of being born. Boccolini, de Carvalho, de Oliviera, and Pérez-Escamilla's (2013) analysis of secondary data from 67 countries also found that BFing within the first hour of life was negatively correlated with newborn mortality; this correlation was stronger in countries with more than 29 newborn deaths per 1000 births.

2.1.2. Improved Outcomes for Preterm and Low Birth Weight Infants

Preterm infants (born before 37 weeks gestation) are particularly susceptible to infections

and developmental issues due to their underdeveloped physical and immunological systems. LBW newborns, weighing less than 2,499g (5.5lbs) when born regardless of gestational age (WHO, 2018b), are often susceptible to the same ailments as preterm infants.

Encouraging parents to nurse their preterm or LBW infant while in the Neonatal Intensive Care Unit (NICU) results in longer duration of BFing (Briere, McGrath, Cong, Brownell, & Cusson, 2015). However, Furman and Minich (2004) found that very LBW infants (<1,500g/3.3bs) took in a smaller amount of milk, fed less efficiently, and spent less time sucking when nursing compared to bottle feeding. The especially important need for these infants to receive adequate nutrition—often fortified to contain more calories than regular HM—contraindicates nursing if even possible, therefore resulting in many parents of preterm and LBW infants resorting to EPing.

Milk choice also has a role to play in the neurocognitive development of preterm infants. Amin, Merle, Orlando, Dalzell, and Guillet (2000) found that the brainstem of preterm infants born between 28–32 weeks fed HM matured more rapidly than those formula fed (FF). The authors noted that this may be clinically important to other potential problems, such as apnea and SIDS (Amin et al., 2000, p. 321). Furthermore, Vohr et al. (2006) found that there is the potential for an increase of 0.53 points on the Bayley Mental Development Index (point scale akin to IQ) for every 10 milliliters per kilogram per day increase in HM given to infants born at an extremely LBW (<1,000g/2.2lbs).

A serious condition primarily affecting preterm and LBW infants, necrotizing enterocolitis (NEC) is an intestinal disease often resulting in bacterial invasion of the intestine wall. It carries a very high risk of severe morbidity and mortality (Young, 2017). Numerous studies, as analyzed by Ip et al. (2007) and Victora et al. (2016), have consistently found that

HM, whether from a lactating parent or donor milk, prevents both incidence of and mortality from NEC. The impact of an exclusive HM diet can be drastic: for example, Hair et al. (2016) found, of their very LBW infants (here, <1,250g/2.8lbs), 6.9% contracted NEC if fed HM exclusively, compared to 16.9% if FF and/or given HM with cow milk-based fortifier. Mortality was 13.6% in the exclusive HM group versus 17.2% in the non-exclusive HM group (Hair et al., 2016). Another study found that newborns receiving *any* formula during their first 2 weeks of life had a 3.5 times greater risk of developing NEC (T. J. Johnson, Patel, Bigger, Engstrom, & Meier, 2015).

Johnson et al. (2015) found that NEC is associated with $43,818 additional NICU hospitalization cost per infant (calculated in 2012), but each additional milliliter of donor HM per kilogram per day resulted in a reduction of $534. Given donor milk has been estimated to cost 10.1–16.9¢ per milliliter, or $3–5 per U.S. fluid ounce (Bar-Yam, 2013), Johnson et al. (2015) concluded that feeding HM exclusively is one strategy to save the costs associated with NEC. Patel et al. (2013) also found that NICU costs were the lowest when HM intake was highest. They further found that for every 10 milliliters per kilogram per day increase in HM given, the odds of a very LBW infant contracting sepsis decreased by 19% (A. L. Patel et al., 2013).

2.1.3. Fewer Gastrointestinal Infections and Improved Microbiome

Otherwise healthy, full-term infants are also at lower risk for gastrointestinal infections and diarrhea as a result of being BF (Lamberti et al., 2011). Using data from 23 studies, Horta and Victora (2013b) found that risk of diarrhea morbidity was 63% less in BF infants under 6 months; risk of hospitalization was reduced by 72% if a BF infant under 6 months did suffer from diarrhea. This protection is universal across developed and developing countries (Ip et al.,

2007). Boone, Geraghty, and Keim's (2016) recent study found that there was a 30% lower risk of diarrhea if an infant was fed HM for 6 months compared to formula, whether that HM was directly from the breast or expressed and bottle fed.

One potential explanation for this reduction, the microbiome, is an area of growing research. The term "microbiome" is defined as "the collective genomes of the microbes (composed of bacteria, bacteriophage, fungi, protozoa and viruses) that live inside and on the human body" (J. Yang, 2012). While some of these are microbes can be harmful, we rely on these microbes to "digest food to generate nutrients for host cells, synthesize vitamins, metabolize drugs, detoxify carcinogens, stimulate renewal of cells in the gut lining and activate and support the immune system" (J. Yang, 2012). As Young (2017) noted, it is becoming "increasingly clear that development of the infant microbiome plays a critical role in shaping future health outcomes and risks" (p. 36).

As far back as 1977, Bullen, Tearle, and Stewart (1977) discovered that the fecal flora of infants in the first 6 weeks of life was dramatically affected by whether they were BF or FF, finding fewer beneficial bacteria and more harmful bacteria in the feces of FF infants; findings that have being replicated and expanded upon more recently (e.g., Azad et al., 2013; Bäckhed et al., 2015). We now know that the prebiotics (the HM oligosaccharides that feed beneficial bacteria) and probiotic bacteria in HM is partially responsible for this finding (Bode et al., 2014; Collado, Delgado, Maldonado, & Rodriguez, 2009; LaTuga, Stuebe, & Seed, 2014; Ward, Hosid, Ioshikhes, & Altosaar, 2013).

Other elements of BFing also contribute to development of a child's microbiome. HM contains antibodies that prevent over-colonization of harmful gut bacteria (Rogier et al., 2014) and hormones (namely, insulin and leptin) that promote "beneficial microbial metabolic

pathways predicted to increase intestinal barrier function and reduce intestinal inflammation" (Lemas et al., 2016, p. 1291). In addition, microbes from the BFer's nipple and areola are transferred to the recipient (Young, 2017). BFing can mitigate some of the negative effects on an infant's microbiome caused by cesarean section (C-section) delivery and/or antibiotics administered during labor (Azad et al., 2016; Bäckhed et al., 2015; Madan et al., 2016).

2.1.4. Protection Against Diseases and Ailments

The microbiome that develops as a result of being BF may play a part in reducing the risk of contracting a wide variety of diseases and ailments in both the short and long term, given the "role it plays in normal immune development, sensitization, and prevention of immune-mediated diseases … intestinal health, development and maturation … and both direct and indirect protection against pathogen infection and inflammation" (Young, 2017, pp. 36-37; see also, Chichlowski, De Lartigue, German, Raybould, & Mills, 2012; Newburg & Walker, 2007; Putignani, Del Chierico, Petrucca, Vernocchi, & Dallapiccola, 2014; Sanz, Olivares, Moya-Pérez, & Agostoni, 2014; P. M. Smith et al., 2013; Tamburini, Shen, Wu, & Clemente, 2016; W. A. Walker & Shuba Iyengar, 2014; Weng, Walker, & Sanderson, 2007).

In the short term, exclusively BF infants under 6 months old have a 63% lower risk of upper respiratory tract infections and between a 72–77% lower risk of lower respiratory tract infections (American Academy of Pediatrics (AAP), 2012); Duijts et al. (2010) found that protection against lower respiratory tract infections continued until 1 year of age. BFing also reduces the need for hospitalization and risk of death if an infant does contract a respiratory infection (Horta & Victora, 2013b). Biesbroek et al. (2014) suggested that fewer RTIs in infants under 6 months could be due to differences in the nasopharyngeal microbiome between BF and FF infants.

BFing has long been associated with reducing the risk of ear infections by 30–40% for the first 2 years of life (Bowatte et al., 2015), especially in high-income countries (Ip et al., 2007). While Bowatte et al. (2015) attribute this to the composition of HM, it has long been recognized that feeding a supine child, something easily done with a bottle, creates the chance that milk could flow into the Eustachian tubes (Beauregard, 1971). Furthermore, the negative pressure caused by some infant feeding bottles can transfer to the middle ear, perhaps precipitating ear infections (C. E. Brown & Magnuson, 2000). Boone et al.'s (2016) study found that infants fed no formula in the first 6 months of life had a 14% higher chance of ear infections if fed expressed milk for 1 month, and a 115% higher chance if fed expressed milk for all 6 months, indicating that feeding mechanism, not the substance, underlies the increased risk of ear infections in non-nursed infants.

There is mixed evidence regarding BFing and allergies, asthma, and eczema. While Ip et al. (2007) found BFing did reduce the risk of childhood asthma and eczema, evidence from more robust studies (e.g., Kramer et al., 2007b) and more recent meta-analyses (e.g., Kramer & Kakuma, 2012; Lodge et al., 2015) found no or only weak evidence to support this connection. Given this, Victora et al. (2016) concluded that BFing offered no protective effect against asthma and eczema and only a weak protective effect against allergic rhinitis.

The evidence that BFing protects against oral malocclusion (imperfect teeth positioning) and dental caries (tooth decay or cavities) is also mixed. In their review, Salone, Vann, and Dee (2013) found strong evidence that BFing—nursing specifically—was protective against malocclusion; Peres, Cascaes, Nascimento, and Victora (2015) found that BF children had a 68% lower risk of developing a malocclusion. Bottle-fed infants use a different sucking mechanism, predisposing them to malocclusion (Salone et al., 2013). BFing protects against dental caries in

the first year of life (Avila, Pordeus, Paiva, & Martins, 2015; Tham et al., 2015), but this protection disappears after 12 months (Tham et al., 2015). In fact, BF children over 12 months old had an increased risk of caries, especially if fed nocturnally or more frequently compared with their non-BFing counterparts (Tham et al., 2015). Tham et al. (2015) noted that more research was needed to explore the connections between dental caries and diet (especially sweet drinks and foods), specific BFing practices, and oral hygiene in early childhood.

While diet and exercise are the primary determinants of obesity, the relationship between BFing and obesity throughout life has been the subject of much research. Other contributing factors, such as genetics, environment, and diet, make it difficult to precisely calculate the improvement in obesity rates attributable to BFing; nevertheless, earlier SR/MAs estimated a reduction of 15–30% in adolescent and adult obesity (Ip et al., 2007; Owen, 2005). This reduction has been observed across a wide range of study conditions and countries (Hancox et al., 2014; Yan, Liu, Zhu, Huang, & Wang, 2014). However, data analyzed in these SR/MAs was from observational studies and have not been supported by the large, randomized Promotion of Breastfeeding Intervention Trial (PROBIT) where no difference between BF and FF children in terms of obesity was observed at either 6.5, 11.5, or 16 years old (Kramer et al., 2007a; Kramer, Matush, et al., 2008b; R. M. Martin et al., 2017; 2013).

Nevertheless, more recent SR/MAs have continued to find reductions in obesity as a result of BFing. For example, Horta and Victora's (2013a) systematic review found an overall reduction of 24% attributable to BFing; however, this reduction fell to 12% when considering only high-quality studies. This result was replicated in Horta, Loret de Mola, and Victora's (2015b) SR/MA, despite the intervening publication of Colen and Ramey's (2014) study that showed no increase in obesity rate or body mass index (BMI) of FF individuals when comparing

them to their BF siblings.

Unfortunately, a confounding issue with obesity studies is the lack of distinction between nursing and bottle-feeding HM. It has long been known that nursed children self-regulate their intake at the breast (e.g., Dewey & Lönnerdal, 1986). Li and various colleagues have conducted several analyses in this area. In one, as the number of nursing feeds grew (thereby reducing the number of bottle feeds), the risk of excess weight in late infancy was reduced (R. Li, Fein, & Grummer-Strawn, 2008a). Another found that bottle-fed infants were more likely to empty a bottle or cup in later infancy (R. Li, Fein, & Grummer-Strawn, 2010), with bottle emptying being associated with more rapid weight gain later on in the first year of life (R. Li, Magadia, Fein, & Grummer-Strawn, 2012). Lastly, mothers who had encouraged bottle emptying in infancy were more likely to pressure their 6-year-old child to eat and finish all the food on their plate, both of which are associated with unhealthy childhood weight gain and less healthful eating behaviors (R. Li, Scanlon, May, Rose, & Birch, 2014). Li et al. (2012) theorized that, since the mechanisms behind less childhood obesity in BF children are not fully known, self-regulation of intake might play a role in this phenomenon. However, Bartok's (2013) study comparing nursed and HM bottle-fed infants found no significant difference in growth or body composition in the first 12 months of life. Nevertheless, bottle emptying is a preventable problem: "paced" feeding, whereby bottle-fed children are fed more slowly and determine their own intake (Lyford, 2004), mimics nursing and encourages the child to control their own milk intake and learn self-regulation.

Regardless of feeding method, BFing is also protective against both type 1 (T1D) and type 2 diabetes (T2D). Both Ip et al. (2007) and Rosenbauer, Herzig, and Giani (2008) found a decreased risk of T1D in BF individuals, with the latter study discovering that risk decreased

further the longer the duration of BFing and the later a bottle was introduced. However, as Young (2017) is careful to point out, grouping all FF individuals in one group can be hazardous, given that "certain formulations of infant formula (e.g., hydrolysate protein formulations) notably impact risk of developing T1D in at-risk infants" (Young, 2017, p. 40). Various SR/MAs have found associations between being breastfed and having a lower risk of T2D (Horta & Victora, 2013a; Horta, Loret de Mola, & Victora, 2015b; Ip et al., 2007; Owen, 2005), with the most recent finding the level of risk reduction to be 35% (Horta, Loret de Mola, & Victora, 2015b). While the exact mechanism of prevention is not known for either type, it has been suggested that the "anti-inflammatory components of HM, combined with lack of exposure to immune-stimulating components of bovine milk protein prevent the autoimmune response that leads to T1D" (Young, 2017, p. 40) (AAP, 2012; see also, Das, 2007). With regards to T2D, the protective effect is thought to be related to BFing's protection against obesity and increased association with feeding self-regulation (AAP, 2012; Young, 2017).

A significant reduction in the rate of childhood leukemia is seen in those who were BF: those BF for 6 months or longer have a 20% reduced risk of acute lymphocytic leukemia and a 15% risk reduction of acute myeloid leukemia (Amitay & Keinan-Boker, 2015; Barclay et al., 2009). Those BF for less than 6 months are still afforded some risk reduction (around 10%) (Barclay et al., 2009; Rudant et al., 2010). BFing is also protective against celiac disease, provided gluten was introduced when a child was consuming only HM and not formula or other cow milk products (Akobeng, 2005), and childhood inflammatory bowel disease (Barclay et al., 2009). The negative effects on the fetus of smoking during pregnancy can also be mitigated by BFing (Batstra, 2003); in addition, HM is still preferable to formula if the BFer continues to smoke while BFing (Dorea, 2007; Napierala, Mazela, Merritt, & Florek, 2016).

Lastly, and perhaps the most fascinating long-term physical health benefit of being BF is a reduction in first-year rejection episodes following a kidney transplant, where the recipient had been BF by, and received a kidney from, their own biological mother (Campbell et al., 1984; Kois, Campbell, Lorber, Sweeton, & Dafoe, 1984). Furthermore, kidney transplants between genetic siblings where there is not a perfect antigen match are more successful when the imperfect donor antigens are inherited from the mother, not father (Burlingham et al., 1998). These improved outcomes have been observed in bone marrow transplantation (van Rood et al., 2002) and transplantation of cells created from a sibling's umbilical cord blood (J. E. Wagner, 1997). Burlingham et al. (1998) attributed this to "immunologic priming" caused by early exposure to maternal antigens during pregnancy and BFing.

2.1.5. Improved Developmental and Cognitive Outcomes

Just as for preterm and LBW infants, BFing produces improved neurocognitive outcomes, even when controlling for confounding factors such as parental intelligence, education, and socioeconomic status (SES). However, several papers caution against relying on studies showing long-term BFing benefits to those presently middle- and older-aged, given the often poor quality and nutritionally-deficient formula in existence when they were infants (R. M. Martin, Goodall, Gunnell, & Davey Smith, 2007; Richards, Hardy, & Wadsworth, 2006). Martin et al.'s (2007) and Richards et al.'s (2006) birth cohort studies of individuals born in 1937–39 and 1946 respectively found that BFing benefits such as social mobility, educational attainment, and reading ability lasted even into participants' 50s and 60s; however, non-HM options in the 1930s and 1940s were severely inadequate (Wolf, 2003).

Several studies have cast doubt on a relationship between BFing and improved neurocognitive outcomes. For example, Gibbs and Forste (2014) found that, while there is a

positive relationship between BFing for 3 months or more and child reading skills, the relationship was due to "cognitively supportive parenting behaviors and greater levels of education among women who predominantly breastfed" (p. 487). Colen and Ramey (2014) found no statistically significant difference between BF and FF siblings in 10 of 11 outcomes (no difference in: BMI, obesity, asthma, hyperactivity, parental attachment, reading comprehension, vocabulary recognition, math ability, memory-based intelligence, and scholastic competence). HM-fed siblings were slightly more behaviorally compliant, but even this result is weak at $p < 0.10$. In addition, Cesur, Sabia, Kelly, and Yang (2016) found no significant difference in the wages of young adults based on whether they were BF or FF.

Despite these findings and a need to exercise caution when interpreting older findings, studies have continued to find a relationship between BFing and improved neurocognitive outcomes. As early as 12 months old, BF infants demonstrated an increased cognitive development over FF infants (Andres et al., 2012). The PROBIT study found that, by age 6.5 years, those in the BFing intervention group (and therefore many times more likely to have been exclusively BF) had, on average, IQ scores of 5.9 points higher and significantly higher academic ratings provided by their teachers than children in the control group whose parents had not received any intervention (Kramer et al., 2008a). At 30 years old, Victora et al. (Victora et al., 2015) found that breastfed individuals had higher IQ scores, educational attainment, and income; IQ and educational attainment increased as duration and exclusivity of BFing increased. They calculated that higher IQ accounted for 72% of the effect on income (Victora et al., 2015). Sacker, Kelly, Iacovou, Cable, and Bartley (2013) found that upward social mobility, measured by whether children get a better job than their parents, was positively associated with being BF. They attributed this to improved neurological development and lower stress.

In bringing these and other studies together in their SR/MA, Horta, Loret de Mola, and Victora (2015a) found that BF individuals had, on average, a 3.4-point higher IQ. Controlling for maternal IQ lowered this difference to 2.6 points. As in the studies above, they noted that long-term follow-up studies suggest BFing impacts school and income (Horta, Loret de Mola, & Victora, 2015a). They surmise that the composition of HM, especially long-chain polyunsaturated fatty acids, such as arachidonic acid (more commonly known as AHA) and docosahexaenoic acid (DHA), and increased maternal bonding contribute to this increase (Horta, Loret de Mola, & Victora, 2015a).

2.1.6. Short-term Responsiveness to Environment, Age, and Gender

In addition to an improvement in disease, developmental, and neurocognitive outcomes, BFing provides other benefits thanks to the ability of HM to constantly change its composition. For example, the fat, lactose, and protein content of HM changes over a 24-hour period, but also over the course of lactation (Mitoulas et al., 2007). Whereas a FF child will need an increasing volume of formula until solid food starts to contribute to calorie intake (around 6 months of age) (Bonyata, 2018a), exclusively BF infants between 1–6 months old tend to consume a stable volume of milk (Bonyata, 2018b), reflecting the change in HM that occurs over the course of lactation. The HM produced by a gestational BFer for their preterm infant significantly differs from HM produced for term infants (Bauer & Gerss, 2011; Faerk, Skafte, Petersen, Peitersen, & Michaelsen, 2001; Molinari, Casadio, Hartmann, Arthur, & Hartmann, 2012).

There is some indication that HM composition changes dependent on infant characteristics. Hahn, Song, Song, and Sang (2017) found that females and taller birth height infants received higher calorie milk. In contrast, Powe, Knott, and Conklin-Brittain (2010) found HM, produced by 25 healthy, well-nourished Massachusetts mothers, had 25% more energy if

feeding male infants. However, Quinn (2013) found no sex-based differences in HM composition in her sample of 103 Filipino mothers. Fujita et al.'s (2012) study found that the relationship was more complicated than mere infant sex: economically sufficient mothers produced fattier milk for sons, whereas poor mothers produced fattier for daughters. While the specific findings of these studies conflict, it does show that the composition of HM differs based on factors such as SES and infant sex and height.

Another benefit of BFing is that of pain relief. Newborns are subject to vaccinations and a heel prick to obtain a blood sample within the first days of life. Studies show that skin-to-skin contact (Cong et al., 2012; Johnston et al., 2017), suckling (Corbo et al., 2000; T. Field & Goldson, 1984), or feeding a sweet liquid (e.g., sucrose solution, HM, formula) (Bueno et al., 2013; Stevens, Yamada, Ohlsson, Haliburton, & Shorkey, 2016) during these painful procedures reduce pain responses in newborns. However, a combination of these three interventions has been found to reduce pain responses the most (Gormally et al., 2001; Marín Gabriel et al., 2013), sometimes by as much as 91% (Gray, Miller, Philipp, & Blass, 2002). Holsti, Oberlander, and Brant (Holsti, Oberlander, & Brant, 2011), in their preterm infant sample, did not find an overall improvement in pain indicators as a result of nursing, but noted that infants with a more mature sucking pattern (i.e., they had "learned" how to BF) had lower behavioral indicators of pain. Nishitani et al. (2009) found that merely the odor of an infant's own mother's milk produced an improvement in both behavioral and biochemical (i.e., cortisol) indicators of pain. Therefore, although no studies appear to exist demonstrating this, it is plausible that skin-to-skin combined with bottle feeding HM might produce the greatest analgesic effect, especially in the absence of a reliable and effective nursing relationship.

2.1.7. Superior Eating Habits

The ability for HM to change with the environment, tasting different depending on the diet of the lactating person, is one explanation for BF children having greater flavor perception and greater acceptance of new types of food. Individuals are first subjected to flavor in utero (Mennella, Jagnow, & Beauchamp, 2001; Mennella, Johnson, & Beauchamp, 1995; Schaal, 2000), which converts into a preference for HM with similar flavors after birth (Hepper, 1988; Schaal, 2000) and upon introduction of solid food (Mennella et al., 2001). Infants who consume HM from someone who regularly eats fruits and vegetables are more likely to accept those same fruits and vegetables (Forestell & Mennella, 2007). At 1 year of age, BF children displayed less negative mealtime behaviors and less mealtime conflict; mothers of these children showed lower maternal control over child feeding and increased sensitivity (i.e., the child was under less pressure to eat) (Farrow & Blissett, 2006). By 2–3 years old, BF children pick a wider variety of food than their FF counterparts (Nicklaus, Chabanet, Boggio, & Issanchou, 2005). In later childhood, BFing reduced the likelihood of picky eating (Galloway, Lee, & Birch, 2003) and abnormal eating attitudes and behaviors (Skugarevsky et al., 2014).

2.2. Benefits of Lactating

BFing also benefits the BFer in both the short and long term. Immediately following birth, nursing aids in preventing postpartum blood loss and more rapid involution (shrinking) of the uterus (AAP, 2012). In the short term, BFing causes amenorrhea (lack of menstrual cycle), aiding in spacing out births which, in turn, improves child survival rates (Kozuki & Walker, 2013). Becker, Rutstein, and Labbok (2003) found that there would be as many as 50% more births if countries with high rates of BFing (in their analysis, Burkina Faso and Uganda) ceased BFing entirely. Other benefits of lactating, examined below, include a potential reduction in

postpartum depression (PPD), equal or better sleep, and a positive impact on weight, T2D, cardiovascular disease and cancer.

2.2.1. Reduced Postpartum Depression

PPD is known to play a role in both duration and cessation of BFing (see below). However, a number of studies have found that BFing can reduce the incidence of PPD. For example, in Figueiredo, Canário, and Field's (2013) study, those who could maintain Exclusive BFing until 3 months postpartum had a significant decrease in depression scores (as measured by the Edinburgh Postpartum Depression Scale). Groër (2005) found that BFing was protective against negative moods and perception of stress. When a nursing parent is depressed, BFing protects the infant from being affected by that depression (Jones, McFall, & Diego, 2004). Those who disliked BFing or had severe BFing pain in the first week were more likely to be depressed at 2 months postpartum (Watkins, Meltzer-Brody, Zolnoun, & Stuebe, 2011). However, it is worth nothing that Dennis and McQueen (Dennis & McQueen, 2007) did not find that BFing was protective against lower Edinburgh Postpartum Depression Scale scores, but that perceptions of feeding method and emotions more generally at 1 week postpartum, regardless of infant feeding method, were far more indicative of week 4 and 8 scores. Victora et al. (2016) also concluded that depression was more likely to affect BFing than the other way around.

2.2.2. Equal or Better Sleep

Contrary to popular opinion that FF infants sleep longer, several studies have found that BFing either does not affect sleep (Montgomery-Downs, Clawges, & Santy, 2010) or increases overall sleep duration at both 1 month and 3 months postpartum (Doan, Gardiner, Gay, & Lee, 2007; Doan, Gay, Kennedy, Newman, & Lee, 2014). Since fatigue, stress, and PPD have all been associated with sleep disturbance (Gay, Lee, & Lee, 2004), BFing may play a role in reducing

incidence or severity of these ailments.

2.2.3. Potential Impact on Weight

In one SR/MA, no overwhelming evidence was found to support a link between BFing and postpartum weight change (Neville, McKinley, Holmes, Spence, & Woodside, 2013). However, Neville et al. (2013) did note that, of the five high quality studies they analyzed, four found a positive association between BFing and weight change. This reflects the findings of Bobrow, Quigley, Green, Reeves, and Beral (2013), who analyzed data from over 740,000 postmenopausal women: for every 6 months respondents had BF, BMI was 1% lower, independent of confounding factors such as SES, smoking, and physical activity.

2.2.4. Lower Type 2 Diabetes Risk

A plethora of studies exist examining the link between BFing and later development of T2D. For gestational parents who suffered from gestational diabetes, the risk of developing T2D 2 years' postpartum was lower the more and longer they had BF. For example, if they had exclusively BF, their risk of T2D 2 years postpartum was 54% less; if they had mostly BF, the risk was lower by 46%; any BFing lowered the risk by 36% (Gunderson, 2016). Those who had BF for greater than 2–5 months had a 45% lower risk; greater than 5–10 months had a 50% lower risk and greater than 10 months, a 57% lower risk (Gunderson, 2016).

In gestational parents who had no history of gestational diabetes, Aune, Norat, Romundstad, and Vatten's (2014) SR/MA found that the longest duration of BFing was associated with a 32% risk reduction for later T2D, when compared to no BFing. They also found, but cautioned that more studies were needed, a 9% lower risk for each 12-month increase in overall lifetime duration of BFing (Aune et al., 2014). The authors suggest that the "major metabolic burden on the mother with 400–600 kcal/day required for milk production during the

first 6 months of exclusive BFing" (Aune et al., 2014, p. 114) and the related fat burning, lower postpartum weight gain, and less abdominal obesity could account for this reduced risk. In addition, other physiological changes connected with BFing, such as increased insulin sensitivity and higher levels of certain metabolic hormones, could also play a part (Aune et al., 2014).

2.2.5. Lower Risk of Cardiovascular Disease

A number of studies have also shown that BFing reduces later risk of cardiovascular disease. Steube et al. (2009) found that parous (have given birth) participants in the Nurses' Health Study (n=89,326) who had BF for greater than 2 years throughout their life had a 37% lower risk of coronary heart disease compared to those who had never BF. For those who had BF for greater than 1 year, their risk lowered by 13% (Stuebe et al., 2009). The authors posited that this finding could be related to permanent changes to metabolism and the body's stress response that occur as a result of BFing. Two studies found that the physical structures of the vascular system are different in BFers that BF for 3 or more months; the vascular characteristics of gestational parents who do not BF are associated with a greater risk of cardiovascular disease (McClure, Catov, Ness, & Schwarz, 2012; E. B. Schwarz et al., 2010).

2.2.6. Reduced Risk of Breast and Ovarian Cancer

Perhaps the most widely studied benefit of BFing to the BFer is that of lower cancer risk. Both Victora et al.'s (2016) and Chowdhury et al.'s (Chowdhury et al., 2015) SR/MAs found 4.3% fewer cases of invasive breast cancer for every 12 months of BFing and, when comparing only parous people, having ever BF was associated with a 7% reduction of breast cancer risk compared with never BFing. Chowdhury et al. (2015) suggested that changes in hormones and mammary cells as a result of BFing may account for this reduction of risk.

Chowdhury et al. (2015) also found a 35% reduction in ovarian cancer for those who had

BF longer than 12 months and an 18% reduction for parous people who had ever BF. Victora et al. (2016) found only a 30% reduction associated with longer periods of BFing. Chowdhury et al. (2015) posited that a reduction in certain hormones as a result of suppressed ovulation is partly responsible for this finding; however, they also recognize that BFing has an independent effect for which we currently do not have an explanation.

