Lactating Parents Attending Winnipeg Breastfeeding Centre: A Descriptive Study

by

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Abstract

Introduction

The World Health Organization recommends exclusive breastfeeding for the first six months of life and continuation of breastfeeding for at least two years. In Canada, 91.0% of parents initiate breastfeeding, yet only 38.0% continue six-month exclusive breastfeeding. The Winnipeg Breastfeeding Centre (WBC) is the only clinic in Manitoba providing physician-level lactation care. My project aimed to describe the WBC patients' demographic characteristics, breastfeeding difficulties, diagnoses, and treatments.

Methods

This retrospective study describes the WBC population from March 2018 – December 2023 using the clinic's electronic medical records, following the exclusion of follow-up appointments. The data included: intake questionnaire (n=3,230), referral data (n=6,778), and a random sample of the visit notes (n=79). To facilitate descriptive analysis, I manually extracted and coded the free text data from visit notes, which involved converting the "assessment and plan" sections into discrete variables reflecting diagnoses and interventions (i.e. education and supportive psychotherapy).

Results

WBC received referrals from physicians (79.7%), nurse practitioners (1.1%), and midwives (0.1%). The mean infant and maternal age were 8.7 weeks (SD ± 11.4, 95% range 1.0 - 37.4) and 34.8 years (SD ± 4.7; 95% range 25.0 - 44.0), respectively, with 57.9% primiparity and 65.7% vaginal delivery. The WBC patient population mostly resided in Winnipeg (75.0%), Southern Health (15.0%), and Interlake-Eastern (8.1%) regional health authorities. Fort Garry, River East, and Saint Boniface were the most common locations in Winnipeg (34.4 % combined). Referrals to the WBC rose 2.1-fold after March 2020 (COVID-19 pandemic onset) compared to pre-pandemic and remained elevated post-restrictions (May 2023), reflecting both clinic growth over the years and COVID-19 pandemic conditions.

At the time of referral, 40.6% of the patients were taking medication, and 42.1% had one or more medical conditions, with the most common being depression or anxiety (20.1%) and thyroid disorder (8.8%). Patients reported supply issues (54.6%), nipple pain (43.8%), and tongue tie concerns (29.6%) as reasons for attending the WBC. In comparison, infant feeding mechanic challenges (35.4%), low milk supply (30.4%), and nipple issues (30.4%) were the most common WBC physician-diagnosed difficulties. The

higher percentage of reported low milk supply compared to diagnosed cases indicates that many parents *perceived* having a low milk supply without actually having it. Education, supportive psychotherapy, and prescriptions were identified as the main WBC intervention strategies. The most common education topics included infant care discussion (77.2%), feeding guidance (74.7%), and latch education (73.4%). The most common supportive psychotherapy topic was emotional status (anxiety and adjustment reactions) (43.0%). 10.5% of the WBC dyads received a prescription, with domperidone being the most common, prescribed to 6.1% of the clinic dyads.

Conclusions

This study lays the foundation for future research within the WBC and highlights the need to expand specialized lactation care beyond the Winnipeg region, provide timely interventions or referrals (e.g. tongue-tie release), and integrate infant care and lactation education into existing services.

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Dedication

To My Mom, Dad, and Brother,

For believing in me.

To Every Child Around the World Who is Denied the Right to Education,

For everyone deserves a chance

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Table of Abbreviations

Abbreviation	Full Name
CMPA	Cow's Milk Protein Allergy
EMRs	Electronic Medical Records
FSA	Forward Sortation Area
GERD	Gastroesophageal Reflux Disorder
MCHP	Manitoba Centre for Health Policy
NICU	Neonatal Intensive Care Unit
WRHA	Winnipeg Regional Health Authority
NRHA	Northern Regional Health Authority
IERHA	Interlake-Eastern Regional Health Authority
SH-SS	Southern Health–Santé Sud
SEFI	Socioeconomic Factor Index
WBC	Winnipeg Breastfeeding Centre

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Chapter 1. Introduction

Breastfeeding supports positive health outcomes for both the breastfeeding parent and their infant.[1] Infant-associated benefits include gut microbiome regulation,[2] protection against respiratory and ear infections,[3,4] lower risk of obesity development during childhood (2 to 12 years old),[5] and supporting cognitive and mental development.[6] Maternal-associated benefits include a decreased risk of ovarian cancer,[7] rheumatoid arthritis,[8] type II diabetes,[9] hypertension,[10] and breast cancer among breastfeeding parents.[11]

Problem Statement and Study Objectives

The World Health Organization[12] recommends exclusive breastfeeding for the first six months postpartum, followed by breastfeeding until at least two years old, supplemented with complementary food. In Low- and Middle - Income Countries, the six-month exclusive breastfeeding rate is relatively high at 46.0% (2010-2018)[13]. In contrast, the six-month exclusive breastfeeding rate is just 25.0% in the United States (2019)[14] and ranges from 13.0% to 39.0% in Europe.[15] In Canada, nearly 91.0% of mothers initiate breastfeeding, but only 38% continue exclusive breastfeeding for the first six months (2022 Canadian Community Health Survey).[16] Manitoba, in particular, has a slightly higher rate of exclusive breastfeeding for six months (42.0%, 2017-2018).[16]

A study in Nova Scotia demonstrated that the majority of mothers who discontinued breastfeeding within the first six months did so in the initial six-week postpartum period.[17] Breastfeeding difficulties and insufficient milk supply are the most common reasons for breastfeeding discontinuation before six months.[16] Breastfeeding difficulties are among the primary reasons for breastfeeding cessation, underscoring the importance of breastfeeding care.