2.3. Benefits of BFing to Society

2.3.1. Prevention of Death on a Global Scale

BFing, especially Exclusive BFing in developing nations, undoubtedly saves lives: Black et al. (2008) estimated that 1.4 million deaths of children under 5 (12% of deaths in this age group) could be attributed to suboptimal BFing. Victora et al. (2016) estimated that, annually, 823,000 lives of under-5 children living in low- and middle-income countries could be saved if 95% of infants under 1 month old and 90% of infant 1–6 months old were exclusively breastfed, and 90% of children 6–24 months were partially breastfed.

Victora et al. (2016) also estimated that BFing currently averts 19,464 breast cancer deaths per year. By increasing BFing duration to 12 months in high-income and 2 years in low- and middle-income countries, they estimated that an additional 22,216 breast cancer deaths could be prevented per year.

In the United States, Bartick et al. (2016) estimated that, in 2012, suboptimal levels of BFing resulted in 3,340 deaths, 78% of which were the gestational parent. Child deaths, totaling 721 (22%), could have been prevented by optimal BFing (Bartick et al., 2016). Furthermore, for every 597 people who optimally breastfeed, one death could be prevented (Bartick et al., 2016).

2.3.2. Cost Savings

While the cost to a family of purchasing formula is examined below, there are larger-scale costs associated with not BFing. Based on both a U.S. and U.K. study, Ball and Wright (1999) estimated that never BFing (compared with BFing for at least 3 months) caused 2,033 excess office visits, 212 excess days of hospitalization, and 609 excess prescriptions per 1,000 infants in relation to lower respiratory tract infections, ear infections, and gastrointestinal infections alone. The cost (late 1990s' values) of these excess healthcare costs amounted to between $331–$475 per FF infant in the first year of life.

In the United Kingdom, Renfrew et al. (2012) estimated that, if 45% of infants were exclusively BF for 4 months and 75% of NICU infants were BF at discharge, over £17 million (2012 values) (≈$27.5 million (XE, 2018b)) could be saved with regards to treating ear infections, lower respiratory tract infections, gastrointestinal infections, and NEC alone. They also found that £31 million (≈$50 million (XE, 2018b)) per annual cohort of first-time mothers could be saved as a result in decreased breast cancer occurrences if half of those who did not BF did so up to 18 months (Renfrew et al., 2012).

In the United States, Bartick et al. (Bartick et al., 2016) conservatively estimated that suboptimal BFing annually costs $3 billion (2014 values) in medical costs and $14.2 billion as a result of premature death ("age-specific value of a statistical life, which is a societal cost based on a willingness-to-pay model" (Bartick et al., 2016, p. 6)). BFing also costs an additional $1.3 billion in non-medical costs ("costs incurred by patients or families because of their disease, (e.g., time missed from work)" (Bartick et al., 2016, p. 6)).

Rollins et al. (2016) calculated the costs associated with childhood morbidity related to suboptimal BFing for several countries. They found that if the rates of exclusive BFing to 6

months increased by 10 percentage points or continued BFing up to 1 or 2 years (depending on country and disorder), savings in the cost of treating childhood disorders of $312 million in the United States, $7.8 million in the United Kingdom, $30 million in urban China, and $1.8 million in Brazil could be realized (2012 US$ values) (Rollins et al., 2016). Rollins et al. (2016) calculated the loss of gross national income experienced as a result of cognitive deficits related to not BFing; these are shown in Figure 3 .

	Estimated percentage loss in gross national income	Estimated loss in 2012 US$
Eastern and southern Africa	0·04%	$0·1 billion
West and central Africa	0·06%	$0·3 billion
Middle East and north Africa	0·97%	$11·8 billion
South Asia	0·05%	$1·0 billion
East Asia and Pacific	0·31%	$28·1 billion
Latin America and the Caribbean	0·39%	$12·1 billion
Eastern Europe and central Asia	0·75%	$17·6 billion
Subtotal (low-income and middle-income countries)	0·39%	$70·9 billion
High-income countries	0·53%	$231·4 billion
World	0·49%*	$302·0 billion (total estimated loss)

Estimates are based on data for 96 countries (of 197 countries in the UNICEF's 2014 database).[91] For details about data and included countries, and country-level results, see appendix pp 115–16. *Global average, weighted by gross national income.

Figure 3. Estimated economic losses from cognitive deficits associated with regional infant feeding practices compared with every infant BFing until at least 6 months of age (Rollins et al., 2016, p. 499).

2.3.3. Fewer Environmental Pollutants

Formula requires energy for producing the raw materials (e.g., cow milk, soy beans), energy for manufacturing, packaging, fuel for transportation/distribution, and water, energy, and cleaning products for preparation and use, all contributing to numerous additional environment

pollutants (Coutsoudis, Coovadia, & King, 2009; Linnecar, Gupta, Dadhich, & Bidla, 2014). Linnecar, Gupta, Dadhich, and Bidla (2014) estimated that 4,700 liters of water are needed to produce just 1 kilogram of powdered formula. In the United States, 550 million cans, containing 86,000 tons of metal and 364,000 tons of paper, are discarded in landfills as a result of FF (Coutsoudis et al., 2009).

2.4. Factors Affecting Breastfeeding Initiation, Exclusivity, Duration, and Cessation

Despite the benefits of BFing to children, BFers, and society, many factors affect—predominantly negatively—BFing initiation, exclusivity, duration, and cessation. Unpacking these complex and often intertwined factors is necessary to determine whether the issue is related to nursing specifically and, therefore, EPing could provide a solution, or whether the impediment is an artifact of BFing more generally. This section follows the structure of the theoretical framework introduced in Chapter 1, thereby examining these factors at the intrapersonal, interpersonal, institutional, and policy and legal levels.

2.4.1. Intrapersonal: The Lactating Individual

2.4.1.1. Insufficient milk supply. While hormonal changes after delivery of the placenta initiates lactogenesis II (the second stage of HM creation, whereby the body begins to make mature milk), continuing lactation is essentially a supply and demand cycle (R. A. Lawrence & Lawrence, 2016). Complete failure to lactate following pregnancy and birth is rare (Neifert, 1999 estimated 5%) and is associated with co-morbidities such as Sheehan syndrome (an endocrine disorder) or physical lack of mammary tissue (such as after a mastectomy) (R. A. Lawrence & Lawrence, 2016). Insufficient milk supply is more common and has many different causes, including retained placenta, diabetes, thyroid disease, polycystic ovary syndrome, breast augmentation and reduction, extreme fatigue, poor nutrition and anemia, temporary illness, need

to feed multiple infants (examined below) and ingestion of certain substances, such as medications, alcohol, and illicit drugs (also examined below) (J. M. Hopkinson, Schanler, Fraley, & Garza, 1992; R. A. Lawrence & Lawrence, 2016; Mennella & Pepino, 2010; Mennella, Pepino, & Teff, 2005; Vanky, Isaksen, Haase Moen, & Carlsen, 2008). Appropriate management of these morbidities, such as appropriate prescription medication, removal of retained placenta, increased breast and nipple stimulation, education on specific BFing techniques, improved diet, and increased rest and familial support, can increase HM supply (Cadwell & Turner-Maffei, 2017; R. A. Lawrence & Lawrence, 2016). However, some BFers may never produce enough HM to exclusively BF (R. A. Lawrence & Lawrence, 2016; Neifert, 2001). Milk expression might be appropriate to stimulate supply and/or to monitor a child's nutrition to prevent malnutrition (Neifert, 2001).

What is more prevalent is a *perceived* insufficient milk supply (PIMS), common to BFing people the world over (e.g., Turkey: Gökçeoğlu & Küçükoğlu, 2017; Brazil: Groleau & Cabral, 2009; Bangladesh: Haider, Kabir, Hamadani, & Habte, 1997; Australia: Newby & Davies, 2016; Mexico: Sacco, Caulfield, Gittelsohn, & Martínez, 2016; Nicaragua: Safon et al., 2016). Li, Fein, Chen, and Grummer-Strawn's (2008b) Infant Feeding Practice Study II (IFPS II) analysis found that when mothers stopped BFing within the first month postpartum, over 50% reported not having enough milk and nearly 50% believed HM was not enough to satisfy their infant, an opinion that was pervasive throughout the first year of life. Wagner, Chantry, Dewey, and Nommsen-Rivers (2013) found that 40% of their participants were concerned about milk quantity 3 days postpartum, a concern which was significantly associated with increased risk of BFing cessation and FF. A number of other studies confirm that PIMS is associated with earlier BFing cessation and increased formula feeding (e.g., Ahluwalia, Morrow, & Hsia, 2005; S.

Arora, McJunkin, Wehrer, & Kuhn, 2000; Cernadas, Noceda, Barrera, Martinez, & Garsd, 2003; Mercer et al., 2010). Newby and Davies (2016) note that, in those BFing longer, PIMS is often related to their child spending less time nursing; in this situation, they recommend education stressing older children's greater efficiency in removing milk.

Both Li et al. (2008b) and Gökçeoğlu and Küçükoğlu (2017) found that lower SES and household income were associated with greater PIMS. Li et al. (2008b) also found that Hispanic parents were more likely to believe that HM alone was not sufficient to satisfy their child. Since BFing is a cycle of supply and demand, supplemental FF can exasperate PIMS and cause actual insufficient milk supply, therefore leading to BFing cessation.

2.4.1.2. Physical health. Li et al. (2008b) found that, of those who ceased BFing within the first month postpartum, 37% reported sore, cracked, or bleeding nipples, 24% reported overfull or engorged breasts, and 29% stated that BFing was too painful. Similar statements were recorded by Ahluwalia et al. (2005), Cernadas et al. (2003), Newby and Davies (2016), and Wagner et al. (2013); the latter found a significant association between these complaints, BFing cessation, and FF. While HM expression could offer temporary or permanent relief for these symptoms, BFing education and support can provide solutions that resolve their underlying causes.

In Li et al.'s (2008b) analysis, maternal ill-health and/or having to take medication was reported by about 13% of respondents as an important reason for BFing cessation. Although some medications are contraindicated when BFing, many have safe and effective substitutes (AAP, 2012; Sachs & AAP Committee on Drugs, 2013). Sachs and the AAP Committee on Drugs (2013) discuss other compounds, such as those used for providing contrast in diagnostic imaging, and their risks to a BF child but note that the "benefits of breastfeeding outweigh the

risk of exposure to most therapeutic agents via human milk" (p. e805). For those on unavoidable but temporary courses of medication or who need contrast agents not compatible with BFing, milk expression can be used to maintain milk supply until it is once again safe. An examination of the effect of non-prescription drugs, alcohol, and smoking on BFing is below.

Obesity affects BFing initiation and duration. In their systematic review, Turcksin, Bel, Galjaard, and Devlieger (Turcksin, Bel, Galjaard, & Devlieger, 2012) found that obese people are less likely to intend to BF and obesity was associated with decreased BFing initiation, shortened BFing duration, a less adequate milk supply, and delayed onset of lactogenesis II. The combination of obesity and large breasts aggravates the problem, as a successful and efficient latch (that is, successfully "attaching" to the nipple and breast to nurse) is harder to achieve in those with large breasts (Katz, Nilsson, & Rasmussen, 2010). Turcksin et al. (2012) also found that exclusive nursing at postpartum hospital discharge was lower and the use of feeding aids (nipple shields, cupped syringe feeding, supplemental feeding systems etc.) higher among obese participants; both of which are risk factors for earlier BFing cessation (Gubler, Krähenmann, Roos, Zimmermann, & Ochsenbein-Kölble, 2013). Stuebe et al. (2014) found that overweight and obese IFPS II respondents were 1.5 times more likely to stop before their desired BFing duration. Physiologically, Rasmussen and Kjolhede (2004) found that prolactin—the hormone responsible for HM production—levels in response to suckling were significantly lower in overweight and obese people. This may lead to lower milk supply and therefore contribute to BFing cessation. Those who struggle with latch, supply, or negative self-image (resulting in an unwillingness to potentially expose themselves during nursing) may be aided by EPing, as suggested by Leonard, Labiner-Wolfe, Geraghty, and Rasmussen (2011).

Dysphoric milk ejection reflex (D-MER) is an under-researched and poorly understood syndrome that results in a variety of negative feelings, such as homesickness, sadness, anxiety, restlessness, or anger, starting a few minutes before milk release and lasting a few minutes (D-MER.org, 2018). It is not the same as aversion to or a general dislike of BFing, but rather thought to be related to mistiming in the rise and fall of hormones associated with milk production and release (D-MER.org, 2018). Those who suffer from the most severe symptoms often stop BFing (D-MER.org, 2018; Heise & Wiessinger, 2011; Ureño, Buchheit, Hopkinson, & Berry-Cabán, 2018), but those with less severe symptoms may seek management options, such as distractions like watching television or reading while nursing, or switching to EPing (so as to avoid associating negative feelings with their child) (D-MER.org, 2018; Ureño et al., 2018).

BFing aversion and anxiety has similar symptoms to D-MER but is not limited to just milk ejection. Those who experience BFing aversion describe feelings of "anxiety, anger, irritation, creepy crawlies, nipple pain, can't stay still, want to run away, violent thoughts" (Yate, 2017, p. 451) while BFing. Little is known about its cause, although Yate (2017) proposes that it may be both physiological and psychological. Regardless, BFing aversion "appears to be both a complex and sensitive phenomenon for women who experience it, and must make breastfeeding very difficult and stressful" (Yate, 2017, p. 453).

2.4.1.3. Mental health. Many lactating parents view BFing as central to their mothering role (Y. L. Hauck & Irurita, 2003). When they fail, they feel guilt, a sense of failure and shame (E. Lee, 2007; Mozingo et al., 2000), and inadequacy and isolation (Hegney et al., 2008). However, depression and anxiety can precipitate BFing cessation (Dennis & McQueen, 2007; Figueiredo et al., 2013; Stuebe et al., 2014; Victora et al., 2016; Yusuff, Tang, Binns, & Lee,

2015). A number of studies (Figueiredo et al., 2013; Yusuff et al., 2015) found that prenatal depression, specifically in the third trimester, negatively affected BFing initiation and duration.

Beck, Gable, Sakala, and Declercq (2011) studied the association between post-traumatic stress disorder (PTSD) and postpartum outcomes. With respect to BFing, they found that those with higher PTSD scores did not BF as long as they wanted and had ceased Exclusive BFing by 1 month postpartum (C. T. Beck et al., 2011). In an earlier study, Beck and Watson (2008) found that experiencing birth trauma (e.g., stressful labor and delivery, emergency C-section, and psychosocial stress or pain due to childbirth) specifically impacted BFing: in one group, birth trauma propelled parents to display "sheer determination to succeed" (p. 228) with BFing; conversely, others experienced insufficient milk supply, intruding flashbacks, and detachment.

2.4.1.4. Breastfeeding experience. The connection between parity (number of births) and BFing has not been reliably established. Some studies have found no difference in BFing initiation and/or duration between primiparas (those having had one birth) and multiparas (those having had two or more births) (Clements et al., 1997; Ekström, Widström, & Nissen, 2003; P. D. Hill, Humenick, Argubright, & Aldag, 1997; Michaelsen, Larsen, Thomsen, & Samuelson, 1994). Others have found that primiparas are more likely to initiate BFing, but multiparas achieve greater BFing duration (K. Ford & Labbok, 1990; R. Li et al., 2008b; Piper & Parks, 1996; J. A. Scott, Landers, Hughes, & Binns, 2001). More specifically, Dewey, Mommsen-Rivers, Heinig, and Cohen (2011) studied BFing in the first 2 weeks postpartum and found that primiparas were at greater risk for suboptimal BFing. In addition, Cernadas et al. (2003) found that duration was not related to parity in itself, but the duration of BFing of a previous child was strongly predictive of duration of BFing for later children. With respect to late preterm

newborns, Demirci, Sereika, and Bogen (2013) found that parity was associated with BFing initiation.

Although not related to BFing experience per se, higher maternal age is consistently positively associated with greater BFing initiation and duration (Callen & Pinelli, 2004; Demirci et al., 2013; Ekström et al., 2003; R. Li et al., 2008b; Piper & Parks, 1996; A. S. Ryan, Wenjun, & Acosta, 2002; J. A. Scott et al., 2001; Stuebe et al., 2014). Similarly, BFing knowledge has been strongly associated with BFing confidence and duration (Chezem, Friesen, & Boettcher, 2003).

2.4.1.5. Breastfeeding intention. A large number of studies have found that BFing initiation is directly associated with intention to BF (Asiodu, Waters, Dailey, Lee, & Lyndon, 2015; Bai, Fong, Lok, Wong, & Tarrant, 2016; Bentley, Dee, & Jensen, 2003; Y. L. Hauck & Dimmock, 1994; Hegney et al., 2008; Murphy, 1999; Nommsen-Rivers, Chantry, Cohen, & Dewey, 2010; Shaker, Scott, & Reid, 2004). This is consistent with the Theory of Planned Behavior (Ajzen, 1991), as illustrated in Figure 4.

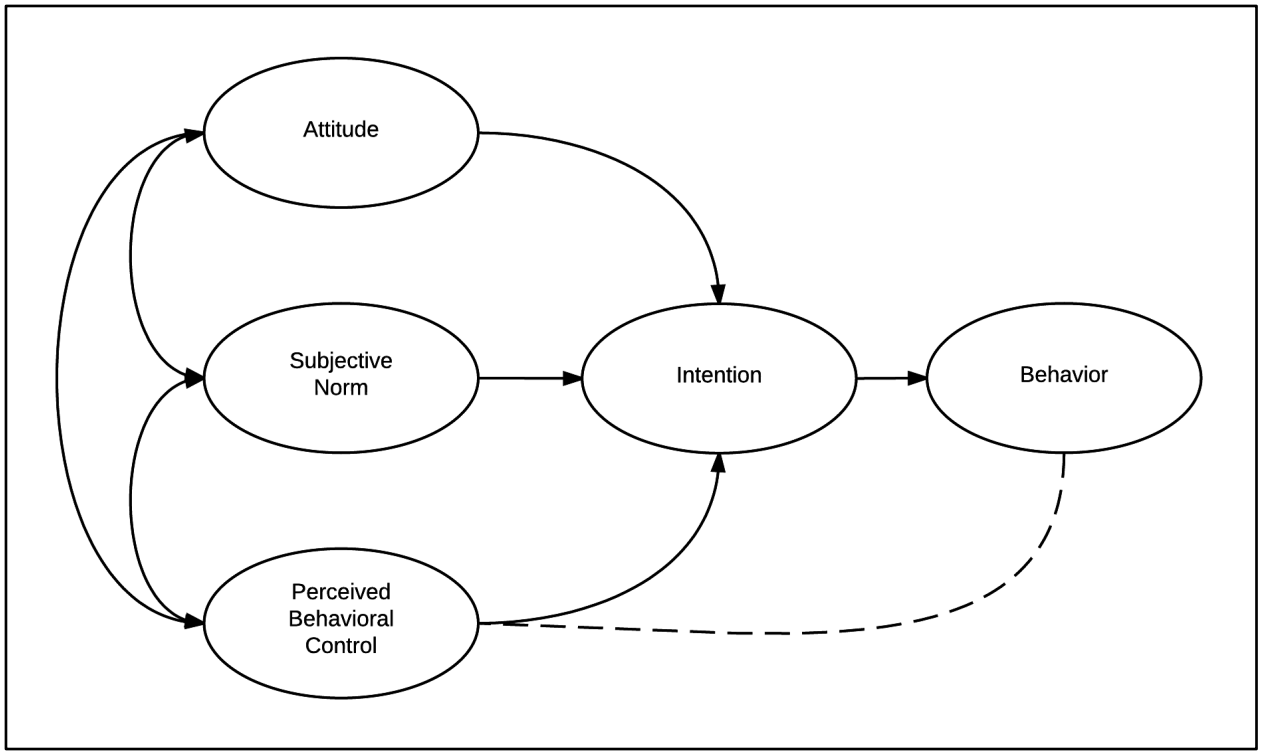

Figure 4. Theory of Planned Behavior (Ajzen, 1991; diagram by Orzanna, 2015).

The theory of planned behavior states that an individual's attitude toward a certain behavior (e.g., the behavior is good, bad, or neutral), the perceived or subjective norm (i.e., the perceived social influences/pressures to indulge in a certain behavior), and an individual's perception of their control over their behavior shapes both their behavioral intention and, thus, their actual behavior (Ajzen, 1991). In the case of BFing, initiation is therefore related to a BFer's attitude that the behavior is good, that the subjective norm within society is that BFing is ideal, and that they have control over whether to BF or not.

2.4.1.6. Time constraints. Of those IFPS II respondents stopping BFing in the first 2 months postpartum, approximately 13% reported that an important reason for stopping was having too many household duties (R. Li et al., 2008b). The proportion reporting this as an important reason for BFing cessation dropped significantly after the first 2 months (R. Li et al.,

2008b). This reflects findings in other studies: for example, in Haider et al. (1997), 12% of respondents gave too much housework as a reason for not exclusively BFing. Ahluwalia et al. (2005) similarly found that respondents attributed stopping BFing to having other responsibilities.

However, in their study of "non-working" (presumably, the authors meant no paid employment) urban women in Honduras, Cohen, Haddix, Hurtado, and Dewey (Cohen, Haddix, Hurtado, & Dewey, 1995) found that the total time devoted to infant (here, 19 and 24 weeks postpartum) feeding was significantly greater in those that both BF and feed supplemental foods compared to those that exclusively BF. In addition, only 15% of exclusively BFing participants said that BFing was "somewhat" or "very" time-demanding, compared with 60% of those who combination fed their infants (Cohen et al., 1995). Similarly, 6% of exclusively BFing participants said that BFing interfered with other activities, compared with 49% of combination feeders; this study also found that exclusively BFing participants spent more time traveling and shopping than combination feeders (Cohen et al., 1995). Therefore, it appears to be the perception of time constraints that interfere with BFing, rather than actual time spent on other responsibilities.

2.4.1.7. Lifestyle alterations. Lifestyle issues, such as wanting to go on a weight-loss or their "usual" diet, wanting their body back to themselves, and wanting to smoke again, were not often cited as important reasons to stop BFing by IFPS II respondents (R. Li et al., 2008b). However, smoking has a role to play in BFing initiation and duration. In their extensive literature review, Napierala, Mazela, Merritt, and Florez (2016) noted that the milk from a smoking BFer contains, among many other compounds derived from tobacco smoking, nicotine and cotinine, which is ingested by the child and causes alterations to their circulatory systems and potentially

long-term deficits in learning and memory. A number of studies reviewed by Napeirala et al. (2016) found that BFers who smoked had lower milk supply, thought to be due to changes in lactation hormones, and wean their child sooner than non-smokers. The authors also found that tobacco smoke taints the taste of HM and its composition, potentially leading to poor feeding and weight gain, risk factors associated with supplementing with formula (Napierala et al., 2016). In addition, infants of smoking BFers are more likely to suffer from ear infections and upper RTIs, as well as colic (defined as a "healthy, well-fed infant who cries more than 3 hours a day, more than 3 days a week, for more than 3 weeks" (WebMD, 2018a)). The protection BFing affords against SIDS does not apply if the BFer is a smoker (Napierala et al., 2016). Despite the risks of smoking and BFing, the consensus is that it is preferable to smoking and FFing (AAP Committee on Drugs, 2001; Dorea, 2007).

BF children can react to substances that make their way into HM from the BFer's diet. For example, an estimated 5–15% of infants show adverse reactions to cow milk proteins (Høst, 2002), with between 2–7.5% demonstrating allergy to it (D. J. Hill, Firer, Shelton, & Hosking, 1986). Since cow milk proteins can make their way into HM, even exclusively BF children can experience adverse reactions (Vandenplas et al., 2007). The "gold standard" for both diagnosis and treatment is to eliminate cow milk proteins from both the child's and the BFer's diet (Vandenplas et al., 2007). Although it appears that no study exists specifically concerning BFing cessation due to the strain of eliminating certain foods from the BFer's diet, approximately 6.5% of IFPS II respondents cited wanting to get back to their "usual diet" as an important reason to stop BFing.

The consumption of alcohol is often thought to be forbidden while BFing, but studies show that the topic is not clear-cut. Regular alcohol consumption by the BFer can have several

consequences: in the BF child, impaired motor development, impaired growth, and sleep disturbances; in the BFer, interruption of lactation hormones, inhibition of the milk ejection reflex, and impairment of judgment, risking the safety of those in their care (AAP Committee on Drugs, 2001; Sachs & AAP Committee on Drugs, 2013). However, in their 2013 review, Haastrup, Pottegård, and Damkier (2013) found that, given the amount of alcohol present in HM is similar to that in the blood, the amount ingested by the BFing child is minute. For example:

> A mother engages in binge drinking and ingests four drinks of 12 g pure alcohol and then breastfeeds her child at the time of the maximum blood alcohol concentration, the child would still not have a blood alcohol level of more than 0.005%. It appears biologically implausible that occasional exposure to such amounts should be related to clinically meaningful effects to the nursing children. (Haastrup et al., 2013, p. 172)

The authors recognize that the long-term effects on a child of consuming milk produced by a chronic alcoholic need more research, but nevertheless state that no specific precautions regarding alcohol use by BFers are needed (Haastrup et al., 2013). Perhaps the highest risk to continuing BFing comes from the alterations in smell and flavor of milk after drinking alcohol: Mennella and Beauchamp (1991) found that HM odor changed in parallel with blood alcohol levels and, during this period, infants consumed significantly less milk. Given potential effects on milk supply, ejection reflex, and infant consumption, regular alcohol consumption is a risk factor for formula supplementation. On the recommendation of the AAP, many BFers will wait several hours after drinking or until they feel sober before BFing (AAP, 2012); since alcohol levels in HM reflect those in the blood, expression does not speed up elimination of alcohol from milk.

Use of illicit drugs, including marijuana, can produce severe side effects in a BFing child, as shown in Figure 5.

Drug	Reported Effect or Reason for Concern
Alcohol	Impaired motor development or postnatal growth, decreased milk consumption, sleep disturbances. Note: Although binge drinking should be avoided, occasional, limited ingestion (0.5 g of alcohol/kg/d; equivalent to 8 oz wine or 2 cans of beer per day) may be acceptable.
Amphetamines	Hypertension, tachycardia, and seizures. In animal studies of postnatal exposure, long-term behavioral effects, including learning and memory deficits and altered locomotor activity, were observed.
Benzodiazepines	Accumulation of metabolite, prolonged half-life in neonate or preterm infant is noted; chronic use not recommended. Apnea, cyanosis, withdrawal, sedation, cyanosis, and seizures.
Cocaine	Intoxication, seizures, irritability, vomiting, diarrhea, tremulousness.
Heroin	Withdrawal symptoms, tremors, restlessness, vomiting, poor feeding.
LSD	Potent hallucinogen.
Methamphetamine	Fatality, persists in breast milk for 48 h.
Methylene dioxy-methamphetamine (ecstasy)	Closely related products (amphetamines) are concentrated in human milk.
Marijuana (cannabis)	Neurodevelopmental effects, delayed motor development at 1 y, lethargy, less frequent and shorter feedings, high milk-plasma ratios in heavy users.
Phencyclidine	Potent hallucinogen, infant intoxication.

Figure 5. Drugs of abuse for which adverse effects on the BFing infant have been reported (Sachs & AAP Committee on Drugs, 2013).

Sachs and the AAP Committee on Drugs (2013) also note that the "effect on maternal judgment or mood may affect ability to care for infant" (p. e800), which can again be considered a risk factor for formula supplementation.

A final individual factor (although concern for others', namely the BFer's partner's, opinions/feelings may play heavily into it) that may affect BFing initiation, duration, and cessation is that of perceived breast changes occurring due to BFing. While post-lactation

involution and ptosis (i.e., shrinkage, drooping, and atrophy) of the breasts are commonly reported (73% of participants in Pisacane and Continisio's (2004) study), neither Pisacane and Continisio's (2004) or Rinker, Veneracion, and Walsh's (2008) studies found a significant difference in the perception of breast changes between BFers and non-BFers. It appears that breast changes are a result of pregnancy, not BFing.

2.4.2. Interpersonal: The Microsystem

2.4.2.1. Child will not or cannot latch and/or suck. One of the most influential factors on BFing success is that of the child. Almost 54% of IFPS II respondents reported trouble with their infant sucking or latching as an important reason for their BFing cessation in the first month postpartum; 27% reported this reason for stopping in the second month (R. Li et al., 2008b). Other studies also report findings of this magnitude with regards to latch, sucking, or more generally "baby had difficulty" (Ahluwalia et al., 2005; Cernadas et al., 2003; Newby & Davies, 2016; Stuebe et al., 2009).

There may be any number of underlying reasons why a child cannot or will not latch or suck, and these are examined in the next few sections. Education and support provided by a competent lactation care provider (LCP) can help to diagnose the issue and provide a solution that leads to successful nursing; however, on some occasions, a successful latch just cannot be established and continuing to nurse would jeopardize the health of the child (Neifert, 2001). In the latter case, EPing provides a solution to those who do not want to FF.

2.4.2.2. Preterm and/or low birth weight newborn. Preterm and LBW newborns are often not stable or physically developed enough to nurse (R. A. Lawrence & Lawrence, 2016), but benefit even more from HM than full-term newborns. Therefore, EPing is a common and essential occurrence among NICU BFers. Those that receive both peer counselor and lactation

consultant support have higher rates of BFing both during NICU admission and after discharge (Oza-Frank, Bhatia, & Smith, 2013). While the effects of prematurity and LBW on BFing outcomes are well known, research is starting to find that even late preterm (34–36 6/7 weeks) and early term (37–38 6/7 weeks) newborns struggle with BFing: the former are 56% less likely to be BFing at 1 month postpartum, the latter 23% less likely (Hackman, Alligood-Percoco, Martin, Zhu, & Kjerulff, 2016).

2.4.2.3. Physical/developmental disabilities of the child. A number of congenital disabilities can interfere with nursing, such as a cardiac defect, Down syndrome, craniofacial abnormalities (such as cleft lip/palate), hypotonia (low muscle tone), and spina bifida (Cadwell & Turner-Maffei, 2017; R. A. Lawrence & Lawrence, 2016). Birth injuries, such as to the newborn's head or shoulders, can also interfere with nursing given that certain positions can cause pain and discomfort (Cadwell & Turner-Maffei, 2017). Other physical issues of various or unknown etiologies that could interfere with successful nursing include torticollis (a newborn's head is persistently tilted to one side (WebMD, 2018c)), cerebral palsy, oral aversion, and tongue and/or lip ties (the frenulum connecting the tongue or lip is abnormally short, thickened, and/or tight (WebMD, 2018b)). Some of these physical and developmental issues can be managed with modified BFing techniques, such as positioning, more frequent feeding, and extra physical support of the child (Cadwell & Turner-Maffei, 2017). However, many lead to a temporary or permanent inability to latch and/or efficiently suckle, and therefore require the BFer to partially or completely express milk (Cadwell & Turner-Maffei, 2017).

2.4.2.4. Illness of the child. Sixty percent of full-term and 80% of preterm infants will appear jaundiced within the first week of life (CDC, 2017c). Jaundice is caused by elevated bilirubin (hyperbilirubinemia); hyperbilirubinemia at a level that causes bilirubin toxicity can

cause encephalopathy (AAP Subcommittee on Hyperbilirubinemia, 2004) and is associated with developmental delay, attention-deficit disorder, and autism (Jangaard, Fell, Dodds, & Allen, 2008). A number of studies (C.-F. Chen et al., 2011a; M.-S. Huang, Lin, Chen, Chien, & Chen, 2009; Itoh, Kondo, Kusaka, Isobe, & Onishi, 2001; e.g., Jangaard et al., 2008; Kaplan et al., 2006; Kuzniewicz et al., 2008; T. B. Newman, Xiong, Gonzales, & Escobar, 2000; H. Yang et al., 2015) have found higher rates of problematic hyperbilirubinemia in BF newborns.

However, hyperbilirubinemia in the first week of life is rarely a product of BFing itself, but rather the smaller volume of milk consumed by BF newborns (about 5–37mL versus 150mL for formula feeders in the first 24 hours) (Davila-Grijalva, Troya, Kring, DeRidder, & Maisels, 2017; Santoro, Martinez, Ricco, & Jorge, 2010). This form of hyperbilirubinemia usually resolves around 2 weeks of age and can be managed with appropriate BFing support, phototherapy, and supplementation with expressed HM (Flaherman, Maisels, The Academy of Breastfeeding Medicine, 2017). "Breast milk jaundice"—hyperbilirubinemia that extends into the first three months of life of a breastfed newborn—can also be treated with phototherapy and an increase in milk intake (Flaherman et al., 2017). Both the Academy of Breastfeeding Medicine (ABM) and the AAP acknowledge the appropriateness of formula supplementation in cases of hyperbilirubinemia not resolved by phototherapy, but only when expressed HM, either the BFer's own or donor milk, is not available (AAP Subcommittee on Hyperbilirubinemia, 2004; Flaherman et al., 2017).

Another newborn problem sometimes treated with supplemental formula is hypoglycemia (low blood sugar). However, the appropriate treatment is not supplemental formula but rather regular HM feedings and glucose solution. FF is required in cases of galactosemia, a rare, but very serious, condition where an individual cannot metabolize the sugar galactose, found in all

mammalian milk. Galactosemia is a complete contraindication to BFing, as life-threatening symptoms can appear within a few days after birth (U.S. National Library of Medicine, 2018a). A BFer may choose to EP so as to donate all their milk. Phenylketonuria (more commonly known as PKU) is another rare disorder whereby the level of phenylalanine in the blood is abnormally high, causing permanent intellectual disability if not managed (U.S. National Library of Medicine, 2018b). Children with PKU can be successfully BF (e.g., Banta-Wright, Press, Knafl, Steiner, & Houck, 2014), but HM intake needs to be closely monitored in order to keep intake of phenylalanine low (HM is supplemented with formula containing no/low phenylalanine) (R. A. Lawrence & Lawrence, 2016). Since HM intake needs to be closely monitored, predominant or exclusive milk expression must be employed to maintain milk supply (van Rijn et al., 2003).

2.4.2.5. Nursing older children. Many older infants and toddlers begin to lose interest in nursing and start to bite. Of those IFPS II respondents who stopped BFing 6–8 months/9 or more months postpartum, 39%/32% cited biting and 48%/47% cited their infant losing interest or beginning to self-wean as important reasons (R. Li et al., 2008b). While respondents in Newby and Davies' (2016) study also gave these as reasons for stopping BFing after 6 months, the proportions were much lower (16% due to biting; 29% due to decreased interest). BFing management techniques can alleviate these two problems (Bonyata, 2018d; 2018c); EPing is also a solution. In addition, some BFers will choose to stop, believing that their child is old enough that the difference between HM and formula no longer matter: 27%/28% of those stopping between 6–8 months/9 or more months postpartum stated this as an important reason in Li et al. (2008).

2.4.2.6. Twins, triplets, and beyond. There is surprisingly little data on the BFing rates of those experiencing multiple births. One study found that there was no significant difference in BFing initiation and duration between full-term singleton, preterm singleton, and full-term multiple births, whereas there was a significant drop in BFing initiation and duration for preterm multiple infants (Geraghty, Pinney, Sethuraman, Roy-Chaudhury, & Kalkwarf, 2004). This trend also held true regarding the exclusivity of HM feeding (Geraghty et al., 2004). Interestingly, data from the same study also found that HM expression rates were similar whether the BFer had a preterm or full-term, singleton or multiple birth (Geraghty, Khoury, & Kalkwarf, 2005). Conversely, Yokohama and Ooki (2004) found that BFing rates were significantly lower among those with multiple births, but had no relation to prematurity or LBW. Instead, they found that cooperation of the husband for childrearing was the most significant factor in BFing success (Yokoyama & Ooki, 2004).

2.4.2.7. Father of the child; spouses and partners of the breastfeeder. Being married is positively associated with BFing initiation, duration, and exclusivity (Callen & Pinelli, 2004; Clayton, Li, Perrine, & Scanlon, 2013; Demirci et al., 2013; Fein, Mandal, & Roe, 2008; Groer, 2005; Hackman et al., 2016; R. Li et al., 2008b; Pineda, 2011; Stuebe et al., 2014). However, marriage is not the sole determinant of a partner's or "father's" role in infant feeding decisions, as demonstrated by the rich and diverse literature available on this topic. The term "father" is used throughout this section, reflecting the terminology used in all of the literature; this does not reflect my own preferred terminology. "Partner" is used to mean the person with whom the BF is in a committed relationship, unless specifically denoting a legal marriage is pertinent, in which case "spouse" is used.

In their concept analysis, Sherriff, Hall, and Panton (2014) found that literature defined father support in five ways: "(1) knowledge about breast feeding; (2) positive attitude to breast feeding; (3) involvement in the decision-making process; (4) practical support; and (5) emotional support" (p. 667). Feeling part of a "breastfeeding team" was expressed by fathers/partners in several studies (deMontigny, Gervais, Larivière-Bastien, & St-Arneault, 2018; L. A. Rempel & Rempel, 2011); it is well established that active support from a partner increases BFing initiation and duration (e.g., Agunbiade & Ogunleye, 2012; Cernadas et al., 2003; Freed, Fraley, & Schanler, 1992; Pisacane, Continisio, Aldinucci, D'Amora, & Continisio, 2005; Premberg, Hellström, & Berg, 2008; Tsai, 2014; Yokoyama & Ooki, 2004). Partner support also increases the likelihood of continuing BFing once the BFer has returned to work (Tsai, 2014).

The *perception* of support from the BFer's partner has also been found to be critical to BFing success (S. Arora et al., 2000; Freed, Fraley, & Schanler, 1993; Tsai, 2014). The most common reason given in Arora et al.'s (2000) study for initiating bottle feeding was the perceived, not actual, support for BFing: Freed, Fraley, and Schanler (1993) found that fathers were actually more favorable towards BFing than their partners predicted.

Multiple factors seem to contribute to a partner's lack of support: simply not understanding the importance of HM; feeling like they will not be able to bond with their child; feeling inadequate, powerless, or useless; being separated from their partner by the child or being excluded; not wanting BFing to interfere with sex; and a desire for their partner to maintain their pre-pregnancy breast aesthetics (Agunbiade & Ogunleye, 2012; A. Brown & Davies, 2014; Freed et al., 1992; Jordan & Wall, 1990; Kessler, Gielen, Diener-West, & Paige, 1995). BFers also report that their partner not taking adequate responsibility for childrearing and/or household

responsibilities contributes to BFing cessation (Haider et al., 1997; Susin & Giugliani, 2008; Yokoyama & Ooki, 2004).

Few studies have examined the effects of a child's father's SES and education on BFing. Flacking, Dykes, and Ewald (Flacking, Dykes, & Ewald, 2010) found that "infants whose fathers had a lower level of education, were receiving unemployment benefits and/or had a lower equivalent disposable household income were significantly less likely to be breastfed at 2, 4, 6, 9, and 12 months of age" (p. 337). Needing to return to work for financial reasons because their partner could not support them was given as a reason to stop BFing in several studies (Haider et al., 1997; K. Ryan, Team, & Alexander, 2013). Furthermore, if a father did not take paternity leave during the first year of their child's life, there was a significantly less likelihood of the infant being breastfed at 2, 4, and 6 months (Flacking et al., 2010).

One solution to including the father/partner is for the BFer to express milk, as it allows them to share feeding responsibilities and bond with their child (K. Ryan et al., 2013). Partners perceive that it allows the BFer time to rest (K. Ryan et al., 2013). Gestational parents often have a desire for the other parent to feed, bond, and build a connection with the child (Ahluwalia et al., 2005; R. Li et al., 2008b; K. Ryan et al., 2013) and some even express the belief that, "unlike the fathers of infants who were formula fed, fathers of breastfed infants were uninvolved and detached" (K. Ryan et al., 2013, p. 475).

Another solution to increase father/partner support of BFing is including them in prenatal education. Studies show mixed results on the initiation of BFing following inclusion of fathers/partners in prenatal education: Susin and Guigliani (2008) and Pisacane et al. (2005) found no higher rates of initiation. In contrast, both Sciacca, Dube, Phipps, and Ratliff (1995) and Wolfberg et al. (2004) found higher rates of initiation following education of

fathers/partners. Several studies found that the exclusivity of BFing was greater when fathers/partners had been educated about BFing (Pisacane et al., 2005; Sciacca et al., 1995; Susin & Giugliani, 2008; Wolfberg et al., 2004). Pisacane et al. (2005) found that when problems with BFing occurred, those with partners that had received the education were far more likely to continue BFing.

2.4.2.8. Grandmothers of the child. Like fathers/partners, grandmothers of the child can help or hinder BFing initiation, duration, and exclusivity (Agunbiade & Ogunleye, 2012; S. Arora et al., 2000; Bentley et al., 2003; Bentley, Gavin, Black, & Teti, 1999; Berkule-Silberman, Dreyer, Huberman, Klass, & Mendelsohn, 2010; Cox, Giglia, & Binns, 2017; Grassley & Eschiti, 2008; Haider et al., 1997; Heinig et al., 2009; Ingram & Johnson, 2004; Karmacharya, Cunningham, Choufani, & Kadiyala, 2017; Raffle, Ware, Borchardt, & Strickland, 2011; Safon et al., 2016; J. A. Scott et al., 2001). In one study, 29% of respondents reported that the person whose "opinion matter most to her" was her own mother (i.e., the child's maternal grandmother) (Kessler et al., 1995). Particularly in the developing world, mothers-in-law of the BFer appear to have significant influence, perhaps because of the increased female subservience and hierarchical family structures in those countries (Nigeria: Agunbiade:2012bk; Bangladesh: Haider:1997th; Tanzania: Falnes:2011ic; Nepal: Masvie:2006ki; Ghana: Gupta:2015eh; India: Islam et al., 2017). Negin, Coffman, Vizintin, and Raynes-Greenow (2016) pointedly note that "most health programs target the individual person most directly involved in the target behaviour—usually new mothers …—without a commensurate understanding of who else influences those decisions" (p. 2). They call for BFing education and awareness programs to pay particular attention to the role of mothers-in-law (Negin et al., 2016).

2.4.2.9. Support and education. Support from the BFer's wider microsystem is essential. There have been several recent SR/MAs that have examined the effectiveness of BFing support. Shakya et al. (2017) reviewed 47 articles about community-based peer support and found that, in low- and middle-income countries, peer support resulted in a 1.5 times increase in the initiation of BFing within the first hour of life and increased Exclusive BFing at 3 months (1.9 times), 5 months (9.6 times), and 6 months (3.5 times). In high-income countries, peer support increased Exclusive BFing at 3 months (2.6 times) (Shakya et al., 2017). In their Cochrane systematic review, McFadden et al. (2017) found that extra support, whether from lay people (i.e., peer support) or LCPs, had a positive impact on BFing. They found that exclusivity outcomes were also improved, especially by face-to-face interventions, lay support, and interventions consisting of 4–8 face-to-face meetings (A. McFadden et al., 2017).

McFadden et al. (2017) found that prenatal support had a positive effect on BFing outcomes. However, Lumbiganon et al.'s (Lumbiganon et al., 2016) Cochrane systematic review found that prenatal *education* did not have a significant effect on BFing initiation, exclusivity, or duration. Although Lumbiganon et al. (2016) found that prenatal interventions employing multiple methods did have some effect on BFing, their overall conclusion was that no conclusive evidence existed showing that prenatal education specifically had a positive effect on BFing. They stated that there is "an urgent need to conduct a high-quality, randomised controlled study to evaluate the effectiveness and adverse effects of antenatal breastfeeding education, especially in low- and middle-income countries" (Lumbiganon et al., 2016, p. 2).

In their SR/MA, Brockway, Benzies, and Hayden (2017) examined the effectiveness of interventions—namely, education and support—in increasing BFing self-efficacy (BSE), that is "the belief in one's capabilities to achieve a goal or perform a task" (p. 487). It "can influence

personal motivation and ability to succeed" (Brockway et al., 2017, p. 487). The studies in Brockway et al.'s (2017) review used the "Breastfeeding Self-Efficacy Scale–Short Form" which produces scores from 14–70; they found that educational interventions increased BSE scores by 2.66 points at 1 month postpartum, but this did not translate to improved BFing rates. They also found that "only interventions delivered in the postpartum period and in a combination of settings significantly improved BSE and BFing rates. … Interventions delivered prenatally or solely in the community or hospital setting did not have any significant effects on BSE or BFing rates" (Brockway:2017cq p494-495; see also, Sinha et al., 2015). Interventions that were informed by BSE theory also had a greater influence on BSE and BFing rates, demonstrating that the content, not just the existence, of interventions is important (Brockway et al., 2017). Literature concerning the information needs of BFers, and therefore specific content of interventions, is examined in Chapter 3.

Studies demonstrate that peer and community support is often preferred over LCP support. For example, McInnes and Chambers's (2008) qualitative synthesis found that support from health services was "described unfavourably with emphasis on time pressures, lack of availability of healthcare professionals or guidance, promotion of unhelpful practices and conflicting advice" (p. 407). Relatedly, Burns and Schmied (2017) found that those supporting BFing, whether peers or LCPs, are most effective when they can be characterized as "a knowledgeable friend," rather than as "resorting to 'prescriptive advice-giving'" (p. 395). This is reflected in a number of other studies demonstrating the effectiveness of support groups, even when there is no official peer supporter or LCP (Fox, McMullen, & Newburn, 2015; Hoddinott, Chalmers, & Pill, 2006; Rayfield, Oakley, & Quigley, 2015). While there may be a preference for peer support, Taveras et al. (2003) found that encouragement from a BFer's clinician was

positively associated with continuation of BFing at 12 weeks postpartum, thus indicating the importance of receiving BFing support from all quarters.

2.4.2.10. Breastfeeding and the workplace. This topic exists in both a BFer's microsystem, as support and facilities in their specific workplace, and their outer macrosystem, as law and policy affecting workplace provision and employment practices more generally. The latter will be examined below.

Those employed full time are less likely to initiate BFing and tend to stop earlier (Mirkovic, Perrine, Scanlon, & Grummer-Strawn, 2014a; 2014b; A. S. Ryan, Zhou, & Arensberg, 2006). Similarly, the earlier a BFer returns to work, the less likely they are to continue BFing—exclusively or at all (Calnen, 2010; Islam et al., 2017; Mirkovic, Perrine, Scanlon, & Grummer-Strawn, 2014b; Ogbuanu, Glover, Probst, Liu, & Hussey, 2011; J. A. Scott et al., 2001). Of the IFPS II respondents stopping BFing 1–5 months postpartum, over one-fifth said that not wanting or being able to BF or pump at work was an important reason for stopping (R. Li et al., 2008b). Shealy, Benton-Davis, and Grummer-Strawn (2005) note that several studies have demonstrated the effectiveness of workplace lactation programs in increasing both the duration and exclusivity of BFing. Workplace support has a positive impact on the BFer's work experience and productivity, overall staff loyalty, and the employer's public image and decreases absenteeism, healthcare costs, and employee turnover (Shealy et al., 2005).

In their systematic review, Dinour and Szaro (2017) reviewed workplace lactation and/or BFing support programs. They found that the most common program in the literature was provision of a lactation space, followed by BFing breaks and comprehensive lactation support programs, all of which had at least one positive outcome, whether related to BFing or not

(Dinour & Szaro, 2017). The CDC's *Guide to BFing Interventions* (Shealy et al., 2005) made a plethora of suggestions for workplace BFing support, including:

> Writing corporate policies to support BFing women; teaching employees about BFing; providing designated private space for BFing or expressing milk; allowing flexible scheduling to support milk expression during work; giving mothers options for returning to work, such as teleworking, part-time work, and extended maternity leave; providing on-site or near-site child care; providing high-quality breast pumps; and offering professional lactation management services and support. (p. 7)

Of critical importance is actually setting up and maintaining a supportive workplace: Ryan et al. (2013) noted that workplace programs are "often not enforced and are inadequately implemented, particularly in unskilled and low-income occupations" (p. 468). Relatedly, employers need to be proactive in their support of parents returning to work; in their study of BFing mothers in Ireland, Desmond and Meaney (2016) found that "many did not disclose to their employers that they were BFing and did not make enquiries about being facilitated to continue to breastfeed after their return to the workplace" (p. 881) and therefore perceived a lack of support.

2.4.3. Institutional: The Exosystem

2.4.3.1. Labor, delivery, and immediate postpartum circumstances. Many options exist for labor and delivery (L&D) and the days following, yet most births occur in a hospital setting (98.5% in 2014 in the United States, (MacDorman & Declercq, 2016); 97.7% in 2015 in the United Kingdom (Office for National Statistics, 2017)). Because hospital practices greatly affect BFing outcomes (CDC, 2015), the WHO developed the Baby-Friendly Hospital Initiative (BFHI) in 1991 (WHO, 2018a). Figure 6 illustrates the 10 steps hospitals must employ to be designated baby-friendly.

Figure 6. The Baby-Friendly Hospital Initiative Ten Steps to Successful Breastfeeding poster (WHO, n.d.).

A number of studies have shown the positive effects of the BFHI Ten Steps on BFing outcomes (Declercq, Labbok, Sakala, & O'Hara, 2009; DiGirolamo, Grummer-Strawn, & Fein, 2008; Merewood, Mehta, Chamberlain, Philipp, & Bauchner, 2005). One study found that "the mean breastfeeding initiation rate for the 28 Baby-Friendly hospitals in 2001 was 83.8%, compared with an overall US breastfeeding initiation rate of 69.5%" (Merewood et al., 2005, p. 628). DiGirolamo et al. (2008) found that those who experience none of the BFHI Ten Steps were almost 13 times more likely to have stopped BFing by 6 weeks postpartum versus those who had experienced L&D in hospitals following at least six of the Ten Steps.

Type of labor and delivery. Epidurals and/or analgesics administered during L&D significantly affect BFing outcomes (Beilin et al., 2005; Dozier et al., 2012; Gubler et al., 2013; M. O'Connor, Allen, Kelly, Gao, & Kildea, 2017; Torvaldsen, Roberts, Simpson, Thompson, & Ellwood, 2006). In one study, those having had an epidural anesthesia were overall 1.26 times more likely to have stopped BFing at 1 month postpartum; the BFHI designation had a positive impact, however, as those having epidurals in BFHI hospitals were only 1.19 times more likely to stop by 1 month, compared with 1.65 times higher likelihood among those having epidurals in non-BFHI hospitals (Dozier et al., 2012). O'Connor et al. (2017) found that those who were not exposed to opioid analgesics (regardless of method of administration) during L&D were over two times as likely to be exclusively BFing at 3 months postpartum. Even among those who had BF a previous child, opioid epidurals (in this case, fentanyl) were significantly associated with BFing cessation (Beilin et al., 2005). L&D medications—whether analgesics or pitocin (synthetic oxytocin) to aid labor—produce side effects in the newborn, often detrimental to the initiation of BFing (Brimdyr et al., 2015; Marín Gabriel et al., 2015; Nissen et al., 1995).

Those who delivered via C-section have poorer BFing outcomes (Dewey et al., 2011; Hobbs, Mannion, McDonald, Brockway, & Tough, 2016; Pérez-Ríos, Ramos-Valencia, & Ortiz, 2008; Rowe-Murray & Fisher, 2002). Those who delivered by planned C-section are less likely to have the intention to BF, less likely to initiate BFing, and BF for shorter durations, whereas those who delivered by emergency C-section have similar intention and initiation rates to those delivering vaginally, but are more likely to have BFing difficulties (Hobbs et al., 2016; Zanardo et al., 2012). Similarly, in multiparas with a previous C-section, those who delivered vaginally or labored but ultimately had an unplanned C-section were significantly more likely to BF than those who delivered via planned C-section (Regan, Thompson, & DeFranco, 2013). Interestingly, Watt et al. (2012) found that the method of delivery in itself was not predictive of BFing initiation, but that those experiencing an unexpected delivery method (unplanned C-section or instrument-assisted vaginal delivery) were significantly more likely to initiate BFing and continue through to 6 weeks postpartum. As with epidurals, BFHI hospitals produce better BFing outcomes after C-section deliveries; however, Step 4 of the BFHI Ten Steps (initiate BFing within half an hour of birth) still proves challenging (Rowe-Murray & Fisher, 2002). Both L&D analgesics and C-section deliveries are associated with the delayed onset of lactogenesis II (Dewey et al., 2011; Lind, Perrine, & Li, 2014a).

Care right after birth. Direct skin-to-skin immediately following birth has a positive effect on BFing outcomes (Aghdas, Talat, & Sepideh, 2014; Bier, 1996; Bramson et al., 2010; Gubler et al., 2013; E. R. Moore & Anderson, 2010; Tootelian, Roman, & Cruz, 2014). Bramson et al. (2010) found that the relationship between exclusively BFing during the postpartum hospital stay and skin-to-skin was dose-dependent: the longer the early skin-to-skin, the higher the likelihood of BFing exclusivity. A more recent study did not find this dose-dependent

relationship at 4 and 8 weeks postpartum; it did, however, find a positive association between skin-to-skin of any length and exclusively BFing at these time intervals (Ruxer, Brewer, Mateer, Burkhardt, & Shay, 2015). Most studies have found that BFers who had early skin-to-skin are more likely to continue BFing and to BF for longer (Bier, 1996; Mikiel-Kostyra, Mazur, & Boltruszko, 2007; Sharma, 2016); however, several studies found that skin-to-skin did not affect BFing duration (E. R. Moore & Anderson, 2010; Redshaw, Hennegan, & Kruske, 2014). Nevertheless, BFers who had skin-to-skin with their newborns had higher BSE scores and increases in the duration of Exclusive BFing (Aghdas et al., 2014). In addition, newborns who were held skin-to-skin in the first hours after birth had better sucking abilities and achieved effective BFing sooner (E. R. Moore & Anderson, 2010), both essential for establishing milk supply and therefore avoiding formula supplementation (Bigelow, Power, MacLellan Peters, Alex, & McDonald, 2012).

Newborns that BF within the first hour of birth are significantly more likely to be still exclusively BFing 2–4 (DiFrisco et al., 2011) and 6 (DiGirolamo et al., 2008) weeks after hospital discharge. In addition, one study found that if bathing a newborn was done around 12 hours after birth, rather than around 2 hours after, in-hospital BFing initiation and exclusivity increased significantly (Preer, Pisegna, Cook, Henri, & Philipp, 2013).

Rooming in. Older literature supports the use of rooming in—that is, a newborn stays in the same room as the parent during their hospital stay—to increase BFing initiation and exclusivity (Buranasin, 1991; e.g., McBryde, 1951; Procianoy, Fernandes-Filho, Lazaro, Sartori, & Drebes, 1983). Some recent studies have found no conclusive evidence to suggest a strong connection between rooming in and BFing outcomes (DiGirolamo et al., 2008; Jaafar, Ho, & Lee, 2016; Perrine, Scanlon, Li, Odom, & Grummer-Strawn, 2012); however, Scott et al. (2001)

found that those whose infants had spent any time in the nursery were 22% more likely to stop BFing during the first 6 months postpartum. Relatedly, Gubler et al. (2013) found that rooming in for less than a full 24 hours per day was significantly associated with non-HM and non-nursing feedings, both risk factors for poorer BFing outcomes. It has been suggested that rooming in/use of the nursery is not causally connected to BFing, but rather indicative of attitudes towards infant feeding (R. P. K. Ford et al., 1994).

Supplementation. Multiple studies have found that in-hospital supplementation of BFing with formula reduces the duration and exclusivity of BFing (Boban & Zakarija-Grković, 2016; Chantry, Dewey, Peerson, Wagner, & Nommsen-Rivers, 2014; DaMota, Bañuelos, Goldbronn, Vera-Beccera, & Heinig, 2012; DiGirolamo et al., 2008; Kind, Schubiger, Schwarz, & Tonz, 2002; M. O'Connor et al., 2017). For example, O'Connor et al. (2017) found that those who did not formula feed in the hospital had a 2.44 times higher chance of still exclusively BFing at 3 months postpartum; Chantry et al. (2014) found the risk of BFing cessation by 60 days postpartum was 2.7 times higher for those who used formula in the hospital. Boban and Zakarija-Grković (2016) found that only 25% of the reasons given for supplementation were categorized as medically acceptable. Relatedly, DaMota, et al. (2012) categorized the decisions to FF into three categories, all unrelated to the newborn's medical need: "inadequate preparation for newborn care (the need for rest and unrealistic expectations about infant behavior), lack of preparation for the process of breastfeeding, and formula as a solution to breastfeeding problems" (p. 466). Furthermore, one study found that giving only HM while in hospital after birth significantly helped BFers meet their Exclusive BFing intentions, regardless of what those were (Perrine et al., 2012).

Forster et al. (Forster et al., 2015) found that BFers who only nursed, rather than

expressed HM, were 1.8 times more likely to still be feeding some HM at 6 months postpartum. Likewise, numerous studies have found that artificial nipples (bottle feeding, pacifier use, and nipple shield use) resulted in a significantly greater risk of stopping BFing (Declercq et al., 2009; Dewey et al., 2011; DiGirolamo et al., 2008; Perrine et al., 2012; e.g., Pincombe et al., 2008).

2.4.3.2. Formula marketing. Early formula supplementation once discharged from hospital also decreases BFing duration and exclusivity, for reasons already discussed (P. D. Hill, Humenick, Brennan, & Woolley, 2016). Likewise, providing formula or formula coupons on discharge from hospital was significantly associated with poorer BFing outcomes (Rosenberg, Eastham, Kasehagen, & Sandoval, 2008; Sadacharan, Grossman, Matlak, & Merewood, 2014); this practice, however, has declined greatly over the past decade (Nelson, Li, & Perrine, 2015; Strader & Kehres, 2016). Providing formula "educational" packs at a pregnant person's first prenatal visit has been significantly associated with BFing cessation before hospital discharge or within the first 2 weeks (Howard et al., 2000). Furthermore, one study found that mothers interpret formula marketing in ways that decrease their confidence in their ability to BF, especially when formula is provided by healthcare professionals and institutions (Parry, Taylor, Dardess, Walker, & Labbok, 2013).

The marketing of infant formula has been the subject of a major WHO campaign since 1981 when they adopted the International Code of Marketing of Breast-milk Substitutes ("the WHO Code;" WHO, 2017). Although the WHO Code is not perfect—especially with regards to breast pumps (e.g., "Make the Breast Pump Not Suck!" Hackathon, n.d.)—it is, nevertheless:

> An important part of creating an overall environment that enables mothers to make the best possible feeding choice, based on impartial information and free of commercial influences, and to be fully supported in doing so. Inappropriate marketing of food products that compete with breastfeeding is an important factor that often negatively affects the choice of a mother to breastfeed her infant optimally. (WHO, 2017, p. 5)

Furthermore,

> The Code explicitly states that there should be no advertising or other form of promotion to the general public. This would include any advertising through mass media outlets such as television, magazine, billboards, websites, or social media. In addition, manufacturers and distributors of breast milk substitutes should not provide samples of their products to pregnant women, mothers or members of their families. Promotion through other means, such as special displays, discount coupons, price reductions, or special sales, is also prohibited. Furthermore, no company personnel should seek direct or indirect contact with, or provide advice to, pregnant women or mothers, whether this is in retail outlets or through social media channels. (WHO, 2017, p. 10)

While 135 countries (out of 194 WHO Member States) have some sort of legal measure covering at least some of these requirements, only 39 countries have comprehensive restrictions on formula marketing reflecting all or most of the WHO Code (WHO, UNICEF, IBFAN, 2016). The legal status of the WHO Code provisions in countries of particular relevance to this proposal (i.e., survey respondents' countries of residence) are listed in Table 1.

Table 1. Legal status of WHO Code in selected countries (WHO et al., 2016, pp. 47-51).

Country	Year of most recent legal measure	Legal status of the Code[a]
Australia		No legal measures
Belgium	2013	Few provisions in law
Canada[b]		Few provisions in law
Denmark	2013	Few provisions in law
Finland	2013	Few provisions in law
France	2013	Few provisions in law
Germany	2013	Few provisions in law
Greece	2013	Few provisions in law
Guatemala	1983	Full provisions in law
India	2003	Full provisions in law
Indonesia	2012	Many provisions in law
Ireland	2013	Few provisions in law
Israel		Few provisions in law
Kuwait	2014	Full provisions in law
Malaysia		No legal measures
Mauritius		No legal measures
Mexico		Many provisions in law
New Zealand		No legal measures
Peru	2006	Full provisions in law
Philippines	2006	Full provisions in law
Qatar[b]	2000	Few provisions in law
Singapore		No legal measures
South Africa	2012	Full provisions in law
Sweden	2013	Few provisions in law
United Arab Emirates[b]	1983	Few provisions in law
United Kingdom	2013	Few provisions in law
United States of America		No legal measures

Notes.
[a] Scale: No legal measures; Few provisions in law; Many provisions in law; Full provisions in law.
[b] These countries have no dedicated Code legislation, but have Code-related provisions incorporated in other legal measures.

Of particular concern is formula marketing during healthcare visits, such as in pediatrician or obstetrician waiting rooms or during the actual consultations, implying endorsement by healthcare professionals and institutions (Foss, 2017; Howard et al., 2000; Meek, Hatcher, AAP Section on Breastfeeding, 2017; Parry et al., 2013; Sobel et al., 2011). However, many pediatricians' offices contain a plethora of formula marketing materials: in Dodgson et al.'s (2014) study, of the 100 waiting rooms that had materials of any kind displayed, not one was WHO Code compliant; 81 had promotional materials for formula readily available. Only 18% of waiting rooms had any BFing support and/or information materials (Dodgson et al., 2014). It was not until May 2017 that the AAP published guidance on how to set up a "Breastfeeding-friendly pediatric office practice" (Meek et al., 2017).

2.4.3.3. Influence of popular media and the "Mommy Wars." Mass media campaigns, delivered by television, radio, magazines, cell phone messages, and the internet, can be effective in producing positive or reducing negative changes in health behavior (Institute of Medicine, 2002; Wakefield, Loken, & Hornik, 2010). Specifically regarding BFing, a number of studies employing varying techniques have demonstrated the effectiveness of media campaigns to increase both BFing initiation and exclusivity (E. J. Baker, Sanei, & Franklin, 2006; Crookston, Dearden, Chan, Chan, & Stoker, 2007; Findley et al., 2013; Flax et al., 2014; Jiang et al., 2014; Nguyen et al., 2014; Sun et al., 2011; Zhang, Carlton, & Fein, 2013). In addition, media exposure can positively affect normative beliefs about BFing (Foss & Blake, 2018; Nguyen et al., 2014) and increase perceptions of BSE (Nguyen et al., 2014). However, representations of BFing, particularly in fictional television shows, is often problematic. For example, Foss (Foss, 2013) found that representations of BFing in U.S. prime-time fictional television:

> Consistently conveyed that for a certain group of women [White, educated, and older], in a private place, for a newborn, breastfeeding is natural, beautiful, and easy. However, outside this narrow definition of "normal," breastfeeding is presented as absurd, unnecessary, socially unacceptable, or deviant. The benefits and obstacles of breastfeeding largely focused on individual women, rather than many of the macro-level issues that influence breastfeeding (i.e., hospital practices that interfere with breastfeeding). These findings were consistent with previous literature that suggests that contemporary media tend to present breastfeeding positively, but as a difficult endeavor for the individual woman. (p. 336)

Furthermore, in their study of 375 undergraduate students at a southeastern U.S. public university, Foss and Blake (2018) found that, although the predominantly (all but six) childless participants knew that BFing is healthier than FFing and were theoretically accepting of BFing, they were "uncomfortable with seeing BFing and questioned the practice of nursing older babies and toddlers" (p. 8). The authors therefore conclude that messages about the benefits of BFing have been successful, but that much more media coverage of BFing toddlers, BFers from a variety of backgrounds and geographical regions, and the obstacles facing BFers is needed (Foss & Blake, 2018).

The "Fed is Best" campaign. According to their website, the Fed is Best Foundation "works to identify gaps in current BFing protocols, guidelines, and education programs, and provide families and health professionals with the most up-to-date scientific research, education and resources to practice safe infant feeding with breast milk, formula, or a combination of both" (Fed is Best Foundation, 2016). They support formula feeding in the first few days of life to prevent dehydration, starvation, and jaundice, which the founder of the campaign implies, with little scientific evidence, are linked to autism and other developmental disorders (LeMieux, 2016). A plethora of criticisms have been leveled at the campaign, namely misinformation allegedly based on scientific studies, their unwillingness to meet and work with other infant feeding groups, refusal to acknowledge that feeding a baby is bare minimum, and the overall impression they create of BFing proponents leaving newborns to starve rather than feed formula

(A. Brown, 2017; Cassels, 2015; LeMieux, 2016; Seals Allers, 2017). Nevertheless, the Fed is Best movement has gained traction and widespread media coverage (Fed is Best Foundation, 2018). What is unknown is the effect it is having on BFing outcomes.

The "Mommy Wars." Predominantly a battle between stay-at-home and working mothers played out in the popular media, the "Mommy Wars" asks "who is the better mother?" and, ultimately, perpetuates the culture of mother-blame in which mothers are blamed for causing problems, delays, or disorders in their child (Zimmerman, Aberle, Krafchick, & Harvey, 2008). The "motherhood ideology" is one of "intensive mothering" that "requires mothers to be consistently attentive to their children's needs and demands and by doing so, frequently sets women's own interests aside" (Crowley, 2015). Mommy Wars extends to BFing: for example, a 2012 *Time Magazine* cover, seen in Figure 7, featured a mother BFing her 3-year-old with the accompanying text "Are you mom enough?"—a provocation aimed to question maternal choices and competence.

Figure 7. Time Magazine cover, May 21, 2012 (Time 2012; photograph by Schoeller, 2012).

Mommy Wars have been criticized for dividing mothers and pitting them against each other, rather than focusing attention on solving the struggles faced by all mothers (Akass, 2013; J. Moore & Abetz, 2016; Zimmerman et al., 2008), and for being over-played in the media when they have little consequence in mothers' everyday lives (Akass, 2012; 2013; Crowley, 2015). Although no direct study appears to have been conducted on the effects of the Mommy Wars on

BFing, they have the potential, on the one hand, to intensify feelings of guilt in those that struggle, fail, or do not want to BF and, on the other, to present FFing as equivalent.

2.4.4. Community and Culture: The Inner Macrosystem

2.4.4.1. Race and ethnicity. There is a marked difference in BFing rates between different racial and ethnic groups (Table 2).

Table 2. 2014 Breastfeeding rates by race/ethnicity in the United States (CDC, 2014).

	Non-Hispanic White	Non-Hispanic Black	Hispanic	Asian	Hawaiian/ Pacific Islander	American Indian/ Alaska Native	2 or more races
Ever BF (%)	**85.7**[a]	68.0[b]	**84.8**	80.7	79.9	79.5	79.9
BF at 6 months	60.0	41.5	52.5	**61.9**	**68.1**	52.8	53.4
BF at 12 months	**37.8**	21.5	31.7	**37.5**	31.7	29.7	32.8
EBF[c] thru 3 months	**51.5**	32.7	45.5	44.3	**59.5**	51.2	42.5
EBF thru 6 months	**27.9**	15.0	24.5	27.6	**29.9**	26.5	21.2

Notes
[a] Bold lettering indicates the two highest values for each BFing category.
[b] Highlighted lettering indicates the two lowest values for each BFing category.
[c] Exclusively breastfed

Table 2 shows that, in the United States, Black parents have the lowest rate of BFing in every category, American Indians/Alaska Natives and mixed race parents also have low rates of initiation and duration of BFing (CDC, 2014). Likewise, in Canada, indigenous people have the

lowest BFing initiation rate (77.8%); in contrast, Blacks have the highest rate (93.9%) (Health Canada, 2012). Most research around race/ethnicity BFing disparities has been carried out in the United States; data from other national agencies—in Australia and the United Kingdom, for example—do not appear to disaggregate race/ethnicity.

The low rate of BFing by Black Americans has been the subject of several studies. Bentley et al. (Bentley et al., 1999) confirmed prior studies documenting the early introduction of semi-solid foods (namely cereal mixed with some form of milk in a bottle) to infants even as young as 1–2 weeks old. Reasons for this included a perception that formula was inadequate, the infant's size and appetite required it, a concern about sleeping and crying, and a lack of distinction between adult and infant diets (Bentley et al., 1999). In addition, infant behavior such as sleeping through the night or a "greedy" appetite validated the decision to introduce semi-solid foods (Bentley et al., 1999). In a later paper, Bentley, Dee, and Jensen (2003) applied a social ecological framework (akin to the framework utilized in this proposal) to analyze the influences on Black Baltimoreans' infant feeding decisions: microlevel factors (media, aggressive formula marketing, welfare reform, hospital policies, and BFing programs) interacted with macrolevel factors (features of the community, neighborhoods, workplaces, social and personal networks, cultural norms, and individual beliefs) (Bentley et al., 2003).

Nationwide, Lind, Perrine, Scanlon, and Grummer-Strawn (2014b) found that hospitals in areas with more than 12.2% Black residents were significantly less likely to utilize any of the BFHI Ten Steps that support BFing. Black BFing rates are especially sensitive to in-hospital formula supplementation (McKinney et al., 2016). Black women are 2.08 times more likely to express comfort with FFing than other races; a comfort level that mediates 37% of the disparity in BFing intentions between Black and non-Black women (Nommsen-Rivers et al., 2010).

Another factor disproportionately affecting Black BFing rates is the perception of breasts as a sexual object, not designed to feed a child (Obeng, Emetu, & Curtis, 2015; Spencer, Wambach, & Domain, 2014).

The low Black BFing rate creates an increase in negative outcomes. For example, Bartick et al. (2017) found that the Black population had 1.7 times the number of ear infections cases, 3.3 times the number of NEC cases, and 2.2 times the number of child deaths because of suboptimal BFing rates. Weden, Brownell, and Rendall (2012) found that short duration or no BFing by Black mothers is "among the significant determinants of racial disparities in childhood obesity" (p. 2062). Black mothers are aware of the health benefits of BFing, but lack the information and supportive environment needed to be successful (Obeng et al., 2015).

In their critical review, Chapman and Pérez-Escamilla (2012) found that BFing rates by minorities (here, Hispanic and Black women) were increased through peer counseling interventions, BFing-specific clinic appointments, group prenatal education, and hospital/WIC enhancements. Cricco-Lizza's (2006) findings stressed the importance of nurses and physicians building trust and rapport with low-income Black mothers, as participants in her study expressed distrust and anxiety about the way they were treated. Other suggestions to increase BFing rates by Black Americans has included increased use of smartphone-based social media to convey knowledge and change cultural norms (Asiodu et al., 2015).

While Hispanic parents have a high rate of BFing initiation—and the highest likelihood of BFing in their maternal family history (McKinney et al., 2016)—they have one of the lowest BFing rates by 6 months postpartum (CDC, 2014). Research shows that Hispanic mothers have significantly lower maternal knowledge and BSE (Alghamdi, Horodynski, & Stommel, 2017), which perhaps contribute to difficulties in sustaining BFing. In addition, this group is also the

most likely to perceive that HM is not enough to sustain their baby and therefore most likely to supplement with formula (Chapman & Pérez-Escamilla, 2012). This contributes to the lower rates of exclusivity seen above, as well as the vicious cycle of milk supply issues that supplementation often causes.

2.4.4.2. Socioeconomic status and education. Higher SES is consistently associated with higher BFing rates (Callen & Pinelli, 2004; Demirci et al., 2013; Gökçeoğlu & Küçükoğlu, 2017; Heck, Braveman, Cubbin, Chávez, & Kiely, 2016; A. J. Khoury, Moazzem, Jarjoura, Carothers, & Hinton, 2005; Liamputtong, 2010; Pineda, 2011; Stuebe et al., 2014; Victora et al., 2016). A number of reasons have been suggested for this association: lack of information (A. McFadden, Renfrew, Dykes, & Burt, 2006; Taveras et al., 2003); lack of support (A. J. Khoury et al., 2005; Lavender, McFadden, & Baker, 2006); and a need to return to work (A. Arora et al., 2017; Fein & Roe, 1998; Haider, Ashworth, Kabir, & Huttly, 2000; Kimbro, 2006) among lower SES parents. Similarly, higher education levels are also strongly associated with higher BFing rates (A. Arora et al., 2017; Callen & Pinelli, 2004; Demirci et al., 2013; Gökçeoğlu & Küçükoğlu, 2017; Heck et al., 2016; J. F. Ludvigsson & Ludvigsson, 2007; Victora et al., 2016).

In their study of BFing among late preterm infants, Demici et al. (2013) found that SES—specifically, being a WIC recipient—was, on its own, associated with lower BFing initiation, but if the WIC recipient was Black, it was associated with higher BFing initiation rates. They also found that, on their own, being married and increasing education were both associated with higher BFing initiation, but when analyzed together (i.e., the participant was both married and had a higher education level), BFing initiation rates were lower (Demirci et al., 2013). They conclude that "BFing behavior is a complex phenemenon [*sic*], heavily influenced

by non-modifiable socio-demographic factors in a non-additive manner" (Demirci et al., 2013, p. 282).

Despite being a complex phenomenon, Raisler (2000) identified interventions that enabled her low-income BFers to succeed:

> Mothers said that helpful BFing care providers knew correct information, established supportive personal relationships, referred women to BFing specialists for problems, showed enthusiasm for nursing, and facilitated BFing through concrete actions during the prenatal, intrapartum, and postpartum periods. (p. 253)

Furthermore,

> Women valued their BFing peer counselors for responding promptly to distress calls, making home visits, being knowledgeable about BFing, providing hands-on assistance, and acting personal and caring. (Raisler, 2000, p. 253)

In addition, Chamberlain, McMahon, Philipp, and Merewood (2006) hypothesized that providing breast pumps increased BFing rates by 54 percentage points in their inner-city population:

> For women who need a breast pump, lack of access can end hopes of providing human milk for their newborn. … In Western society, many women no longer stay home with their children for the first year of life and beyond, and a breast pump is as important as day care and transportation for women who need help to support their families and pursue their careers. (p. 97–98)

2.4.4.3. Culture. McKinney et al. (2016) noted that, despite their low SES status, the BFing norms in the native countries of the Spanish-speaking Hispanics in their study seemed to overcome the association between low SES and low BFing rates. Thus, the importance of culture and norms in BFing rates cannot be understated (Eidelman, 2016). Biologically-speaking, BFing a child for between 2.5–7 years is normal for the human species, yet cultural norms push this down to the lower end of this range (Dettwyler, 2004). Extended BFing—that is, longer than 3 years—is exceptionally uncommon in the developed world (estimated to be less than 2% of all children (Dettwyler, 2004)). Unfortunately, because attitudes towards BFing, especially in

public, are often negative and unsupportive (Bock, Pain, & Jhang, 2017; Henderson, McMillan, Green, & Renfrew, 2011; Saha, 2002; Spear, 2007), BFing rates suffer.

Seeing others BF is critical to increasing BF rates and improving attitudes towards BFing (Henderson et al., 2011; Hoddinott & Pill, 1999). For example, Hoddinott and Pill (1999) found that exposure to a stranger BFing had a negative impact on their study's participants (low-income, White women from London), whereas "when breast feeding was witnessed as part of normal everyday life by both the woman and her family and friends she was more confident in her own ability to breast feed and committed to her decision" (p. 32). Societal beliefs about HM itself, especially colostrum (excretions from the breast, around the time of birth, prior to lactogenesis II), are particularly important (Liamputtong, 2010).

As discussed above, despite evidence to the contrary (Pisacane & Continisio, 2004; Rinker et al., 2008), there is still the perception that BFing will cause "unattractive" breasts (Saha, 2002). Professional advice literature is peppered with advice about the necessity for a BFer to resume sexual intimacy with their male partners and to "reassure men that female breasts are still theirs and that the primary purpose for his female partner's breasts are for his pleasure" (Saha, 2002, p. 68). Instead of challenging the strong association of breasts and nipples with sex (Bock et al., 2017; Henderson et al., 2011), "the focus is on how best to *conceal* one's breasts while BFing in public" (Saha, 2002, p. 65). Saha (2002) goes on to say:

> Good manners dictate that one does not offend others in public while one is breastfeeding; the exposure of female breasts is so steeped in sexual connotations in modern-day Western society that the good mother has no choice but to arrange her day, her schedule, and the way she breast-feeds such that her breasts are never in view to the public. (p. 66)

Some BFing advice books even suggest that expressing milk and bottle feeding is more acceptable (Saha, 2002)—which Saha (2002) argues combines with other pressures to create a situation in which "the woman is not visible; that her milk is all that matters; and that the

complex bonding interaction between the woman and her baby, which includes sexual meaning, is at once both trivial and to be feared" (p. 66). Henderson et al. (2011) stress the importance of including "advice on tackling problems generated by wider sociocultural issues of sexuality and masculinity" (p. 61) in prenatal/postpartum education with men.

2.4.5. Policy and Law: The Outer Macrosystem

The law and policies at the macrosystem level have overarching effects. For example, the effect of maternity leave is substantial, with longer leave resulting in longer BFing duration (Calnen, 2010; Mirkovic, Perrine, Scanlon, & Grummer-Strawn, 2014b). Paternity leave also significantly increases the likelihood of an infant still being BF at 2, 4, and 6 months (Flacking et al., 2010). It is worth noting that the mere existence of statutory leave and pay does not automatically lead to higher BFing rates. For example, the United Kingdom has statutory maternity leave for up to 52 weeks, paid for up to 33 weeks (Gov UK, n.d.), yet has one of the worst BFing rates in the world at 6 and 12 months (34% and 0.5% respectively; Boseley, 2017); despite the United States having no requirement for employers to provide paid family leave, 6 and 12 month BFing rates are 56% and 34% respectively (CDC, 2014).

A number of other laws protect BFing. In the United States, stronger protections in state law, for example enforcement of workplace pumping laws, have been associated with increased BFing at 6 months (Smith-Gagen, Hollen, Tashiro, Cook, & Yang, 2014). On a federal scale, the Patient Protection and Affordable Care Act passed in 2010 requires most medical insurers to provide BFing support services, including a free breast pump, and most employers to provide breaks and a non-bathroom, private location to express HM while at work (United States Breastfeeding Committee, 2018). The Affordable Care Act has had a positive effect on BFing rates: while one study showed that the probability of BFing initiation increased by 2.5 percentage

points (Kapinos, Bullinger, & Gurley-Calvez, 2016), a second study found that the Affordable Care Act was associated with a 10% increase in BFing duration and a 21% increase in Exclusive BFing duration (Gurley-Calvez, Bullinger, & Kapinos, 2018). The effects of laws protecting BFing in other countries, such as the Equality Act of 2010 in the United Kingdom and the Sex Discrimination Act of 1984 in Canada, are not as easily tracked and therefore little is known about the effects of legislation in general on BFing outcomes.

2.4.6. Summary of Factors Affecting Breastfeeding

Figure 8 depicts the factors affecting BFing initiation, exclusivity, duration, and cessation that have just been examined.

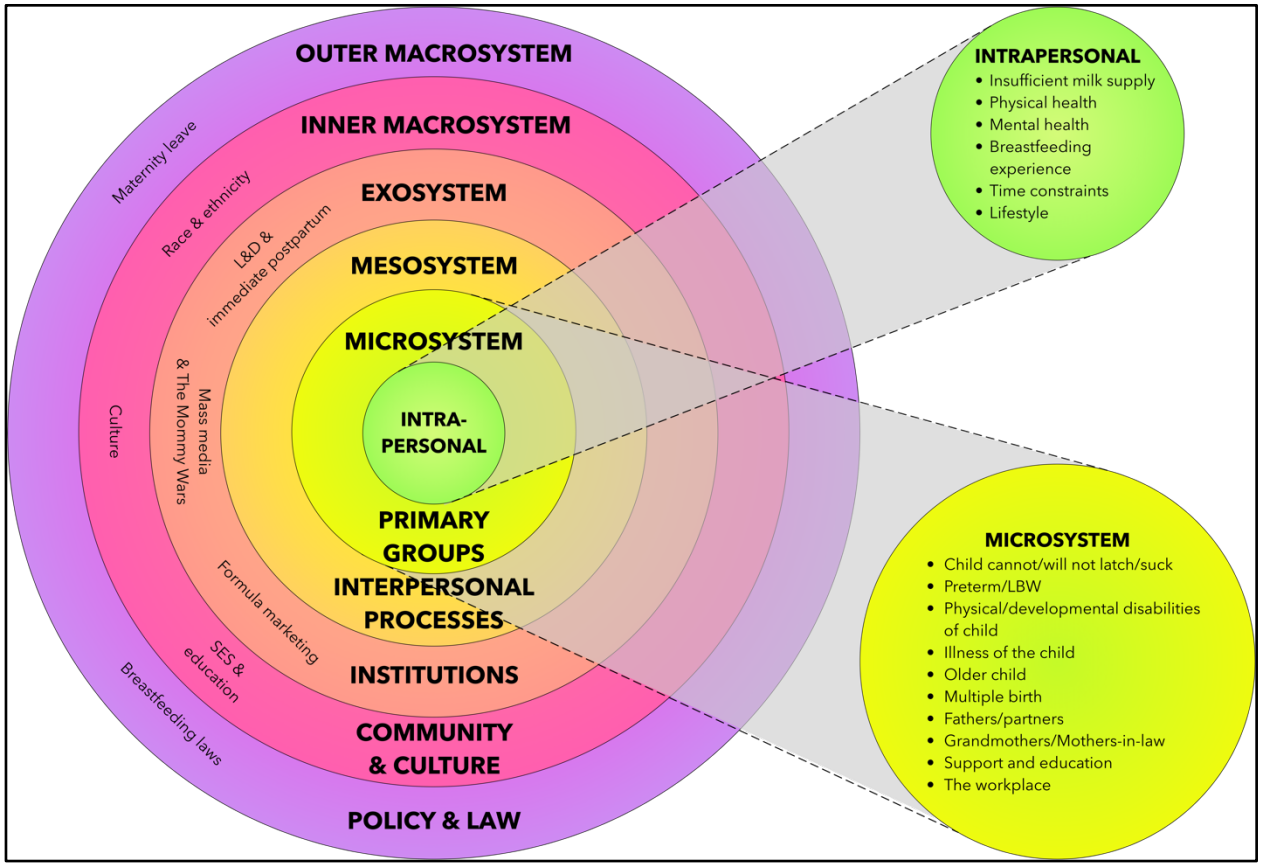

Figure 8. Factors affecting breastfeeding within the ecological framework.

2.5. Milk Expression and Exclusive Pumping

There are a number of combinations for BFing and FFing, all of which exist on a spectrum. For example, one child may be exclusively nursed, in which case they will be receiving no formula and no bottles, whereas another may receive all their milk in bottles, but be consuming a combination of formula and HM. If the HM in those bottles comes from a BFer who only expresses milk, then that person is an EPer, whether the child consumes 1% or 100% HM. Felice and Rasmussen's (2015) framework provides diagrammatic representation of the BFing spectrum (Figure 9).

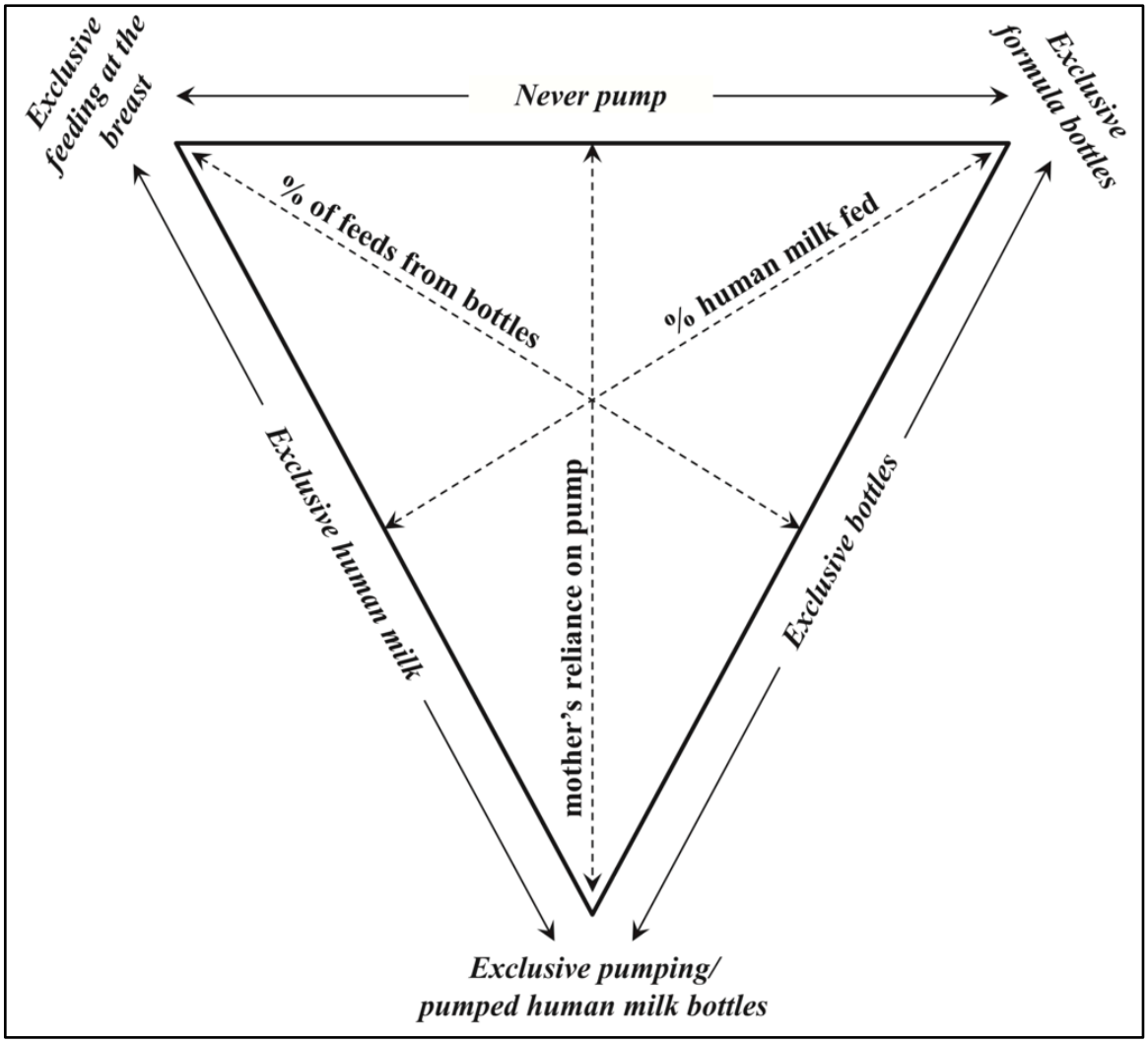

Figure 9. The breastfeeding spectrum according to Felice and

Rasmussen (2015).

2.5.1. Prevalence of Milk Expression

2.5.1.1. Non-exclusive expression. In the developed world, it appears that milk expression is ubiquitous among lactating people. For example, Johns, Amir, McLachlan, and Forster (2016) found that 62% of their Australian sample had already expressed milk by 2 weeks postpartum (52% before hospital discharge); by 6 months postpartum, 85% of respondents had expressed milk and 83% had a breast pump. Another Australian study found that 98% of all respondents had expressed milk (Clemons & Amir, 2010).

Labiner-Wolf, Fein, Shealy, and Wang's (2008) analysis of IFPS II found that 85% of those who had breastfed between 1.5–4.5 months postpartum had successfully expressed milk. Of those continuing to breastfeed after this time, 92% had expressed milk at some time (Labiner-Wolfe et al., 2008). All 40 respondents in Geraghty, Sucharew, and Rasmussen's (2012) study had expressed milk. In a more recent study, 15% of respondents had already started expressing before leaving the hospital after giving birth, with over one-quarter of them citing latch problems as the reason (Loewenberg Weisband, Keim, Keder, Geraghty, & Gallo, 2017).

2.5.1.2. Exclusive expression. In the United States, Geraghty, Khoury, and Kalkwarf (2005) found that 5% of respondents EPed, but all were mothers of premature infants, whereas Shealy, Scanlon, Labiner-Wolfe, Fein, and Grummer-Strawn's (2008) analysis of IFPS II data found the rate of EPing by mothers of infants born from 35 weeks' gestation onwards was 5.6%, with only one-third of these reporting EPing for longer than 1 month. One fifth (20%; 4 out of 20) of participants in Felice et al.'s (Felice et al., 2017a) study relied "primarily or solely on bottles to feed HM" (p. 3), whereas Keim, Boone, Oza-Frank, and Geraghty (2017) had a proportion—6.9%—of EPers more closely mirroring that of Shealy et al. (2008).

Clemons and Amir (2010) found that the EPing rate in Australia was comparable to that in the US (4%). Conversely, Hornbeak, Dirani, Sham, and Li (2010) found that the rate of EPing in Singapore increased from 9% to 18% between 2000 and 2008; Bai, Fong, Lok, Wong, and Tarrant (2016) found that the rate of EPing in Hong Kong ranged from 5.1–8.0% in 2006–2007, increasing to 18.0–19.8% in 2011–2012.

Felice, Cassano, and Rasmussen (2016), Bai et al. (2016), and Keim et al. (2017) all found that those who relied on pumping to a high degree (which would include EPers) or exclusively expressed milk were particularly likely to cease feeding HM sooner. None of the EPing participants in Geraghty et al.'s (2005) study were still BFing at 6 months postpartum. Keim et al. (2017) found that "exclusive pumping is a suboptimal approach to producing milk for durations currently recommended by major health organizations" (p. 426). Bai et al. (2016) found that supplementation with formula, lack of previous HM feeding experience, having a planned C-section, and returning to work postpartum were all more likely to result in EPing.

2.5.2. Reasons for Milk Expression

It appears that milk expression is an essential element to meeting BFing intentions and goals (Felice et al., 2017a; 2017b): "All mothers felt that, to avoid or reduce formula use, they would need pumped HM for when feeding at the breast was not successful, available, or desired" (Felice et al., 2017a, p. 6). When asking those who were still in hospital following childbirth why they plan to use breast pumps in the future, Loewenberg Weisband et al. (2017) found that maintaining HM supply when away from their child and building up a supply in the freezer for when they return to work were the two most frequently cited reasons. This reflects the experience of many participants in O'Sullivan, Geraghty, and Rasmussen's (2016) study. In fact, most women (82.3%) in Clemons and Amir's (Clemons & Amir, 2010) study had frozen their

expressed HM and in Geraghty et al.'s (2012) study, 13% of infants were fed their own parent's stored expressed HM after the parent had ceased to lactate.

Concerns about milk supply is a common reason for wanting to express (Clemons & Amir, 2010; Felice et al., 2016; Flaherman & Lee, 2013; Labiner-Wolfe et al., 2008; K. Ryan et al., 2013). Having stored HM brings BFers a sense of relief that their child could still be fed if they were not present or if their supply went down (Labiner-Wolfe et al., 2008; K. Ryan et al., 2013).

In their SR/MA, Johns, Forster, Amir, and McLachlan (2013) found that nursing difficulties, preterm or LBW infants, parental ill health, and BFing inexperience often precipitated milk expression. Those who had already started expressing milk before post-delivery hospital discharge reported increasing their milk supply and problems with latch as reasons for using a breast pump (Loewenberg Weisband et al., 2017). However, Flaherman et al. (2011) found that those who hand expressed during this early postpartum period had higher BFing rates at 2 months postpartum. At 6 months postpartum, Johns et al. (2016) found that the two most common reasons for expressing milk were to have the freedom to go out and leave the baby and to increase or measure milk supply. These findings reflect the experiences of Felice et al.'s (2017a) study participants: although most milk was expressed due to nursing being unavailable, those who expressed during early infancy reported latch problems whereas those who expressed after early infancy reported employment as the reason for nursing unavailability.

Felice et al.'s (2016) analysis of IFPS II data divided reasons for milk expression into elective and non-elective. They found that those who expressed for non-elective reasons stopped feeding HM to their infants sooner than those who expressed electively (Felice et al., 2016). In addition, those who did not nurse in the early postpartum period had more difficulty sustaining

their milk supply for an extended period (Felice et al., 2016). Reasons respondents gave as to why they pumped and their classifications as elective or non-elective reasons are show in Table 3.

Table 3. Felice et al.'s (2016) classification of pumping reasons.

Elective	Nonelective
To mix with cereal or other food	To relieve engorgement
To have an emergency supply of milk	Because my nipples were too sore to nurse
To donate to a baby other than my own	To increase my milk supply
	For me to feed to my baby when I do not want to breastfeed or when baby cannot breastfeed
	To keep my milk supply up when my baby could not nurse
Ambiguous: To get milk for someone else to feed my baby	

2.5.3. Reasons for Exclusive Milk Expression (Exclusive Pumping)

In her informal online survey, Glenn (n.d.) found that EPers did not nurse due to failure to latch, pain, a need or desire to monitor intake, a NICU infant unable to nurse, and/or an actual or perceived low HM supply. Non-elective EPers often mourn the loss of the nursing relationship they imagined themselves having and, in many cases, had prepared for by attending a prenatal BFing class, reading extensively, and purchasing nursing supplies such as bras and pillows (Casemore, 2014). Similarly, Felice et al. (2017) note that similar preparation is often not possible if a person has to resort to non-elective expression: "a mother who pumps for unanticipated motivations may not have enough time to plan and prepare accordingly—for example, by gathering funds, supplies, instructions, or support for pumping" (p. 9). It is important to note that a number of EPers choose this form of BFing either from birth, regardless of their ability to nurse, or after a period of nursing.

Felice et al. (2017a) reported that their study participants (all BFers, but 80% of whom nursed) reported that the cost and health benefits provided the motivation to express and bottle-feed HM rather than FF. However, those who have the comparative convenience of nursing at least some of the time are only inconvenienced by having to express milk part of the time. EPers express 100% of the time, yet there appears to be no data on why they specifically choose to EP and feed expressed HM rather than FF: Keim et al. (2017) note that the "characteristics of these women and how long they are able to produce HM for their infant remain largely unexplored. This hampers efforts to provide tailored lactation support for these dyads" (p. 422).

2.5.4. Characteristics of Those Who Express Milk and Their Experiences

Just as BFing in general is positively associated with various demographic characteristics (see above), a number of studies have found that lactating people who express milk have more education, higher household income, and are more likely to be employed (Bai et al., 2016; Hornbeak et al., 2010; Labiner-Wolfe et al., 2008). Bai et al. (2016) noted that:

> Lower-income women are less likely to be employed full-time and therefore do not need to exclusively express breast milk. Another possible reason may be that mothers with lower income are less likely to own an electric breast pump, which is commonly used in exclusive expressed breast-milk feeding. (p. 499)

In contrast, Keim et al.'s (2017) EPing participants were of a lower average SES; they suggested that this is because a higher-than-average proportion of participants in this group delivered preterm, something that is more likely in lower SES groups.

BFing experience is also associated with milk expression: first-time lactating people were found to be more likely to express, both in general and exclusively, in several studies (Bai et al., 2016; Johns et al., 2013; Labiner-Wolfe et al., 2008). Those having delivered via C-section are more likely to express milk (Bai et al., 2016; Labiner-Wolfe et al., 2008). The physical characteristics of the BFer also play a part, with those of a higher BMI or with larger breasts

more likely to express milk, perhaps due to discomfort with their appearance and/or difficulty establishing a latch (Johns et al., 2013). One study found that overweight and obese participants had longer durations of BFing if they had expressed milk (Leonard et al., 2011).

The subjective experience of milk expression is captured less often than quantitative data about it. Ryan, Team, and Alexander's (K. Ryan et al., 2013) study demonstrates the spectrum of feelings about expressing milk. Negative feelings included: "I never got on with the expressing. ... I don't enjoy it. I dread expressing" (p. 473); "I had a hand breast pump that I tried to express milk with and it didn't ever work. I found it painful. I found it uncomfortable and I never got any milk" (p. 480); and "I felt like a cow or something. … I didn't like it. It's a bit animalistic. I don't feel comfortable expressing milk" (p. 480). Participants in Ryan et al.'s (2013) study who nursed felt guilty for feeding expressed HM rather than directly feeding and worried whether their child would drink from a bottle, but were disappointed if their child easily did. Felice et al. (2017a) also discovered complicated feelings in those who failed to express enough milk to satisfy their child's needs:

> Well, I just feel like a little bit like my self-worth is tied to my milk output. I feel like, 'Oh, if I'm not making enough milk, I'm not going to provide for my baby.' But that adds to the stress, and then that makes it harder to get the milk out. (p. 7)

Milk expression is also an inconvenience, but one that some BFers feel is necessary to fulfill their child's nutritional needs (Felice et al., 2017b). Those expressing milk at work often encounter challenges. For example, availability of a private, clean, and quiet space with a refrigerator to store expressed milk is often not available, with BFers having to express in shared offices, bathrooms, or a storage closet (Felice et al., 2017b). Washing pump parts caused some of Felice et al.'s (2017b) participants embarrassment and concern about the cleanliness of the facilities.

Participants in Ryan et al.'s (2013) study also had positive experiences of milk

expression: “You can express and still go out and do things” (p. 474); “I now know that I can express milk. Because I’m breastfeeding, I don’t have to be at home all the time. It doesn’t mean that nobody else can ever feed the baby” (p. 474); “If I wanted a break or if I had to go somewhere … if I had some milk they could then feed my daughter” (p. 474); “I did start expressing to a bottle, so my husband can feed him, because it’s nice [for my husband] to feed him. He really likes it, he really does enjoy it” (p. 475); “I was expressing milk for the next feed while feeding him [by bottle] for this current feed, and we basically had a production line” (p. 480). The sense of freedom and sharing feeding responsibilities were reflected by participants in a number of other studies: “With pumping it does kind of give you that freedom of, you know, that you can do things and you can leave” (Felice et al., 2017b, p. 7);

Felice et al. (2017b) found that the type and quality of the pump influenced their experience of pumping: “Mothers who used manual or single-electric pumps reported delayed or weak letdown, inadequate suction and yield, and “wasted” HM leaking from the opposite breast” (p. 7). Several studies mention problems specifically associated with the physical process of pumping itself (S. L. Brown, Bright, Dwyer, & Foxman, 2005; Clemons & Amir, 2010; K. Ryan et al., 2013). Although the data are somewhat dated (1992–2003) and breast pump technology has progressed somewhat in the past 15 years, Brown et al.’s (2005) paper on reports to the FDA of adverse reactions to breast pumps highlights problems reported after using both manual and electric pumps: pain, soreness, and discomfort, breast tissue damage, and infection. The most common reported adverse effects in Clemons and Amir’s (2010) study were pain and damage to nipples.

No study appears to have examined the reactions milk expression, especially EPing, elicits from partners/spouses, family and friends, healthcare professionals, LCPs, coworkers, and

society in general. Ryan et al. (2013) offer up one kind of reaction, as they argue that the growing focus on expression and bottle feeding HM is:

> An in vivo experiment—backed by vested interests drawing on the discourses of 'fathers' rights to experience' and 'mothers' rights for a break'—with, as yet, no evidence of the long-term consequences on women's health, mother-infant bonding, infant psychological development, and men's transition to fatherhood. (p. 481)

They go on to say:

> This experiment, although increasing women's options, may result in them spending more time with technology than with their babies, constricting their movements with their breastfeeding babies, and subjecting them to societal pressures to leave their babies and return to paid employment and public life. (K. Ryan et al., 2013, p. 481)

While there are policies and practices (examined previously) that negatively affect lactating parents' abilities to nurse their child as often and for as long as they desire, Ryan et al. (2013) failed to consider those who are unable to establish a nursing relationship with their child and for whom EPing offers the only option to continue feeding HM.

2.5.5. Donation and Sharing of HM

HM must be expressed if then donated to HM banks or shared directly with other children. As more is discovered about the benefits of HM, especially to sick, preterm, and LBW infants, the demand for HM grows. EPers are in a unique position to monitor and control their milk supply: the supply of those who predominantly nurse reacts to the demand of only a child, while an EPer can artificially create more demand and therefore potentially create more supply. Although no data seems to exist concerning the BFing practices of those who donate milk, it is plausible that EPers are disproportionately represented among HM donors.

Grief donation and/or sharing occurs when an individual loses their child either prenatally or postpartum but expresses milk to donate to a HM bank or share with others. These lactating people are, unfortunately, EPers by definition, but they find that milk expression and donation "was a profound way to feel like a mother in the absence of her baby," "became a substitute for

the new baby that a mother was unable to hold in her arms and breastfeed," and "contributed to helping other babies survive in honor of their babies, who died, and there was tremendous comfort in that experience" (Welborn, 2012, p. 509). Busta Moore and Catlin (2003) noted that HM suppression or donation was a missing aspect of care for those with a dying child; similarly, Carroll et al. (2014) and Welborn (2012) note the importance of discussing and supporting continued lactation in this context.

2.6. A Few Words about Formula

As explained above, studies on the effects of BFing necessarily use the effects of FFing as the comparison group. This results in the mentality that wherever there is a "pro" in favor of BFing, there is a "con" against FFing. Furthermore, it has also been demonstrated that the marketing and introduction of formula has a detrimental effect on BFing initiation and duration. However, the matter is not as simple as "HM = good, formula = bad."

2.6.1. The Need for HM Substitutes

The need for appropriately-formulated HM substitutes cannot be overstated—they are quite literally lifesaving in a number of situations, the most obvious being when a parent cannot produce any or enough of their own milk and donor HM cannot be obtained. The AAP's (2012) Policy Statement, *Breastfeeding and the Use of Human Milk*, sets out a variety of situations where formula feeding is appropriate. For example, hypoallergenic formula is essential when a child has galactosemia. Lactating people with human T-cell lymphotropic virus type I and II, untreated brucellosis, or who are HIV positive and live in the industrialized world[2] should not BF

[2] "In the developing world, where mortality is increased in non-BFing infants from a combination of malnutrition and infectious diseases, BFing may outweigh the risk of acquiring HIV infection from human milk. Infants in areas with endemic HIV who are exclusively breastfed for the first 3 months are at a lower risk of acquiring HIV infection than are those who

at all, therefore making FFing the only choice. As discussed above, some drugs—both legal and illegal—transfer to HM and regular, heavy alcohol consumption can affect milk supply and infant motor development. In these situations, formula may be a more appropriate choice. Another common situation in which formula has a beneficial effect is that of severe hyperbilirubinemia where it is not possible to use HM to increase milk intake (see above).

2.6.2. Bacterial Contamination

Despite these positive uses of formula, there are a number of concerns associated with FFing. For instance, there have been a number of bacteriological concerns regarding powdered formula, storage practices, and feeding equipment (i.e., bottles, nipples, etc.). As recently as April 2017, the CDC updated its page on the risk of cronobacter contamination of infant formula, stating that, while infections are rare, they can be deadly in newborns (CDC, 2017d). There is clear evidence showing that salmonella can be present in powdered formula (Boué et al., 2017) and growing evidence that other bacteria such as clostridia and enterobacter are also potential contaminants (Barash, Hsia, & Arnon, 2010; Boué et al., 2017).

Using hot (>70°C) water to reconstitute the powder is recommended (Food and Agriculture Organization of the United Nations (FAO) & WHO, 2006), but this is sometimes ineffective and potentially destroys micronutrients (Barash et al., 2010; Hunter & Bean, 2013). Furthermore, access to clean drinking water and a way to heat water by those in the developing world can be limited and even those in the developed world could feel inconvenienced by having to heat water, then rapidly cool it to around 37°C, before feeding their child. Formula that is prepackaged as a ready-to-feed liquid is considered to be sterile (FAO & WHO, 2006), but is

---

received a mixed diet of human milk and other foods and/or commercial infant formula" (AAP, 2012 p. e832-e833)

also the most expensive option (Jana & Shu, 2015). Refrigeration of untouched (i.e., it has not started to be drunk, then saved for later) formula that has been made with >70°C water and cooled quickly is relatively safe, but any other storage practices (room temperature, made with cool water, saving half-drunk bottles) pose the risk of unsafe levels of contamination (FAO & WHO, 2006).

Feeding equipment such as bottles and nipples/teats can also be contaminated. Biofilms, "architecturally complex communities" (Lopez, Vlamakis, & Kolter, 2010 p.a000398) of bacteria adhered to a surface, are one way in which the equipment needed to bottle feed could be compromised. Bacteria, like those described above, present in formula—whether present in the formula powder or introduced during the reconstitution process—can form a biofilm on feeding equipment, even at refrigeration temperatures (Iversen, Lane, & Forsythe, 2004). Biofilms are resistant to antimicrobial agents (such as antibiotics, antibacterial cleaners, and bleach); physical removal, such as scrubbing, produces the best cleaning results in the absence of highly sophisticated or caustic enzymes or chemicals (Giaouris & Simões, 2018; Gibson, Taylor, Hall, & Holah, 1999; M. Simões, Simões, & Vieira, 2010). While the WHO (2007) describes scrubbing infant feeding equipment prior to sterilization, the CDC (2017a) does not suggest scrubbing if washing in a dishwasher, thereby creating a higher risk of biofilm accumulation.

2.6.3. Chemical Contamination

Chemical contamination of formula itself is another hazard of FFing. For example, Bargellini et al. (2016) found levels of iron and manganese many times higher than an adequate daily intake; levels of cadmium were close to 75% of the provisional tolerable daily intake. Despite criticizing the level of aluminum in formula in 2010 (Burrell & Exley, 2010), Chuchu, Patel, Sebastian, and Exley (2013) still found levels to be too high 3 years later. In an exceptional

case, but one that demonstrates how easily formula can be tainted, at least six babies died and many more became ill due to the addition of melamine to formula produced in China (Kent, 2015). The European Union prohibits any detectable pesticide residue in formula (EU Directive 91/321/EEC, 1999); there is no such law in the United States.

2.6.4. Nutritional Content

While contamination with harmful chemicals is obviously problematic, so is a lack of standards for the nutritional content. In the United States, there is Federal law (21 CFR 107.100) mandating minimum and maximum levels for a variety of different macro- and micronutrients, barely changed since the 1980s (Kent, 2012). Since infant formula is classed as food in the United States, manufacturers must only demonstrate that it is safe (it does no harm in the short term): they need not demonstrate its effectiveness, in other words, that the nutrients are sufficient for adequate nutrition of a child (Kent, 2012). Based on definitions of nutritional adequacy set out by the Codex Alimentarius Commission of the FAO, Kent (2012, p. 23) argues:

> A food's nutritional adequacy should be assessed in terms of its results, not its ingredients. Infant formula should be viewed as nutritionally adequate only if it is proven to be as good for children as breastfeeding. Any other definition short-changes children.
>
> Furthermore, since:
>
> feeding with infant formula consistently produces worse health outcomes, formula should not be viewed as nutritionally adequate. Feeding with formula might be claimed to be adequate in the sense that it can keep a child alive. But it should never be implied to be as good, or nearly as good, as breastfeeding. (Kent, 2012, p. 25)

While Kent's view is somewhat strongly worded, there is indeed a recognition among experts of the need for a global standard for the composition of infant formula: Koletzko et al. (2005) convened an International Expert Group of the European Society for Paediatric Gastroenterology Hepatology and Nutrition to do just this. Unfortunately, US formula requirements (21 CFR 107.100) do not even come close to these standards, whereas the EU

regulations (EU Regulation 2016/127) exceed them.

Another formulation issue concerns soy-based formula. While essential for children with galactosemia or documented intolerance to cow milk-based formula, Bhatia, Greer, and the AAP's Committee on Nutrition (2008) found no other situations in which soy formula was beneficial. In fact, they concluded that soy formula should be avoided in preterm infants, even when especially formulated for this group. Reassuringly, however, they also noted that the higher levels of aluminum in soy formula compared to cow milk formula have no detrimental effect on a healthy child with normal renal function and there was no evidence to support later health problems caused by the presence of isoflavones (a form of phytoestrogen).

2.6.5. Financial Cost

For those purchasing formula with their own money, financial costs are high: based on January 2016 prices, Bonyata (2018a) estimates that it costs U.S. residents between (depending on the formula) $816.48 and $3,163.86 to formula feed a child for one year, compared to between $628.97 and $2,411.04 in the UK (First Steps Nutrition Trust, 2016).[3] Costs of formula feeding are especially high in the United States, perhaps because about half of all infant formula is purchased by the US federal government through WIC (with parents "paying" for it at a store with WIC-provided vouchers), leaving those purchasing it themselves having to make up the shortfall in formula manufacturers' profits (Grayson, 2016; Kent, 2006). Therefore, it is unsurprising that formula stretching, that is diluting it, feeding smaller volumes, or increasing the time between feeds is relatively common: Burkhardt et al. (2011) found that 15% of families stretched formula, a rate that rose to 27% in those households having food insecurity, or "the

[3] Based on daily costs of £1.20–£4.60 (First Steps Nutrition Trust, 2016, pp. 4-5) and converted to USD using XE.com's (XE, 2018a) exchange rate on February 1, 2016.

lack of access to enough food to fully meet basic nutritional needs at all times due to lack of resources" (p. 238). They also found that "65% of families ran out of WIC-supplied infant formula most months" (M. C. Burkhardt, Beck, Kahn, & Klein, 2011, p. 241). Given the financial cost of formula and the prohibition on saving half-drunk bottles (WHO, 2007), it is not surprising that bottle-fed children are more likely to empty bottles (see above).

2.6.6. Formula Versus Exclusive Pumping

The pertinent question for the purposes of this research is whether feeding expressed HM is more beneficial than FFing. In some aspects, they may be on level ground: for example, the problems associated with the action of bottle feeding (emptying, feeding position-related ear infections, and dental malocclusion) are common to both formula feeding and feeding expressed HM. In addition, given the numerous breast pump parts needed to express milk (with a pump), the problem of contamination and biofilm may be more pronounced with EPing, especially because the recently-published breast pump cleaning advice from the CDC still does not advocate for scrubbing if washing in a dishwasher (CDC, 2017b). Of particular concern is Felice et al.'s (Felice et al., 2017a) finding that expressed HM comes into contact with between 2–6 containers before feeding, echoing others' concerns about widespread pathogenic contamination of expressed HM (Boo, Nordiah, Alfizah, Nor-Rohaini, & Lim, 2001; Keim et al., 2013).

As examined in detail above, HM has many nutritional benefits over formula. However, there is a question as to whether the benefits of feeding stored (in the refrigerator or freezer) HM outweigh the benefits of freshly made/opened formula. Some of the benefits of HM are lost when stored, for example reductions in its antioxidant capacity (Hanna et al., 2004), fat content (Chang, Chen, & Lin, 2012; García-Lara et al., 2012), vitamin C (Buss, McGill, Darlow, & Winterbourn, 2001; Ezz El Din, Abd El Ghaffar, Gabry, Fahmi, & Bedair, 2004; R. A.

Lawrence, 1999), vitamin B6 (R. A. Lawrence, 1999), vitamin A and E (Ezz El Din et al., 2004), activity in the live cells (responsible for the immunological properties of HM) (Pittard & Bill, 1981), and bactericidal activity (Ogundele, 2002; Silvestre, Löpez, March, Plaza, & Martínez-Costa, 2006). In addition, immunological components in the HM were created in response to environmental pathogens at the time of expression, not at the time of consumption (O'Sullivan et al., 2016).

However, short-term storage (up to 3 months) does not significantly affect the caloric content of HM (García-Lara et al., 2012; Hanna et al., 2004) and macro- and micronutrients remain within the reference range for mature HM (Ezz El Din et al., 2004). While scalded or gentle pasteurization (30 min at 62.5°C) of HM prior to storing "inactivates all cellular components of milk" (Ewaschuk, Unger, Harvey, O'Connor, & Field, 2011, p. 179), HM only loses minimal macro- and micronutrients (Ewaschuk et al., 2011; Romeu-Nadal, Castellote, Gayà, & López-Sabater, 2008; A. A. Vieira, Soares, Pimenta, Abranches, & Moreira, 2011) and retains its oligosaccharides (Ewaschuk et al., 2011). Therefore, HM that has been processed and stored is still preferable to formula, even when a child is compromised (e.g., preterm or low birthweight infants) (Boyd, Quigley, & Brocklehurst, 2007; Heiman & Schanler, 2006; Kim, Lee, & Chung, 2017).

2.7. Summary

In summary, in the absence of nursing, HM that has been expressed, or even further processed and stored, is preferable to formula. Furthermore, the objective benefits stemming from lactation itself are lost if a person chooses to suppress lactation. Subjectively, FFing fails to fulfill the desire of many parents to BF and circumvents the opportunity to feel the closeness that comes from sustaining the life of a child. Absent any BFing contraindications or milk supply

issues, EPing is a more desirable solution than formula feeding for both the child and the lactating person.

This analysis of the benefits of BFing to children, BFers, and society, the factors that influence its initiation, duration, exclusivity, and cessation, and issues with infant formula is essential to this study. Any one of the topics above could be a reason given by study participants— current or former EPers—for choosing to feed their child with and/or donate expressed HM. However, little is known about the information behavior of EPers, that is, how they first came to know that they could BF without nursing. Their needs and challenges, especially relating to what information they need, how they go about finding it, and how they use it, are not well documented. This study aims to fill this gap.

The next chapter examines information behavior theories and models fitting within each of the ecosystems of the framework introduced in Chapter 1. These theories and models provide a basis for analyzing the information needs, seeking, and use of EPers.

Chapter 3. An Ecological Framework and Information Behavior

Following the structure of the ecological framework introduced in Chapter 1, information behavior (IB) and social support theories relevant to this research and its potential findings are reviewed. Given that most IB theories and models focus on individuals, first section of this chapter (the intrapersonal system) receives the most attention. This section also includes IB literature pertaining to specific topics such as health, parenting, and infant feeding. Figure 10 displays the remainder of the theory and literature reviewed in this chapter and their location within the ecological framework, moving from the intrapersonal outward to the microsystem, through mesosystem to the exosystem, reaching the inner and outer macrosystems, and finally finished with the chronosystem.

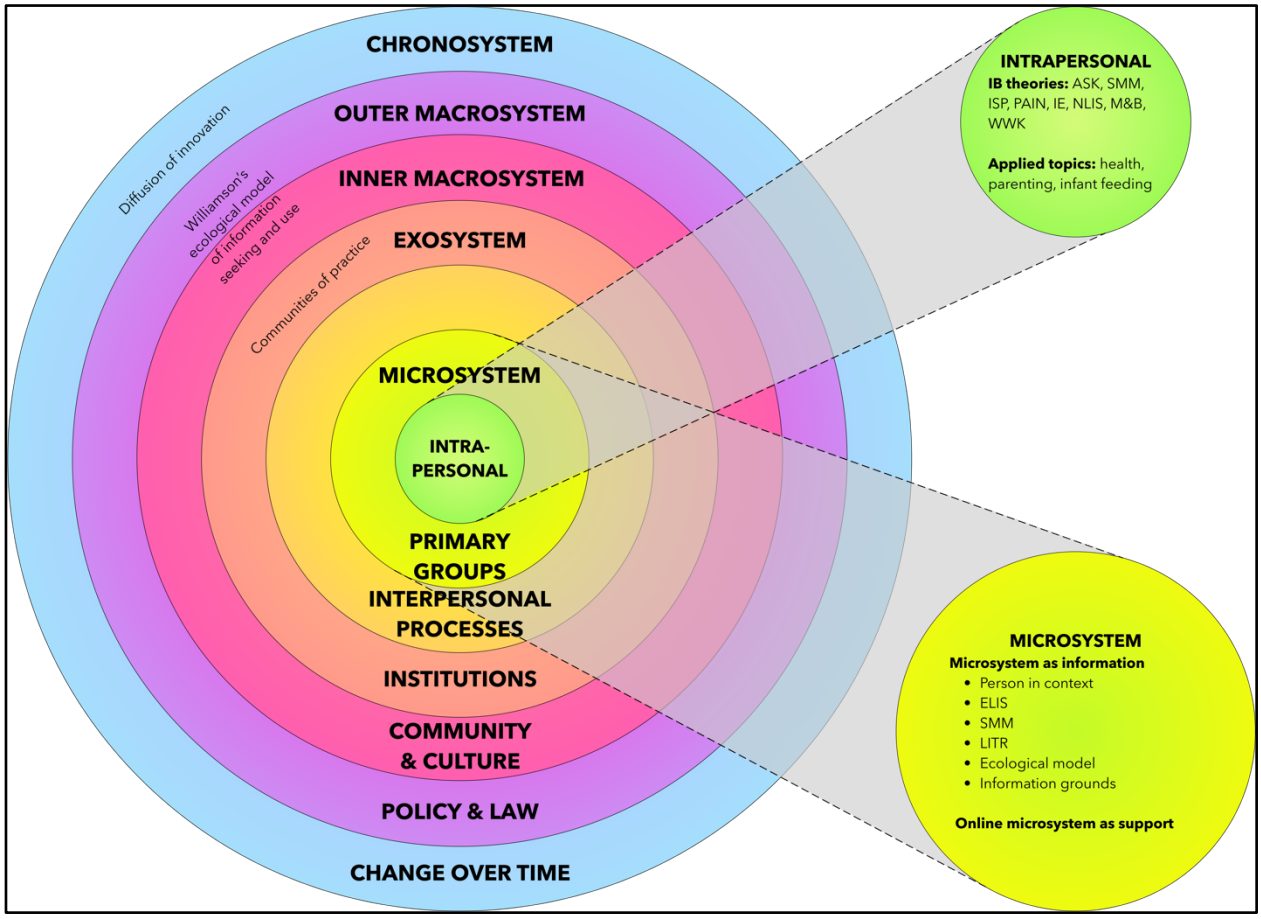

Figure 10. Topics examined in Chapter 3 within the ecological framework.

3.1. The Intrapersonal System

3.1.1. Defining Information Behavior

In his seminal 2000 paper, Wilson defines IB as:

> The totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use. Thus, it includes face-to-face communication with others, as well as the passive reception of information as in, for example, watching TV advertisements, without any intention to act on the information given. (T. D. Wilson, 2000, p. 49)

Information seeking (IS) and use (IU) usually follows having an information need (IN), whether articulated as such or not. While there is a vast literature on other aspects of IB, Case

(2012) states that "most writers assume that information needs exist and are relatively unproblematic" (p. 81). Nevertheless, scholars have examined whether INs arise from seeking answers (R. S. Taylor, 1968), reducing uncertainty (Atkin, 1973; Belkin, 1978), sense-making (Dervin, 1976; 1983), and a personal anticipated IN (Bruce, 2005a).

Wilson (2000) defines IS as "the purposive seeking for information as a consequence of a need to satisfy some goal" (p. 49). Theories, such as Foster's (2004) *Nonlinear Model of Information Seeking* and serendipitous discovery (Erdelez, 1997), that expand or challenge this simplistic definition are examined below. IU "consists of the physical and mental acts involved in incorporating the information found into the person's existing knowledge base" (T. D. Wilson, 2000, p. 50). Theories about how information becomes knowledge, such as *Women's Ways of Knowing* (WWK; Belenky, Clinchy, Goldberger, & Tarule, 1986), and why information is ignored or discarded (e.g., Crook, Stephens, Pastorek, Mackert, & Donovan, 2015; Wurman, 1989) are central to this discussion of IB, as are those about the outcomes of IB (e.g., Lambert & Loiselle, 2007).

3.1.2. Information Needs

Scholars have theorized that an IN can arise in a number of different ways. Belkin's (1978; 1980; 2005) *Anomalous State of Knowledge* proposes that a cognitive need for information exists because an individual's "state of knowledge with respect to a topic is in some way inadequate with respect to the person's ability to achieve some goal" (Belkin, 2005, p. 44). Dervin's *Sense-Making Methodology* characterizes IN as arising from an information gap that must be bridged (Figure 11).

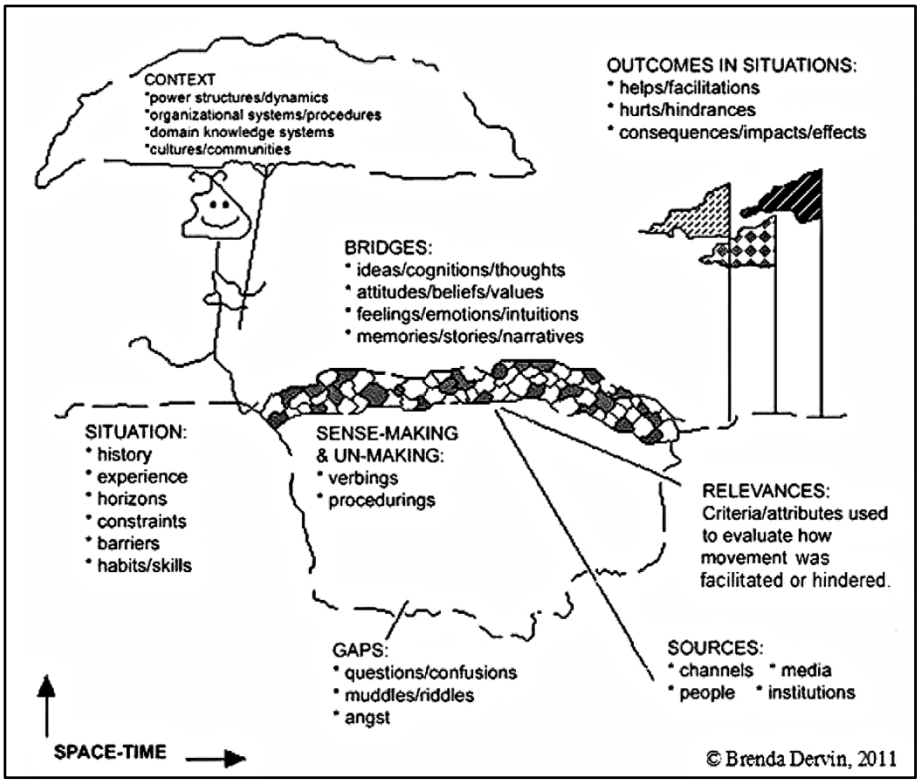

Figure 11. Dervin's Sense-Making Methodology of information behavior (Reinhard & Dervin, 2012, p. 33).

Similarly, Kuhlthau (1993), in her *Information Search Process* theory, posits that an IN arises when "a person becomes aware of a lack of knowledge or understanding, making uncertainty and apprehension common" (Kuhlthau, 2005, pp. 230-231). Bruce (2005a) suggests that individuals may, at times, "acknowledge the usefulness of the information but delay the information use to another time," (n.p.) therefore displaying an awareness of a *Personal Anticipated Information Need*.

In focusing on the characterization of IN, Taylor (1968) proposed that need could be categorized into four different levels:

> Q1—the actual, but unexpressed need for information (the visceral need);
> Q2—the conscious, within-brain description of the need (the conscious need);
> Q3—the formal statement of the need (the formalized need);
> Q4—the question as presented to the information system (the compromised need). (p. 182)

Taylor's theory, arising out of interactions between individuals and sources of information (namely libraries and librarians), bridges the gap between IN and IS: formal, purposeful information seeking only begins when the compromised need is presented to an information system (such as a search engine) or information professional (such as a librarian).

3.1.3. Information Seeking

There have been many theories and models of IS behavior, many of which could fit the IB of EPers. For example, Zipf's (1949) *Principle of Least Effort* "predicts that seekers will minimize the effort required to obtain information, even if it means accepting a lower quality or quantity of information" (Case, 2005, p. 291). Requiring even less effort is serendipitous *Information Encountering* (Erdelez, 1997), defined as "an instance of accidental discovery of information during an active search for some other information" (Erdelez, 2005, p. 180).

Several models of IB suggest more structured forms of IS. Kuhlthau (2005) characterizes her information search process as a "process of construction" (p. 230) that "describes common patterns in users' experience in the process of information seeking for a complex task that has a discrete beginning and ending, and requires construction and learning to be accomplished" (p. 230). The feelings, thoughts, and actions associated with the six stages of the information search process are depicted in Figure 12. IS occurs throughout stages 2–6.

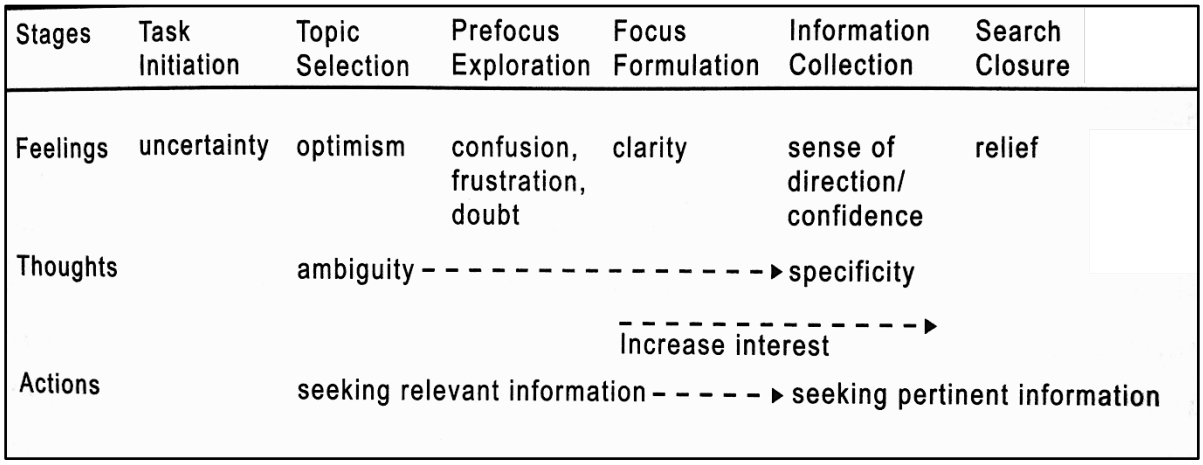

Figure 12. Kuhlthau's Information Search Process (Kuhlthau, 2005, p. 231).

A second model that recognizes that IS occurs on an ongoing basis is Foster's (2004) nonlinear model of information seeking. This model suggests that there are three processes to IS—opening, orientation, and consolidation—that are concurrent, continuous, cumulative, and looped (Foster, 2004). During opening, an individual seeks, explores, and reveals information to explore topic breadth as well as inform further seeking activities (Foster, 2004). Orientation focuses on identification of sources, communities, and keywords and "picture building, reviewing, and identifying the shape of existing research" (Foster, 2005, p. 256). Consolidation involves judging and integrating information, deciding whether further seeking is required, and discussing information with others (Foster, 2004). A key component of the nonlinear model of information seeking is viewing IB as part of larger internal and external contexts, such as feelings and thoughts, coherence, and knowledge and understanding (internal), as well as social and organization influences, time, navigation issues, and access to sources (external) (Foster, 2005).

Ongoing IS may also be described as *monitoring and blunting* (S. M. Miller, 1980). Monitoring and blunting was originally described in the context of stressful or adverse situations:

some individuals experience decreases in stress by monitoring relevant information and knowing "what is happening" (L. M. Baker, 2005, p. 239). Blunters "use distracting behavior to avoid information about a stressful event because it increases their stress levels" (L. M. Baker, 2005, p. 239). Likewise, fear, denial, and anxiety can invoke reactions of monitoring and blunting (J. D. Johnson & Case, 2012).

3.1.4. Information Use, Knowledge, and Outcomes

When information is serendipitously or unintentionally encountered (Erdelez, 1997; Erdelez et al., 2016), Bruce's (2005) personal anticipated information need theory suggests that individuals may evaluate the information against their motives for seeking it and decide that it will be useful at another point in time, rather than in response to the current information need. Depending on their sensitivity and reactions to their anticipated need, many will then add this information to their *Personal Information Collection*, whatever its form (documents, websites, notes, calendars, etc.), structures (piles, lists, folders, etc.), and pointers (people, links, favorites, etc.) (Bruce, 2005b). This information is thus available for future use.

Information is used in variety of different ways. Todd's (1999) information intents assumes an "active-creative role of the user for the process of use, explicitly talking of cognitive transformation, knowledge conversion, adaptation, reformulation, or re-invention" (Wingens, 1990, p. 37). In other words, through the process of using information, an individual undergoes some sort of change to their knowledge. Figure 13 displays the connection between the intended use of the information and the changes in an individual's knowledge structure.

Information Intent	Manifestation of changes in knowledge structures
Get a complete picture	a) inclusive: adding specific instances, examples or types b) elaborative: building associative structures: • property-oriented structures • manner-oriented structures • cause-oriented structures • goal-oriented structures c) integrative: separate structures integrated more holistically
Get a changed picture	a) construction: building up a complete picture b) deconstruction: removing incorrect ideas c) reconstruction: replacing with more appropriate ideas
Get a clearer picture	a) explanation: tells how and tells why b) precision: appending information to add precision of detail
Get a verified picture	a) no change b) emphatic: repetition of ideas to add weight or emphasis c) inclusive: including more precise, specific ideas d) defensive: defend and reaffirm viewpoints
Get a position in a picture	a) reactive: expressions of agreement/disagreement b) formative: deriving personal conclusion based on facts c) potential positioning: foreseeing future use of facts d) predictive: predicting new events and states

Figure 13. Information intents and manifestations of changes in knowledge structures (Todd, 2005, p. 201).

Turning information into knowledge is critical to IU. The unique ways that women come to know has been examined by Belenky et al. (1986) in *Women's ways of knowing: The development of self, voice, and mind.* WWK challenges the long-held presumption that "ways of

knowing identified as historically feminine … (intuitive knowing … *connected knowing*) have been devalued and discouraged" (Goldberger, 1996, p. 9). In their interviews of a diverse group of ordinary women, they identified five ways in which they came by knowledge (as summarized by Julien, 2005, p. 388):

1. *Silence,* or not knowing, where the individual feels powerless, mindless, and voiceless. This situation appears to result from a social context of isolation, that discourages conversation and discussion.
2. *Received knowing*, in which knowledge and authority are the sources of truth, and are understood to be outside the self, and in which one learns from powerful others through listening.
3. *Subjective knowing*, where knowing is "personal, private, and based on intuition and/or feeling states" (Goldberger, 1996, p. 5).
4. *Procedural knowing*, a place where "techniques and procedures for acquiring, validating, and evaluating knowledge claims are developed and honored" (Goldberger, 1996, p. 5). This way of knowing can be further subdivided into *separate* knowing (characterized by skepticism and distance) and *connected* knowing (which is more empathetic and associative).
5. *Constructed knowing*, in which "truth is understood to be contextual; knowledge is recognized as tentative, not absolute; and it is understood that the knower is part of (constructs) the known … constructed knowers [value] multiple approaches to knowing (subjective and objective, connected and separate) and [insist] on bringing the self and personal commitment into the center of the knowing process" (Goldberger, 1996, p. 5).

Information science literature has yet to fully embrace WWK, yet it holds great potential to identify differences in information seeking and use (Julien, 2005), especially when research focuses on women.

When information is used and turned into knowledge, outcomes can be both positive and negative. Lambert and Loiselle (2007, p. 1014) identify four types of outcomes of health information seeking behavior (HISB):

1. Cognitive: increased knowledge and informed decision making;
2. Behavioral outcomes: increased self-care abilities and adherence to treatment;
3. Physical: increased physical quality of life; and
4. Affective: decreased anxiety, fear, and distress.

(p. 1014)

They recognize that, while most outcomes are positive, an increase in information can

also cause feelings of being overwhelmed and an increase in worry (Lambert & Loiselle, 2007, p. 1015). When "information doesn't tell us what we want or need to know" (Wurman, 1989 cover), our information anxiety increases; when information overloads or provides unexpected answers, it can become "a burden rather than a benefit" (Crook et al., 2015).

Nahl (2005) has operationalized the affective effect that information can have as follows:

> Affective Load = U [irritation + frustration + anxiety + rage] x Time Pressure
> (p. 41)

For example, as irritation and frustration increase, so would affective load. As the time pressure for finding the information is increased, so is affective load. Affective load is at its lowest when irritation, frustration, anxiety, rage, and time pressure are all at their lowest.

Having examined some general IB theories, what follows is an overview of IB theories and models relating to the specific topics of health, parenting, and infant feeding.

3.1.5. Health Information Behavior

With the ever-increasing medicalization of pregnancy, childbirth, and parenting (Kukla & Wayne, 2016), seeking information about infant feeding is undeniably HISB. While Lambert and Loiselle (2007) in their review of 100 articles and five books found that "HISB is partially developed, and further concept clarification is needed" (p. 1012), they categorized HISB into three contexts: coping with a health-threatening situation, participation and involvement in medical decision making, and behavior change and preventive behavior. Arguably, all three of these apply to infant feeding: poor feeding is a health-threatening situation; the parents must participate and be involved in decision making about infant feeding, especially during the postpartum hospital stay; and infant feeding comes with a large list of dos and don'ts which must be changed or prevented if incorrect. Furthermore, healthcare professionals, such as midwives, lactation consultants, and pediatricians, are at the forefront of providing information about infant

feeding, thus giving the impression that it is indeed a medical matter.

Based on her study of Canadian women pregnant with twins, McKenzie (2003) developed a two-dimensional model of HISB with four different modes of IS behavior: *active seeking*, *active scanning*, *nondirected scanning*, and *obtaining information by proxy*. When individuals "connect" and "interact" with information sources, descriptions of what activities take place within each mode of IS behavior is shown in Figure 14.

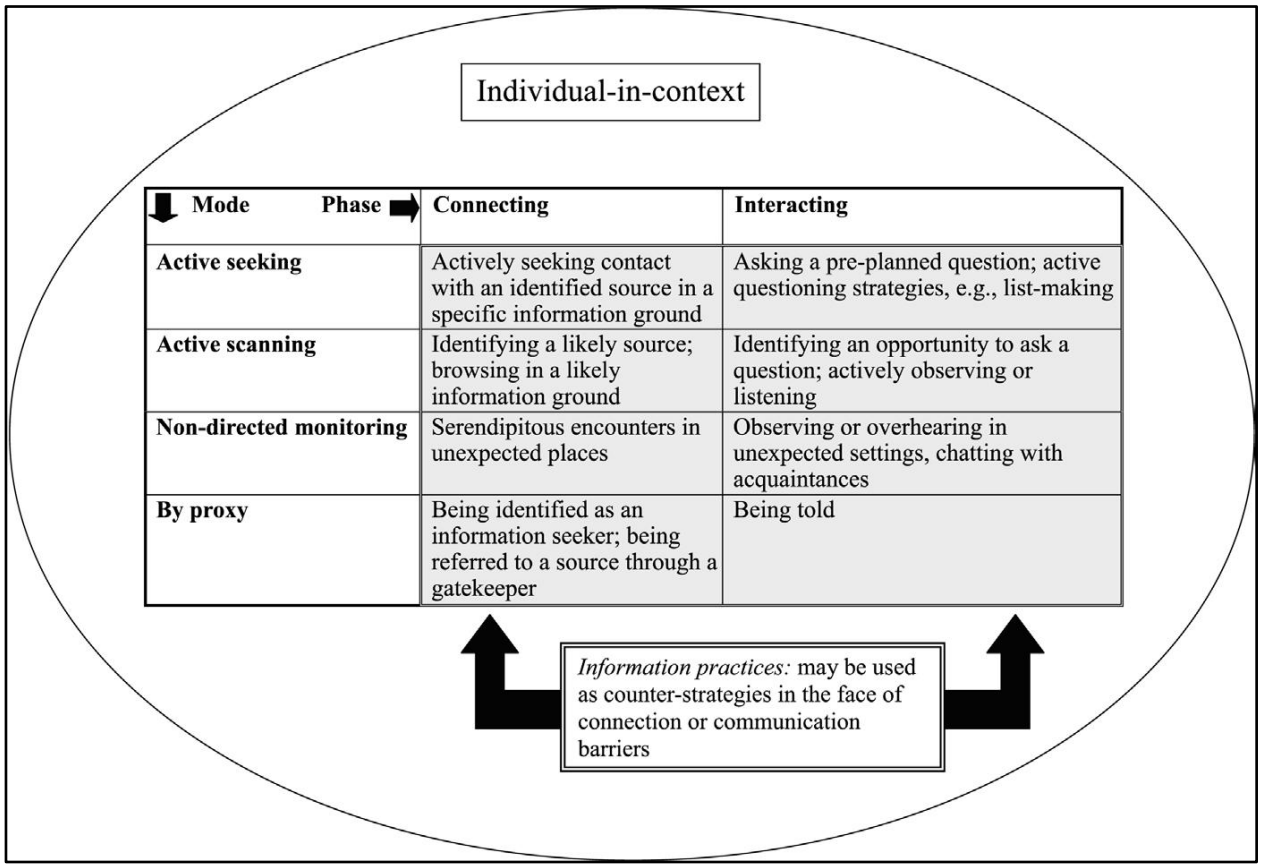

Figure 14. Two-dimensional model of the information practices described by the participants in McKenzie's (2003) study.

3.1.5.1. Conflicting health information. Carpenter et al. (2015) warned of the growing problem of conflicting health information, particularly when "mass media have increased the visibility of such conflicting and often politically charged controversial health information" in

the context of "a growing professional emphasis on involving individuals in health-care decisions" (p. 1173). The authors identified several negative effects of conflicting health information, namely confusion leading to trust issues and deference to the source they deem, potentially incorrectly, most credible (p. 1174). Other consequences of conflicting health information include increased anxiety, decreased ability to assess the reliability of information sources, and reduced medication adherence. Furthermore, sense-making activities, and therefore cognitive effort, are often required, exacerbating cognitive biases and increasing errors in judgment (p. 1174).

Carpenter et al. (2015) identified four dimensions of conflicting health information, which may exist alone or in combination: the substantive issue is under conflict; there are a number of conflicting sources (multiplicity); the degree to which the evidence types (e.g. medical study, expert opinion, newspaper article) are heterogeneous; and the degree of inconsistency over time. BFers, and especially EPers, frequently face all four dimensions, for example: whether the full benefits of BFing are conferred through EPing (substantive issue under conflict); an LCP says to pump for 15 minutes, but EPers themselves advise 20–30 minutes (multiplicity); internationally recognized peer support groups fiercely defend "breast is best," but medical studies increasingly show less difference between HM and formula (evidence heterogeneity); and, in times past, any bottle of infant milk that had been drunk from was only drinkable for an hour, whereas the current advice distinguishes between HM and formula (temporal inconsistency).

3.1.6. Parenting Information Behavior

3.1.6.1. Information needs and sources. Loudon et al. (2015), in reviewing the IS behaviors of first-time mothers, noted that "informational support helps mothers feel prepared

and confident for their new role, and eases the transition to parenthood" (p. 24). They found that the most pressing IN concerned sleeping, feeding, weaning, and healthcare, and that other mothers (face-to-face), family, websites, and their general practitioner were deemed the most important and useful sources of information. Librarians or library assistants and friends without children were deemed the least important sources, indicating that "mothers clearly valued the experiential nature of the information they received from other mothers and family, and the shared reality of their experience" (Loudon et al., 2015, p. 39).

Nicholas and Marden's (1998) study collected data about information needs and sources from parents of children under five years old; they too found that health of the child—which included sleep and feeding—was the number one topic upon which parents needed information. Nicholas and Marden (1998) also discovered a preference for perceived trustworthiness and lived experience: the most common sources for information about health and feeding were the parent's health visitor,[4] general practitioner, and family and friends (Nicholas & Marden, 1998, p. 45). Berkule-Silberman et al.'s (2010) study again highlighted the importance of family and friends and healthcare providers as sources of information, but also found print (books, magazines, etc.) to be a primary source of information for the low socio-economic status mothers in their study.

The internet is a popular source for parenting information: Larsson (2009) found that 84% of respondents to a waiting room questionnaire recruited from an offline health clinic had used the internet to look up prenatal information, assessing reliability by its degree of consonance with other sources. In contrast, Grimes, Forster, and Newton (2014) found that less

4 "A person employed to give advice to people, especially older people and the parents of very young children, about health matters, sometimes by visiting them in their own homes" (Cambridge Advanced Learner's Dictionary & Thesaurus, 2016).

than half (44%) of their respondents had used the internet to access information. Interestingly, the type of pregnancy and postpartum care respondents received altered their assessment of information usefulness: those receiving care from a midwife described their midwife as their most useful source of information, whereas the internet was the most useful source to those receiving care from a doctor (Grimes et al., 2014). This was reflected in Lagan, Sinclair, and Kernohan's (2010) study in which 49% of respondents (women from 24 countries who had used the internet for parenting information while pregnant) reported dissatisfaction with information given by health professionals. In addition, Lagan et al. (2010) found that respondents' confidence levels grew significantly after internet usage.

Social media specifically is an important source of parenting information (e.g., Bartholomew, Schoppe-Sullivan, Glassman, Kamp Dush, & Sullivan, 2012; De Choudhury, Counts, & Horvitz, 2013; Nolan, Hendricks, Ferguson, & Towell, 2017), but one study found that infant feeding information on these platforms was either not present or not memorable (Asiodu et al., 2015). Bartholomew et al. (2012) found that 44% of the mothers in their study reported more Facebook use after birth, but that they were primarily using it to build and maintain weak-tie connections, not seek information. In an analysis of Twitter use by mothers before and after birth, De Choudhury et al. (2013) found about 14–15% of their participants reduced their social media interactions after birth, but what they did tweet displayed "a number of changes in emotion expression in a generally negative direction" (p. 1440). Social networking sites (Nolan et al., 2017) and the internet more broadly (Valaitis & Sword, 2005) have been found to be particularly important resources for adolescent mothers.

However, many do not have the chance to participate online because the digital divide is still a significant problem. Those that do not have the necessary literacies or access to the

internet (the "have-nots") are still disproportionately represented by lower SES, less educated, and minority people, especially Blacks (Brodie et al., 2000; Cotten & Gupta, 2004; Sayakhot & Carolan-Olah, 2016; H. Song, Cramer, McRoy, & May, 2013).

3.1.6.2. Barriers to information seeking. Loudon et al. (2015) identified four barriers to IS mentioned by the mothers throughout their study: "lack of time and opportunity; conflicting information from different sources; requiring information about potentially contentious or sensitive topics; and lack of engagement with peers" (p. 36). Related to the last two themes, Loudon et al. (2015) also found that "mothers feared being "judged" by other mothers, family and healthcare professionals about their parenting choices, causing them to hold back and refrain from seeking advice on contentious or sensitive topics in particular" (p. 39). They found that internet anonymity played an important role in getting IN met in these circumstances, but that this fear of judgement was still not completely eliminated online (Loudon (2015); see also Plantin & Daneback, 2009).

Another aspect of parenting IS that could be designated a barrier concerns the role of instinct. Reflecting Belenky et al.'s WWK theory, Loudon et al. (2015) found that mothers often resorted to their instinct when resolving information conflicts, instead of continuing to seek information. Loudon et al. (2015) also refer to O'Key and Hugh-Jones's (2010) finding that instinct or intuition is the justification most commonly given when a mother's parenting decision is contrary to professional advice or recommendations; instinct and intuition, therefore, may act as a barrier to further parenting information seeking.

3.1.6.3. Information overload and unmet needs. Loudon et al. (2015) recognized that mothers tend towards ""obsessive" seeking practices … particularly online and in the coping context" (2015, p. 41). Instead of a positive affective outcome as a result of IS, parents could

experience an increase in anxiety, fear, or distress because of information overload (Lambert & Loiselle, 2007).

While Nicholas and Marden (1998) found a variety of parenting IN unmet, Loudon et al. (2015) found that unmet IN particularly applied to FFing, given both government legislation in the United Kingdom banning the promotion of formula and the prevailing social stigma associated with not BFing.

3.1.7. Infant Feeding Information Behavior

3.1.7.1. Breastfeeding information needs. *Generally.* The need for practical advice about BFing that is clear, concise, consistent, and correct is a constant theme throughout BFing-related IB studies. For example, Rajan (1993) found that BFing success was significantly associated with help given by the hospital staff during the immediate postpartum period, but that inaccurate or conflicting information frustrated this success. When comparing BFing outcomes of a 1997 cohort of mothers who were provided written instructions and frequent nurse visits at home throughout the first year of their infant's life with a 1993 cohort who received no such support and information, Hoyer and Horvat (2000) found that the 1997 cohort BF for statistically significantly longer, reflecting findings in earlier studies (for example, Brent, Redd, Dworetz, D'Amico, & Greenberg, 1995; Hartley & O'Connor, 1996; Jenner, 1988).

In Graffy and Taylor's (2005) qualitative study of 730 mothers, conflicting BFing advice was a significant problem for the participants. This is echoed in many other studies (A. Brown, 2016; Clifford & McIntyre, 2008; Mozingo et al., 2000; Rajan, 1993; Smale, Renfrew, Marshall, & Spiby, 2006; Spear, 2004; Spiro, 2016), highlighting the importance of thorough and up-to-date education and training for all healthcare providers in contact with BFers (Clifford & McIntyre, 2008; Smale et al., 2006; Spiro, 2016). Graffy and Taylor (2005) and Rajan (1993)

specifically note the lack of confidence in BFing that can result from receiving conflicting advice.

Although Graffy and Taylor (2005) found that practical advice and information on BFing benefits was most helpful, Brown's (A. Brown, 2016) study found that mothers expressed a desire for BFing information that stressed benefits other than infant health (e.g., convenience, cost, and closeness), employed less of an all-or-nothing approach, and included information about both the positive and negative aspects of BFing (cf. Spear, 2004 discussed below).

Prenatally. While several studies have concluded that BFing outcomes are improved following prenatal education (Cox et al., 2017), Lumbiganon et al.'s (2016) meta-analysis of 24 such studies found that there was no conclusive evidence indicating that prenatal peer counseling, lactation consultation, and formal education increased BFing initiation and duration. However, information about EPing can be distinguished from nursing information: while most pregnant women know that nursing is one of their infant feeding options, many may not know that EPing is also on that list. There is no research on the impact of prenatal education that includes EPing information on BFing initiation and duration, as echoed by Bai et al. (2016): "despite the growing trend of breast-milk expression, antenatal breast-milk feeding education has not sufficiently addressed this issue" (p. 499).

Spear (2004) used a case study approach to highlight the importance of receiving accurate information about BFing initiation prior to birth, including what could go wrong or what alternative methods might need to be employed. She stresses that "explanation about alternative feeding methods for infants who cannot be breastfed initially, familiarization with use of the breast pump, and hand expression of milk prior to delivery may be helpful" (p. 774) so as to prevent idealized and unrealistic expectations of the BFing experience (see Mozingo et al.,

2000). Relatedly, the mothers studied by Graffy and Taylor (2005) felt that the information they were given prenatally did not reflect the "realities of breastfeeding" such as "discomfort and the time they might spend feeding, and … common feeding problems" (p. 181) (A. Brown, 2016; see also Smale et al., 2006).

3.1.7.2. Formula feeding. Similar information challenges face those who FF. For example, Lakshman, Ogilvie, and Ong (2009) found in their systematic review that mothers consistently felt that they did not receive enough information about FFing and did not feel empowered to make decisions. This lead to feelings of guilt, anger, worry, uncertainty, and a sense of failure, as well as mistakes in the preparation of formula (Lakshman et al., 2009; E. Lee, 2007). Lee (2007) found that while 80% of participants (British mothers) had received information about BFing, only 47% had received information about FFing; many participants resorted to reading the information on the formula packaging.

3.1.7.3. Milk expression. Given the likelihood that most BFers will express milk at some point, correct and comprehensive information about milk expression is essential. However, "despite the growing trend of breast-milk expression, antenatal breast-milk feeding education has not sufficiently addressed this issue" (Bai et al., 2016, p. 499). According to Rasmussen and Geraghty, "at present, the lay literature (e.g., magazine articles, Internet postings) remains a major source of information about maternal behavior related to milk expression, and some of these behaviors are of public health concern" (2011, p. 1356). Furthermore, McInnes, Arbuckle, and Hoddinot (2015) found that the information on U.K. websites about milk expression and pumping was inconsistent, incomplete, and not evidence-based. Commercial websites (i.e., pump manufacturers' sites) emphasized the restrictions associated with BFing, lack of sleep, and the

baby's bonding with other family members, whereas non-commercial sites emphasized hand expression and separation from the baby due to circumstance, not choice (McInnes et al., 2015).

In their analysis of milk expression and breast pumping posts in the "April 2014 Birth Club" group on the online forum section of the website, BabyCenter.com, Yamada, Rasmussen, and Felice (2016) found that four main themes (i.e., information needs) emerged from the posts. These themes and their related topics are shown in Figure 15.

Main Theme	Examples of Topics Raised by Women
Choosing and purchasing pumps	Options available through insurance policy; length and logistics of insurance process; pump affordability vs. quality; when, where, and how to get a pump out-of-pocket
Storing and preparing pumped HM	Bag and bottle quality and desired traits (e.g., maintenance required to keep supplies clean and cost); length of storage time at room temperature, in refrigerator, and in freezer; thawing and warming; mixing from different pumping sessions; effects of alcohol, caffeine, and medications on pumped HM; smell, taste, and appearance of fresh, refrigerated, or frozen pumped HM
Strategies for and difficulties with pumping and integrating pumping into work	Pump features and malfunctions; managing physical discomfort; other experienced and anticipated barriers to pumping (e.g., heavy workload and a lack of designated place to pump)
Stopping pumping	Appropriate time to stop pumping and/or providing pumped HM; acceptable reasons to stop pumping; guilt; painful engorgement; drying up HM supply

Figure 15. Themes and topics about milk expression and breast pumping from the April 2014 Birth Club on BabyCenter.com (R. Yamada et al., 2016, p. 4).

According to Chen, Johnson, and Rosenthal (2011b), IFPS II respondents who received breast pump education from classes, a support group, or friends/relatives were likely to BF for longer; there was a negative association between respondents who received education from a physician or a physician's assistant and BFing duration. No positive or negative associations could be made between BFing duration and receiving breast pump education from nurses, lactation consultants, nutritionists, WIC, or the media (P. G. Chen et al., 2011b).

3.1.7.4. Information sources. Preferred sources of infant feeding information mirror those for obtaining more general parenting information examined above. While healthcare providers and reading materials were popular, Chezem et al. (2001) found that mothers were four

times as likely to initiate a conversation about infant feeding with a family member or friend, irrespective of their chosen or preferred feeding method (HM, formula, or both). Gildea et al.'s (2009) study found that the number one source of feeding advice for the mothers in their Northern Ireland study was their health visitor, with their own parents (the child's grandparents) coming in a close second. The trend of written material, family, and healthcare providers being the most popular sources of information is reflected in a number of other studies (for example, Grimes et al., 2014; Lewallen, 2004; Shieh, McDaniel, & Ke, 2009; H. Song et al., 2013; White et al., 2006).

Chezem et al.'s (2001) view that "encouraging women to view friends and family with breastfeeding experience as sources of valuable advice may increase the likelihood that they will be called upon when breastfeeding assistance is needed" (p. 25) demonstrates their opinion that this informal information network has a positive influence on BFing. Contrary to Lee (2007), Chezem (2001) found no difference in the information sources used by those planning to FF versus BF. Clifford and McIntyre (2008) strongly recommend "providing information to these support people that is both practical and timely in relation to the promotion and management of breastfeeding" (p. 14), a sentiment that receives official support from the Academy of Breastfeeding Medicine (2009) and mothers themselves (A. Brown, 2016). Although fathers/partners are the most influential person in the initial decision to BF (see above), they are rarely mentioned as a source of information.

Despite the above discussion, the internet remains a popular source of information about BFing: of 95% of respondents in McDougall and Ecclestone's (2015) study that had used the internet during pregnancy, 60% had searched for BFing information. Fifty-six percent of postpartum mothers in Slomian, Bruyère, Reginster, and Emonts' (2017) Belgian study had

searched for BFing information online; most (83%) found the information quite useful, but did not rate the quality of information very highly (an average of 5.3 out of 10). Both Slomian et al. (2017) and McInnes et al. (2015) found that participants used information found on the internet to help them make decisions about infant feeding.

Although in need of updating, Shaikh and Scott's (2005) study found that most of the BFing websites they assessed complied with the WHO code and about half complied with the *Health on the Net Code of Conduct* (Team HON, 2018) standards for effective and reliable health information on the internet. They found that "while much information on breastfeeding on the Internet is accurate, there is wide variability in the extent of information, usability of Websites, and compliance with standards of medical Internet publishing" (Shaikh & Scott, 2005, p. 175). Because of questions about accuracy, completeness, and trustworthiness, participants in Slomian et al.'s (2017) study expressed a desire for health professionals to suggest reliable websites for new mothers.

3.2. The Microsystem

3.2.1. The Microsystem as a Source of Information

The models examined so far treat IS behavior as an individual activity. However, the microsystem, that is the primary social groups, in which the information seeker finds themselves influences the entirety of the information needs–seeking–use continuum. For example, (Thomas) Wilson's model of IS starts with examining the context of the IN, including the view of a "person in context" shown in Figure 16.

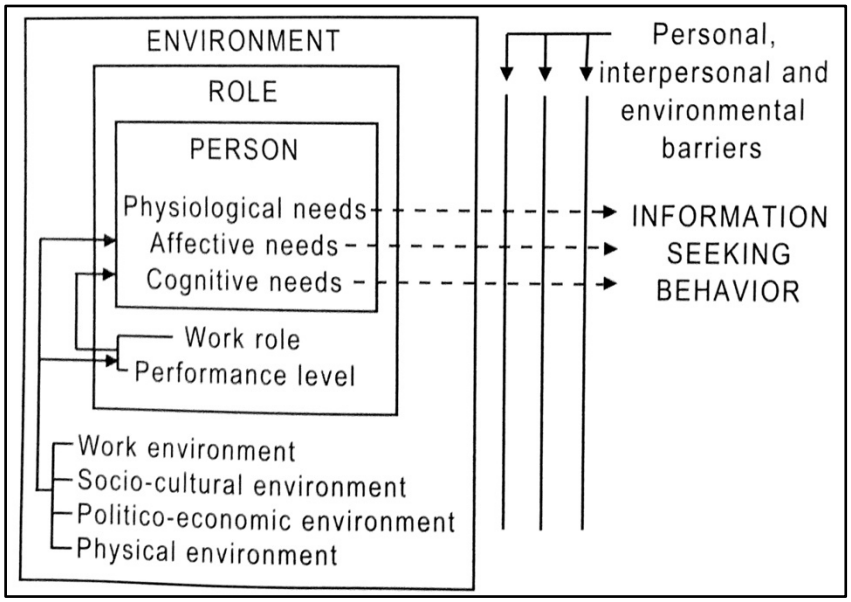

Figure 16. Wilson's "person in context" (T. D. Wilson, 2005).

Another framework that examines an individual as part of a larger system is that of *Everyday Life Information Seeking* (ELIS). Originally a model devised by Savolainen (1995), ELIS has now developed into a framework that incorporates a number of different models focused on "the ways in which people access and use various information sources to meet information needs in areas such as health, consumption, and leisure" (Savolainen, 2010). Dervin's sense-making, in the context of individual IS, was examined above. However, as the illustration of Dervin's model in Figure 11 shows, an important element of sense-making is that of "situations" which "stands for the time–space context, where the individual becomes aware of the insufficiency of one's earlier definition of a situation" (Savolainen, 2010, p. 1782).

Another model falling under the ELIS umbrella is that of Chatman's *Theory of Life in the Round* (1999). Life in the round is a "public form of life in which things are implicitly understood" (Chatman, 1999, p. 212). Of the four concepts—small world, social norms, social types, and worldview—central to life in the round, that of a "small world" can be likened to an individual's microsystem: a small world is "a society or world in which members share a

common worldview" (Chatman, 2005, p. 80). Individuals move out of their small world only when there is a need for information that they cannot get from within it (Chatman, 1999). Consequently,

> life in the round adversely affects information seeking in day-to-day situations; people will not search for information if there is no need to do so. Small world inhabitants ignore information if they perceive that their world is working without it (i.e., they have enough certainty, comfort, and situational predictability so that the need to seek information is negated). Individuals will cross information boundaries only if: 1) information is perceived as critical; 2) there is a collective expectation that the information is relevant; and 3) a perception exists that the life lived in the round is no longer functioning. (Savolainen, 2010, p. 1784)

Williamson's (1998; 2005) ecological model was examined briefly in Chapter 1 and subsequently incorporated into the framework for this proposal. As well as suggesting that social and cultural contexts have an effect on IN, IS, and IU, Williamson's (2005) model also "suggests that, although people purposefully seek information in response to perceived needs, they also monitor their world and receive information incidentally" (Savolainen, 2010, p. 1784). How information is monitored—and the degree of importance given to each source of information—is also based on social and cultural context, such as individual background and values, physical environments, person characteristics, SES, and lifestyle (Williamson, 1998; 2005). As described by (Patrick) Wilson (1983), those who are deemed to "know what they are talking about" have cognitive authority; what constitutes "knowledge" is, again, based on the social and cultural context. Therefore, the same individual may have cognitive authority in one venue (e.g., in an online group) but not in another (e.g., a doctor's office), even concerning the same topic.

Fisher's *Information Grounds* (née Pettigrew, 1999) could be seen combining Chatman's (1999) small worlds and Williamson's (1998; 2005) ecological perspective, given that the propositions of information grounds are as follows.

> *Proposition 1:* Information grounds can occur anywhere, in any type of temporal setting and are predicated on the presence of individuals.

Proposition 2: People gather at information grounds for a primary, instrumental purpose other than information sharing.
Proposition 3: Information grounds are attended by different social types, most if not all of whom play expected and important, albeit different roles in information flow.
Proposition 4: Social interaction is a primary activity at information grounds such that information flow is a byproduct.
Proposition 5: People engage in formal and informal information sharing, and information flow occurs in many directions.
Proposition 6: People use information obtained at information grounds in alternative ways, and benefit along physical, social, affective, and cognitive dimensions.
Proposition 7: Many subcontexts exist within an information ground and are based on people's perspectives and physical factors; together these subcontexts form a grand context.
(K. E. Fisher, Durrance, & Hinton, 2004, pp. 756-757)

Everyday information grounds include medical clinics, hair salons, bars, clubs, daycare centers, metro buses, bike shops, bookstores, libraries, food banks, restaurants, coffee shops, communal laundry rooms luggage carousels, places of worship, and the workplace (K. E. Fisher, 2005; K. E. Fisher et al., 2004). One study recognized the growing importance of the internet as an information ground (K. E. Fisher, Naumer, Durrance, Stromski, & Christiansen, 2005).

A theory (so far) unrelated to ELIS is Rioux's (2005) *Information Acquiring-and-Sharing*. Rioux (2005) theorized that an individual:

1. Cognitively stores representations of other people's information needs
2. Recalls those needs when acquiring (in various contexts) information of a particular type or quality
3. Makes associations between the information that s/he has acquired and someone s/he knows who s/he perceives to need or want this information
4. Shares this information in some way
(2005, p. 169)

Particularly pertinent to web-based sharing tools, this theory stresses that IA&S behaviors are fundamentally social. For example, when an individual comes across (per Erdelez's information encountering (1997)) information on the internet that they realize serves the perceived information need of someone else within their microsystem, they will share it via some form of communication (e.g., email, text message, tagged Facebook post, word-of-mouth, etc.)

(Rioux, 2005). Rioux (2005) surmises that "the notion that users acquire information in response to both their own needs and motivations as well as the needs and motivations of other people they know sets forth a holistic rather than an atomistic view of human experience" (p. 171).

3.2.2. An Online Microsystem as a Source of Support

Information grounds can also be sources of support. As examined in Chapter 2, a BFer's in-person microsystem support is important to their BFing success; what was not examined in Chapter 2 was the potential effect that online support could have on infant feeding. Participants in Bernhardt and Felter's (2004) "expressed preference for online clinical health information that is presented by clinical professionals, and online parenting advice that is presented from other parents" (p. e7) demonstrating that a microsystem of other parents provides an important source of information. For example, Plantin and Daneback (2009) found that parents had "not only a desire for facts and information but an interest in more experience-based advice as well as interacting with other parents" (p. 42). O'Connor and Madge's (2010) study found that the internet was an important source of "safe," non-judgmental advice and support for parents, especially because they are less likely than previous generations to receive support or up-to-date advice from their own parents. They did note, however, that internet-based interactions did "not replace face-to-face communication or more traditional support mechanisms such as family, friends, and health carers, rather it serves to supplement these by providing an additional resource" (H. O'Connor & Madge, 2010, p. 351).

Nevertheless, Bartholomew et al. (2012) found that when "when mothers reported that a greater proportion of their Facebook friends were family members or relatives, they reported greater satisfaction with the parenting role" (p. 465), perhaps indicating a melding of on- and offline support networks. However, they also found that "no aspect of Facebook use was

significantly associated with parenting self-efficacy for mothers or fathers, and for mothers, more frequent visits to Facebook accounts and more frequent content management were each actually associated with higher levels of parenting stress" (Bartholomew et al., 2012, p. 465). Although McDaniel, Coyne, and Holmes (2011) likewise found no associated between social networking and connectedness or social support, they did find that blogging (reading and/or authoring) positively predicted feelings of connection with extended family and friends. They theorized "that as mothers are able to share successful parenting experiences on blogs, receive feedback from family and friends, and also learn through vicarious experience while reading blogs, their perceptions of social support could increase" (B. T. McDaniel et al., 2011, p. 1515).

However, other studies have found that online social support has positive outcomes for mothers, especially if young and isolated or struggling with the mental health (Dunham et al., 1998; Scharer, 2005). Cowie, Hill, and Robinson (2018) found that posts and comments on the Australian Breastfeeding Association's forum almost universally expressed or provided emotional support (82% and 97% respectively); only 29% and 8% of posts/comments, respectively, gave or sought factual advice/opinion. Relatedly, Madge and O'Connor (2006) found that the internet increased their participants' "real sense of empowerment in the transition to motherhood" (p. 199), despite the very traditional stereotypes of mothering and gender roles. One study characterized online support as providing reassurance that resulted in participants feeling less alone and more able to normalize symptoms or experiences they were undergoing (Prescott, 2017).

3.3. The Mesosystem and Exosystem

Those that seek information and, in particular, participate in on- and offline communities have multiple microsystems that interact with one another and with an individual's exosystem

(those institutions whose existence and actions affect the individual and their society) (Bronfenbrenner, 1986). The quality of an individual's mesosystem (an individual's network of microsystems and the process through which they interact) is related to the degree of social capital they may able to leverage. Lin (2001) defines social capital as "resources embedded in a social structure which are accessed and/or mobilized in purposive actions" (p. 12): the higher the quality of social resources available to an individual, the more likelihood there is of achieving desired outcomes or goals. Social capital theory dovetails with the ecological framework, as it provides a way to assess the reach, range, and diversity (N. Lin & Dumin, 1986) of an individual's mesosystem and therefore evaluate its role in facilitating information exchange within and between systems. Likewise, social capital theory is compatible with IB theories and models such as Erdelez's (1997) information encountering (those with higher social capital will likely encounter more and higher quality information), Savolainen's (1995) ELIS (those with greater range and diversity of information sources within their everyday lives would be more likely find the information they need), and Fisher's (Pettigrew, 1999) information grounds (those whose small worlds are larger or more diverse will likely have higher social capital).

Social capital can be influenced by an individual's exosystem. For example, Lave and Wenger's (1991) *Communities of Practice* can be seen as both exosystems in which information, knowledge, and social capital of specific kinds are created, curated, and kept, as well as a community of individual members who have become attuned to one another through the pursuit of a common practice (e.g., midwifery, Alcoholics Anonymous, K–12 education). Rather than sharing information within one's own microsystem, a community of practice exists if the following three elements are present:

- Members must understand what the community is for; that is, the members must feel a sense of *joint enterprise* and accountability.

- *Mutual engagement* arises when members have time to build trust and relationship with one another through regular interactions.
- Members will develop a *shared repertoire* of stories, language, etc. that embodies the distinctive knowledge of the community and allows member to negotiate meaning. (Wenger, 1998; Davies:2005ve p105; citing 2000)

Indicators that a community of practice exists include

> Evidence of sustained relationships; rapid flow of information and propagation of innovation; knowing what others know, what they can do, and how they can contribute specific tools, representations, and other artifacts; shared stories, inside jokes; and a shared discourse reflecting a certain perspective on the world
> (E. Davies, 2005, p. 105)

Newcomers to an established community of practice not only learn to be practitioners, but have their identities shaped by the community of practice. Davies (2005) suggests that community of practice is relevant to the study of IB because of its focus on context and learning within a specific community with its own social practices.

3.4. The Inner and Outer Macrosystems

An individual's social practices are also influenced by their community and culture and the policy and law of their geographical location. In her ecological theory of human IB, Williamson (2005) recognizes that an information user is influenced not only by their personal network, media, and institutional sources, but also by the physical environment, social and cultural values, and socio-economic circumstances. Figure 17 illustrates how these different influences interact.

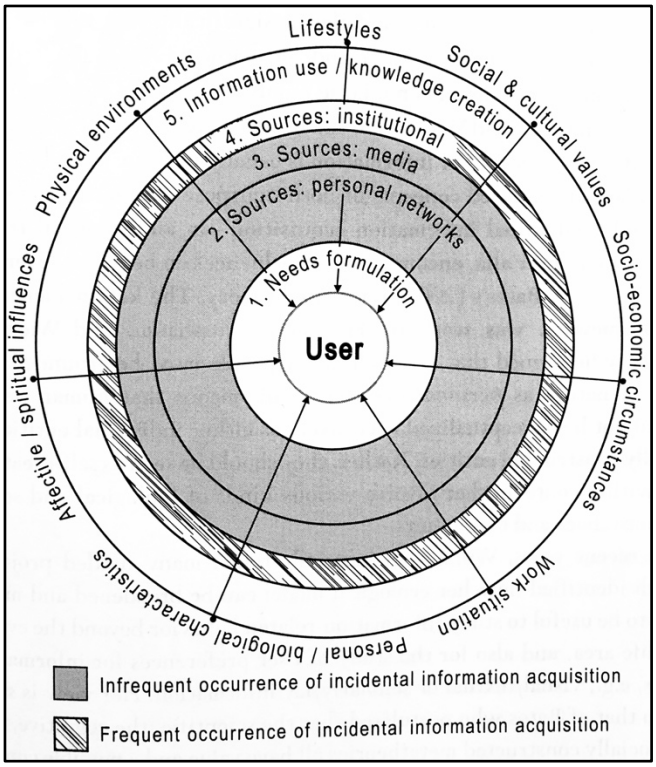

Figure 17. Ecological model of information seeking and use (Williamson, 2005).

Williamson's model was examined in Chapter 1; in addition, macrosystem influences on BFing were examined in Chapter 2.

3.5. The Chronosystem

The *Diffusion of Innovations Theory* (DIT), developed by Rogers in the early 1960s, describes how innovations are adopted into mainstream use (or not) as time passes. DIT can be embodied in a simple definition: "Diffusion is the process by which an *innovation* is *communicated through channels over time* among members of a *social system*" (LajoiePaquette:2005we p118 , citing Rogers, 2003). An innovation can be an idea, practice, or object perceived of as new. IS behavior to find out and reduce uncertainty about the innovation is required to move from *knowing* (about the innovation) to *persuasion* (forming an attitude toward the innovation) to *decision* (to adopt or reject the innovation) to *implementation* (of the

innovation) to *confirmation* (of the innovation) (Rogers, 2003).

The time that passes while this innovation-decision process take place is just one of three temporal elements in DIT. The second assesses the timeliness of an individual in adopting the innovation: in comparison to others in their social system, were they an early, average, or late adopter (Rogers, 2003)? How long it takes member in a social system to adopt an innovation will depend, to some degree, on the channels of communication through which diffusion of the innovation occurs (Rogers, 2003). For example, mass media marketing of a new breast pump might result in a large number of adopters in a short period of time, whereas a hack discovered by an EPer might be diffused through word of mouth and therefore take a great deal of time to be adopted.

The third element of time in DIT is the rate of adoption of an innovation, for example, slow change over a long period of time (e.g., societal acceptance of BFing in public) or fast change over a short period of time (e.g., widespread reliance on breast pumps). Rogers (2003) suggested five characteristics that influence how quickly an innovation is adopted:

- *Relative advantage*, measured by cost, efficiency, social status, convenience, satisfaction, etc., compared to the former idea, practice, or object.
- *Compatibility* with current values, social norms, and experiences of those in the social system.
- *Complexity* of the innovation, for example the ease of understanding, implementation, or use of it.
- *Trialability*, or the degree to which it can be tried on an experimental basis before adopting permanently.
- *Observability* reflects whether the innovation or the results of the innovation will be visible to others.

DIT is relevant to this proposal not only because it explains an element of IB, but also because EPing is a relatively new phenomenon that could still be regarded as an "innovation." Thus, DIT could be a lens through which both the IB surrounding and the practice of EPing is viewed.

3.6. Summary

This chapter examined IB models and theories at each level of the ecological perspective on EPing set out in Chapter 1. Each had its unique properties and no single model or theory has so far been able to explain the totality of IB, or even of its constituent parts: needs, seeking, and use. It is unlikely that one model or theory will explain the IB of EPers, especially since the topic has so many confounding factors. Social support, especially when found online, blurs with IB and may even turn into a community of practice if the community shares a specific culture and outlook and is specifically joined together to learn about, teach, and practice EPing. Finally, EPing could be regarded as an innovative practice and therefore practitioners of it are early adopters involved in diffusing information about it. The data collected in this study should illuminate whether these hypotheses are supported.

As EPing grows in popularity, it is the responsibility of LCPs to provide accurate and useful information available to expectant parents on this topic so that BFing outcomes can be improved. Information provided in print and online should also be comprehensive and correct. However, the gaps in the current literature expose how little we know about the IB of EPers and therefore it is impossible to tailor these resources to include the information they need in a format that is clear, succinct, and ready to apply to their EPing practices. The next chapter, Methodology, explains this study, which aims to fill these gaps.

Chapter 4. Methodology

This chapter covers the what, where, how, and when of the study conducted for this PhD research project. It starts by examining the overall research design, then describes the participants and how they were recruited. It goes on to describe the specific survey design and how data were and will continue to be collected. It finishes by describing the data analysis that will be performed to answer the following research questions (as laid out in Chapter 1):

1. Why do EPers exclusively pump?
2. When and from where do EPers first hear about EPing?
3. What are the information and support needs of EPers?
4. Where do EPers get their information and support about breastfeeding and EPing from and how useful are those sources?
5. Does IB and support relate to how EPers feel about EPing and their level of success?
6. Does the experience of EPing change over time?

4.1. Research Design

As the goal of this research is to investigate the lived experiences, and especially the information behavior (IB), of exclusive pumpers (EPers), this study employs two main protocols: an initial online survey open to both current and former EPers and follow-up online surveys sent periodically to respondents currently EPing up until the time they are no longer EPing. This protocol was reviewed and approved by the University of Maryland's Institutional Review Board (reference 1026503-2).

4.1.1. Initial Survey

Using Qualtrics (2018), I compiled an initial survey of 170 open- and closed-ended questions, utilizing matrix tables, Likert scale-type responses, sliders, and open text boxes where

appropriate. Since respondents were routed through the survey depending on their individual experiences (e.g., whether they were currently EPing, whether they wanted to answer questions about their breast pump, etc.), no respondent was eligible to respond to all 170 questions. An online survey of this length and format is ideal for this research because surveys allow for both quantitative and qualitative data to be collected in a form already convenient for analysis. My recruitment through online groups naturally suggested a web-based format.

The most important factor for choosing this survey length and format was based on my knowledge as an active member of the target population: many EPers harbor feelings that their voices have not been heard and are therefore highly motivated to tell their stories. This survey provided them that opportunity and, therefore, a lengthy survey with a considerable number of open-ended questions did not have a detrimental effect on respondents' willingness to participate. Open-ended questions are essential to uncover the subjective experience of EPers and to elicit meaningful stories in addition to measurable variables (Auerbach & Silverstein, 2003, pp. 22-23). Furthermore, although I am a former EPer, I am by no means an expert on the diversity of experiences emanating from it. Open-ended questions, analyzed through inductive coding (see "Data Analysis" below), allows me to use respondents as "expert informants" (Auerbach & Silverstein, 2003, p. 25) and collect data on topics that might have otherwise been missed if the surveys contained closed-ended questions alone.

4.1.2. Follow-Up Survey

Follow-up surveys, initially sent out every two months (follow-up surveys 1, 2, 3, and 4), are now being sent out every month (follow-up survey 5 onwards) to opting-in respondents who indicated on the initial survey that they were currently EPing. Respondents, who re-opt-in at the end of each follow-up survey, continue to receive follow-up surveys until the survey after they

finish EPing. These surveys, containing 83 open- and closed-ended questions (again, no one answered all 83 questions), provide longitudinal data about EPers' experiences throughout their EPing journey.

4.2. Participants

4.2.1. Eligibility Criteria

The target population for this study was current or former EPers. The eligibility criteria for the initial survey were (a) at least 18 years of age and (b) either a current or former EPer. Respondents confirmed they met these criteria (a) at the time of consenting to participate (survey question one) and (b) immediately after consenting (survey question two). Any respondent answering "no" to question one or two was barred from responding further. The initial survey collected responses from March 7, 2017 to March 6, 2018 and was started 2,403 times; 2,367 (98.5%) responses satisfied these basic eligibility criteria.

As discussed above, respondents who indicated on the initial survey they were currently EPing were asked whether they would be willing to participate in follow-up surveys. Respondents continued to be eligible to participate as long as they continued to EP; when a respondent indicated that they weaned from the pump during the most recent between-survey time period, they were routed to questions about weaning and ceased to be eligible to receive any future follow-up surveys. The first follow-up survey was sent out in early May 2017; they will continue to be administered until all of those in the follow-up survey cohort wean from the pump. Follow-up survey 1 was started 372 times; follow-up surveys 2–8 were started 185, 102, 56, 21, 11, 9, and 5 times respectively.

4.2.2. Recruitment

Respondents were recruited through an email newsletter and various online groups, a list

of which can be found in Appendix 1. These recruitment opportunities were either known to me as a participant in these groups or found through an internet search for "exclusive pumping." Therefore, the initial sample was one of convenience. Respondents also shared the opportunity to participate through on- and offline word of mouth, so as to create a certain snowball sampling effect. The initial "Invitation to Participate" is in Appendix 2.

Respondents to the follow-up surveys were recruited from those who responded to the initial survey during March and April 2017 and indicated that they were currently pumping and interested in participating in follow-up surveys. The "Invitation to Participate in Follow-Up Surveys" (see Appendix 3) was sent out to email addresses provided by respondents in their initial surveys.

4.3. Survey Design

4.3.1. Initial Survey

Survey questions were developed from personal knowledge of and published literature about IB, EPing, and/or the prenatal and postpartum periods and in close consultation with colleagues more experienced in survey methodology. After editing and testing by academic peers, the complete survey was pilot-tested by four EPers (two respected leaders within online EPing groups, the author of exclusivepumping.com and its companion newsletter, and a personal friend and EPer with a Master of Public Policy degree). Testers took the survey and were given space to include comments, questions, and suggestions at the end of each set of questions. Based on their suggestions, I changed the wording of several questions and added questions about weaning off the pump and attempts to nurse both pumplings and other children. Testing also revealed some technical issues with the survey which were corrected, assuring that responses conveyed the respondent's answer correctly (e.g., the year of birth was only accepting single

digit answers prior to correction).

The initial survey contained questions concerning the following categories: consent to participate; inclusion criteria; demographics; grief pumping screener and warning (the survey is phrased as if their pumpling is still alive); employment; circumstances surrounding each episode of EPing; reasons for EPing; IB regarding EPing; experiences of EPing in general; feelings about EPing; experience with various types of breast pumps; general health; plans for future EPing; and willingness to participate in follow-up surveys. Figure 18 summarizes the questions within each survey section and illustrates the different ways respondents could be routed through the survey. The breadth of topics was intentionally expansive because of the lack of prior research and my desire to comprehensively study this population. However, given the sensitivity of this topic, very few questions were mandatory (only those needed to correctly route respondents through the survey) and most had a "I prefer not to answer" option. Appendix 4 contains the complete initial survey instrument.

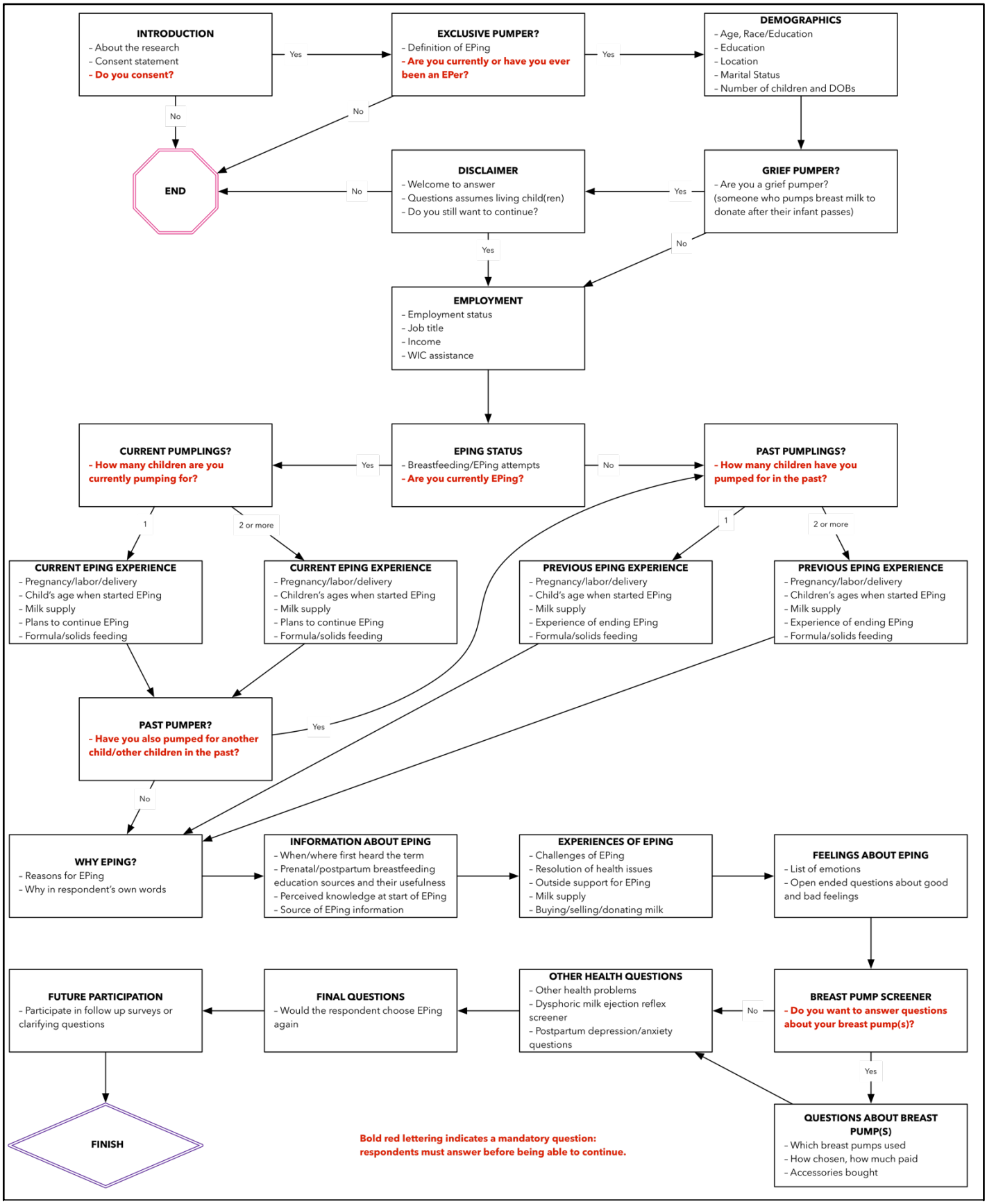

Figure 18. Initial survey flow diagram.

4.3.2. Follow-Up Surveys

The follow-up survey utilized a small number of questions copied from the initial survey and was therefore not pilot tested. The following categories were covered in the follow-up survey: consent to participate; email address (to connect previous responses with current responses); current EPing status; changes to employment; information about EPing or weaning off the pump; experiences of EPing; feelings about EPing; changes to breast pumps they were using; new pump accessories; general health; and willingness to participate in future follow-up surveys. Questions asked only about the period of time between the previous and the current survey. Figure 19 summarizes the questions within each survey section and illustrates the different ways respondents could be routed. Appendix 5 contains the complete follow-up survey instrument.

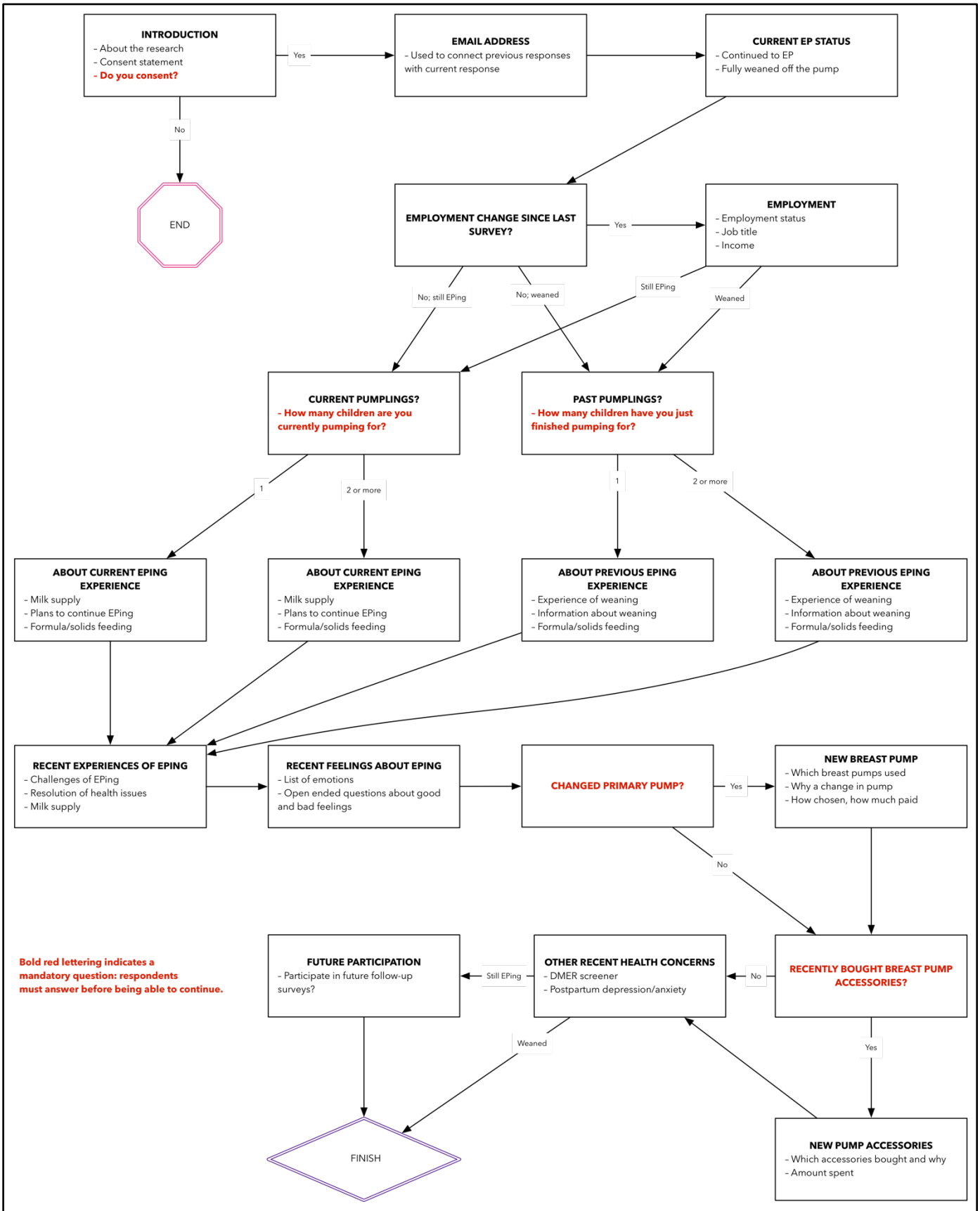

Figure 19. Follow-up survey flow diagram.

4.4. Data Collection

Informed consent was obtained through a mandatory survey question inquiring about the respondent's understanding of the study and its risks and benefits. Data were stored in compliance with the University of Maryland Institutional Review Board requirements. Measures to protect confidentiality included not collecting names of respondents, asking only for an email address if willing to participate further or to connect previous responses with the current responses (follow-up surveys only), and excluding those email addresses in data downloads where feasible.

Respondents accessed and completed both surveys through a URL, included on the Invitation to Participate, accessible on any internet-enabled device. They were able to save their progress and return to finish the survey within a month of starting it; however, no reminders were sent out as a respondent's email address was only collected if they were eligible and interested in participating in follow-up surveys. Of the 2,403 respondents who started the survey, only 1,567 (65.2%) respondents finished the survey completely. An additional 440 (18.3%) respondents completed the survey up to and including the questions about why they EPed. Since this data answers Research Question 1, this degree of completion was used as the threshold for inclusion in the data analysis, thus $N = 2{,}007$ (83.5%). Figure 20 presents a visual representation of this threshold.

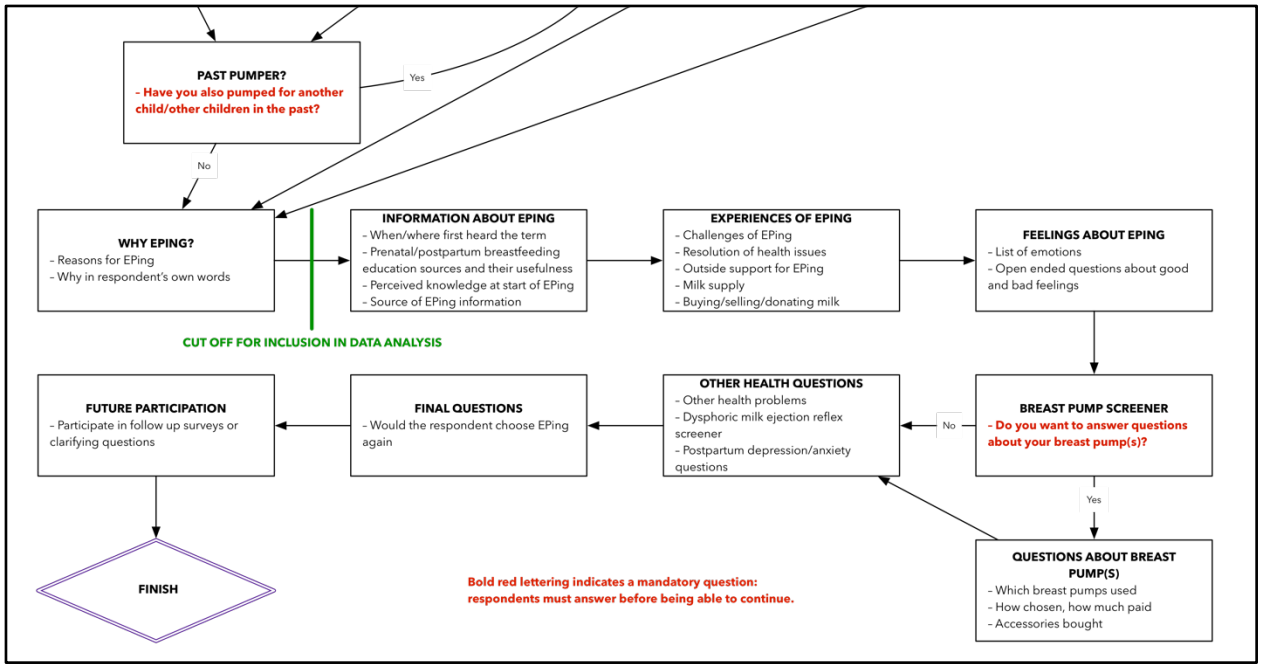

Figure 20. Cut off for inclusion in data analysis.

Follow-up survey respondents accessed the follow-up surveys from a URL included in an email sent to the address they provided in their initial survey or in the most recent follow-up survey they completed. Automated reminders were sent after 7 and 14 days to respondents who had not completed that specific survey. Only data from completed follow-up surveys will be analyzed; incomplete follow-up surveys do not afford the opportunity to connect responses over several different surveys. The number of responses to each follow-up survey sent out so far is shown in Table 4.

Table 4. Number of Responses to Follow-Up Survey.

Survey	Number of invitations to participate sent	Number of times survey started	Number of surveys meeting inclusion threshold; *N* (%)
Follow-up survey 1 *May 2017*	516	377	341 (66.1)
Follow-up survey 2 *July 2017*	257	196	171 (66.5)
Follow-up survey 3 *September 2017*	122	103	98 (80.3)
Follow-up survey 4 *November 2017*	64	56	55 (85.9)
Follow-up survey 5 *January 2018*	27	22	21 (77.8)
Follow-up survey 6 *February 2018*	11	11	11 (100.0)
Follow-up survey 7 *March 2018*	10	9	9 (90.0)
Follow-up survey 8 *April 2018*	5	5	5 (100.0)

"Complete sets" of follow-up surveys are those that contain a response to every follow-up survey a respondent was sent; in other words, they completed all surveys up to and including one survey after they finished EPing, thus providing details about weaning from the pump. The number of complete sets cannot be calculated until all follow-up survey respondents have weaned from the pump. As of the end of April 2018, two survey respondents have not yet weaned from the pump and have agreed to complete at least one more follow-up survey.

4.5. Data Analysis

4.5.1. Quantitative Data

Qualifying survey responses will be downloaded from Qualtrics and cleaned in Microsoft Excel to ensure that data across responses is represented in the same formats (e.g., dates, ages,

spellings). Data will then be analyzed in Excel using the XLSTAT plug-in (Addinsoft, n.d.) to calculate both descriptive and inferential statistics. Statistical tests to be performed on the data include Chi-square tests of independence, independent samples t-tests, Mann-Whitney U tests, and analysis of variance (ANOVA). Statistical significance will be determined using a 95% confidence interval (i.e., $p < .05$, unless otherwise noted).

4.5.2. Qualitative Data

Qualitative data—that is, responses to open-ended survey questions—will be coded based on grounded theory methodology. Grounded theory, originally developed by Glaser and Strauss (1967), allows for theories to be developed from (i.e., grounded in) what research participants say, rather than based on the researcher's preconceived notions of what might be discovered. Furthermore, it allows for the uncovering of issues that are open and unclear in a particular topic (Auerbach & Silverstein, 2003, p. 15). These goals are achieved through bottom-up coding (i.e., no pre-established codes), the process for which is as follows (based on Auerbach & Silverstein, 2003):

1. Upload respondents' answers to open-ended questions to NVivo (QSR International, n.d.), labeled with a unique respondent identifier (i.e. respondent number).
2. In NVivo, identify repeating ideas within the answers to one specific question, keeping the research questions in mind.
3. Create and assign a "theme" to similar ideas. A theme is "an implicit topic that organizes a group of repeating ideas" (Auerbach & Silverstein, 2003, p. 38).
4. Group themes into "larger, more abstract ideas" (Auerbach & Silverstein, 2003, p. 39), known as "theoretical constructs."
5. Present the theoretical constructs as a narrative, describing what has been learned

about the subjective experiences of the EPers participating in this study.

These subjective experiences can then be connected to quantitative data so themes within specific subsamples of respondents can be identified. Criteria for inclusion in subsamples will include parity status (single or multiple pregnancies and birth), intended duration of breastfeeding, pregnancy/birth circumstances, chronic health issues, perceptions of knowledge about breastfeeding and EPing, age, race, income, and education.

The coding process will be completed by at least one additional graduate student, as well as in consultation with my advisor, so as to minimize researcher expectancy effects and maximize the accuracy and comprehensiveness of inductive theme identification. Inter-coder reliability will be calculated to ensure consistency and validity.

4.5.3. Data Analysis Plan by Research Question

4.5.3.1. RQ1: Why do EPers exclusively pump? Descriptive statistics will be used to display the reasons respondents provided for EPing and for not feeding solely formula and/or donor milk. Inferential statistics will be produced to compare whether respondents from different subsamples EP for different reasons. Respondents' own stories of their reasons for EPing and feeding their child formula will be coded to reveal themes not apparent in the quantitative data. These themes will also be analyzed for between-subsample differences.

4.5.3.2. RQ2: When and from where do EPers first hear about EPing? Descriptive statistics will be extracted to determine the proportion of respondents who had heard of EPing prenatally versus postpartum and from what source(s). Inferential statistical tests will be performed to assess whether there is a difference between the timing between different respondent subsamples. Further tests will be performed to explore whether there is a link between this timing and whether respondents had received prenatal or postpartum education.

Tests will also be performed to determine whether the timing and source of first hearing the term correlates with respondents' perception of their EPing knowledge when they first started and to ascertain whether various respondent characteristics are associated with differing perceptions. This timing will also be analyzed for its correlation with respondents' feelings about EPing.

4.5.3.3. RQ3: What are the information and support needs of EPers? The importance of different facets of EPing information (e.g., how to EP, how to store milk, what pump to choose, etc.) will be ranked using descriptive statistics. Using inferential statistics, these data will also be compared to check for between-subsample differences. Responses from respondents with residual questions about EPing will be coded to identify whether there are common information gaps. Respondents' reports of their EPing challenges, breast health issues, attempts to increase/support their milk supply, and experiences with D-MER or PPD/PPA will also be analyzed in response to this RQ, as challenges often lead to an information and/or support need. Support needs that are revealed in the qualitative analysis of open-ended questions will also be included here.

4.5.3.4. RQ4: Where do EPers get their information and support about breastfeeding and EPing from and how useful are those sources? Using descriptive statistics, data will be analyzed to show what sources respondents used at different times (e.g., prenatally versus postpartum) and how useful they found those sources to be with respect to both breastfeeding and EPing information. The information sources used by those who reported treating breast health issues at home, attempting to increase/support their milk supply, or suffering from D-MER or PPD/PPA will also be analyzed. For each of these topics, differences between groups of respondents will be analyzed with inferential statistics. Respondents' own descriptions of their IB will be coded to reveal any additional themes.

Quantitative data about the degree of support received from a variety of sources will be analyzed and compared between different subsamples. Any references to the usefulness of those sources within the qualitative analysis will also be included in response to RQ4.

4.5.3.5. RQ5: Does information behavior and support relate to how EPers feel about EPing and their level of success? Quantitative data concerning feelings about EPing will be reported using descriptive statistics; open-ended questions will be coded to produce a set of themes concerning feelings about EPing. Differences (especially concerning various information and support behaviors) between subsamples will be analyzed using inferential statistics. "Success" will be measured by the length of time weaned EPers fed their child HM as well as how that length of time compared with their intended breastfeeding duration. Any references to feelings or perceptions of success in open-ended questions will also be referred to in this analysis. Levels of success will be reported using descriptive statistics, and between-subsample differences analyzed with inferential statistics.

4.5.3.6. RQ6: Does the experience of EPing change over time? To analyze whether there is any change in respondents' experiences of EPing over time, follow-up surveys from the same respondent must be collated and responses to the same questions compared from one survey to the next. Trends in quantitative data will be analyzed per respondent, but also between respondents. Themes from coding the qualitative data can also be compared per respondent and between respondents. An overall narrative for each respondent that provided a complete set of follow-up surveys will be written so that similarities and differences between respondents' experiences over time can be highlighted.

To support the longitudinal data produced by the follow-up surveys, initial survey respondents will be grouped into cohorts. Grouping will be based on EPing duration for those

currently EPing at the time of the initial survey and, for those who have weaned, on both how long they EPed for and how long ago they weaned. Using inferential statistics, comparisons will be made between these cohorts.

Chapter 5. Future Work

This chapter briefly describes the limitations of this study and the timeline for future work.

5.1. Limitations

The convenience sampling methods used in this study have resulted in a biased sample—although respondents somewhat reflect the demographic of BFers in general, respondents were even more likely to be married, White, and have higher than average household incomes and education levels than an average BFer. In addition, 86% of qualifying respondents were resident in the United States. Additionally, the question "Did you receive breastfeeding education before the birth of your child/children?" was poorly worded: respondents may not have considered their own research/reading "education." As described above, answers to "When did you first hear the term "exclusive pumping?"" were also ambiguous.

Researcher bias may also play a part in this research. As there are no existing studies on the information behavior of EPers, I drew heavily on my own personal EPing experience, perhaps causing researcher expectancy effects. Nevertheless, I aimed to be neutral and comprehensive designing the survey and neutral and systematic when analyzing the data.

5.2. Future Work

Qualitative data analysis will commence shortly after defense of this proposal. With the aid of an internal grant (application currently under review), I will employ a research assistant to help code the qualitative data (of which there is approximately 500,000 words). Quantitative data

analysis will be done in preparation for writing up my final thesis.

In the next 12–18 months, I plan to analyze subsets of the survey data in order to write and submit journal articles. Some possible topics include EPers' perceptions about the effectiveness of galactagogues (substances that promote lactation and milk supply); the donation, sharing, and receiving of HM; and the reactions of others to EPing. Elements of IB will be examined in each.

Table 5 contains the anticipated timeline for the future work already mentioned and also includes conferences at which I hope to present my work.

Table 5. Anticipated progression of future work.

Task	Start Date	Completion Date
Coding of qualitative data	**June 2018**	**August 2019**
Journal submission 1	June 2018	August 2018
Journal submission 2	September 2018	December 2018
Present at the 19th Conference of the International Society for Research in Human Milk and Lactation	*October 2018*	
Present at Healthy Children Project, Inc.'s International Breastfeeding Conference 2019	*January 2019*	
Journal submission 3	January 2019	April 2019
Participate in the Doctoral Colloquium at the iConference 2019	*March/April 2019*	
Present at the iConference 2019	*March/April 2019*	
Journal submission 4	May 2019	July 2019
Present at the International Lactation Consultant Association Conference 2019	*July 2019*	
Analysis of remaining quantitative data	**August 2019**	**December 2019**
Present at the 20th Conference of the International Society for Research in Human Milk and Lactation	*October 2019*	
Present at Healthy Children Project, Inc.'s International Breastfeeding Conference 2020	*January 2020*	
Write up final thesis	**January 2020**	**April 2020**
Defend final thesis	**May 2020**	

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Appendix 1: Recruitment

Table 6. Avenues of recruitment for study participants.

Facebook groups	Approximate Number of Members/Subscribers 03/2017[a]
Exclusive Pumping: Breastfeeding Without Nursing	3,800
EP-BWN: Off Topic Forum	1,300
Exclusive Pumping Mums	22,200
Exclusively Pumping Mamas[b]	9,100
Exclusively Pumping Moms PRIVATE GROUP	16,500
Hack the Breast Pump	2,000
Extended Breastfeeding for Exclusive Pumpers	160
Exclusively Pumping Mamas[b]	1,600
Exclusively Pumping Moms – Exclusive Group	2,000
Life After the Pump	2,000
Queer Mamas*	16,800
TheBump.com breastfeeding message board	Unknown
La Leche League International Exclusively Pumping forum	Unknown
WhatToExpect.com Exclusive Pumping forum	11,800
ExclusivePumping.com newsletter	3,000
BabyCenter.com The Exclusive Pumpers! group	33,000

Notes

[a] Many EPers are members of multiple Facebook groups, so these numbers do not reflect a discreet number of people.

[b] There are two identically named Facebook groups.

Appendix 2: Invitation to Participate in the Initial Survey

I'm writing to ask you to participate in an online survey which focuses on the experiences of mothers who currently exclusively pump (EP) breast milk or have done in the past.

I am a PhD student at the College of Information Studies, University of Maryland. I am conducting the (to my knowledge) first ever academic research on EPing. Your response is essential to help me and many other people better understand EPing. As this research aims to help to identify the information that would be useful to EPers, one of the future benefits could be that women are provided with correct information about EPing earlier when it can be of the most use to them.

Please click the link below to go to the survey (or copy and paste the link into your browser). The survey takes about 30–45 minutes to complete and, if you're currently EPing, you will be invited to participate in follow up surveys.

Survey link: https://umdsurvey.umd.edu/SE/?SID=SV_4OfVvAxPG6XLYRT

Please note that the survey may not load if you have ad or tracker blockers installed.

Your participation in the survey is completely voluntary and all of your responses will be kept confidential. You must be 18 years old or older to participate. No personally identifiable information will be associated with your responses to any reports of these data. The University of Maryland Institutional Review Board has approved this survey. Should you have any comments or questions, please feel free to contact me at fjardine@umd.edu.

Thank you very much for your time and participation.

Sincerely,

Fiona Jardine

Appendix 3: Invitation to Participate in Follow-Up Surveys

I'm writing because one month ago, you participated in an online survey about EPing and indicated that you'd be interested in completing follow-up surveys.

Thank you so much for answering several follow-up surveys already! Your participation is very much appreciated. As you have been pumping for a considerable amount of time, I would like to get monthly insights into your journey from now on. Your monthly participation means that I get even more insight into women who EP, especially those who do it for over 6 months.

As a reminder, I am a PhD student at the College of Information Studies, University of Maryland. I am conducting the (to my knowledge) first ever academic research on EPing. Your response is essential to help me and many other people better understand EPing. As this research aims to help to identify the information that would be useful to EPers, one of the future benefits could be that women are provided with correct information about EPing earlier when it can be of the most use to them.

Please click the link below to go to the survey (or copy and paste the link into your browser). The follow-up survey takes about 15–30 minutes to complete and, if you're still EPing, you will be invited to participate in further follow-up surveys.

Survey link: [personalized per participant]

Please note that the survey may not load if you have ad or tracker blockers installed.

Your participation in the survey is completely voluntary and all of your responses will be kept confidential. You must be 18 years old or older to participate. No personally identifiable information will be associated with your responses to any reports of these data. The University of Maryland Institutional Review Board has approved this survey. Should you have any comments or questions, please feel free to contact me at fjardine@umd.edu.

Thank you very much for your time and participation.

Sincerely,

Fiona Jardine

Appendix 4: Initial Survey Instrument

See attachment.

Appendix 5: Follow-Up Survey Instrument

See attachment.