The Winnipeg Breastfeeding Centre (WBC) (www.wpgbreastfeedingcentre.com), a consultant physician clinic, was established in 2017 to address this need. The clinic is Manitoba's first and only breastfeeding and lactation medicine clinic that provides physician-level diagnostic care. Starting with two physicians, it gradually grew to six by 2024 and supports breastfeeding, chest feeding, and human milk feeding. WBC is a private practice clinic that provides treatment plans and services at no cost to parents insured by Manitoba Health. As the sole specialized clinic for breastfeeding support in Manitoba, the clinic's

physicians seek a deeper understanding of the population they serve to optimize the quality of their care provision.

Designed in collaboration with the WBC co-founders, this study aims to describe WBC clients' demographic characteristics, breastfeeding difficulties, diagnoses, and treatments. Furthermore, as this clinic has been operating before, during, and after the COVID-19 pandemic, I aim to explore potential changes in healthcare provision during this period, using appointment frequency as an indicator.

Language Note

I acknowledge that not all individuals who breastfeed identify as women. I also recognize that these people may prefer the healthcare system, society, and researchers to identify them as they wish. However, I have used the words "mothers," "women," and "breastfeeding" to reflect the cited literature accurately. Additionally, I have adopted the term "breastfeeding dyad" in my project findings to accurately represent the act of feeding between a parent and infant.

Additionally, in this study, I refer to breastfeeding difficulty as any problem associated with either breastfeeding or lactation that influences the duration, exclusivity, and comfort of this practice which requires the lactating parents to seek professional help.

Chapter 2. Review of the Literature

2.1 Sociodemographic Characteristics of Breastfeeding Dyads

It is important to consider that in addition to medical factors, non-medical factors (i.e. Social Determinants of Health (SDH)) also play a role in population health. World Health Organization defines these determinants as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life”.[18] These factors are important in breastfeeding practices as well. For example, socio-demographic factors, such as marital status, age, education level, race, and socioeconomic status are associated with breastfeeding exclusivity and duration.[19] A 2016 cross-sectional study on dyads with infants of 6 - 24 months of age in Morocco (N=297) demonstrated that breastfeeding exclusivity and duration were positively associated with parents' sociodemographic characteristics, particularly higher education level.[20] Similarly, a study of 220 women from Italy’s 'Mamma and Bambino' birth cohort reported that higher parent/maternal education levels and full-time employment were positively associated with 6 months of exclusive breastfeeding.[21] A study in New Zealand (N=350) found that mothers aged ≤25 and 25–34 faced a higher risk of shorter breastfeeding duration than mothers aged 35 and older. [22] Marital status is also positively associated with breastfeeding duration, with married individuals breastfeeding longer than those who are single or cohabiting.[23]

In Manitoba, women with lower financial resources have a lower breastfeeding initiation rate.[24] For instance, only 60.0% of women in Manitoba who received income assistance initiated breastfeeding compared to 83.0% among those who were not receiving income assistance (2007/09).[24] Single parents in Manitoba are also less likely to initiate breastfeeding during their hospital stay than parents with partners (69.0% vs. 87.0%).[24] Given these association between socioeconomic factors and breastfeeding practices and considering Hector et al.'s conceptual framework,[25] I decided to examine the neighbourhood level socioeconomic status of the WBC patient population.

2.2 Common Breastfeeding and Lactation Problems

Breastfeeding and lactation problems can arise from factors related to the infant, parent, or both. Unresolved issues may result in early weaning, non-exclusive breastfeeding, early introduction of

complementary food, or formula supplementation. According to the Public Health Agency of Canada's 2022 Breastfeeding Progress Report, the most common reasons for early breastfeeding discontinuation in the first month postpartum included low milk supply (42.5%), breastfeeding challenges (20.8%), breastfeeding-associated discomfort or fatigue (8.7%), and health conditions (either baby or parent (15.6%).[16] This section presents a literature review of common breastfeeding difficulties. A major part of this project is quantifying breastfeeding difficulties among the Manitoba population, which has not been explored in the past.

Insufficient Milk Supply

On a global scale, 45.0% of breastfeeding women report introducing formula because of insufficient milk supply.[26,27] It is important to differentiate self-reported low milk supply from actual low milk supply, as the two may not align. In a systematic review conducted by Huang et. al, 10 to 25% of breastfeeding mothers experienced actual low milk supply, whereas 50.0% reported low supply as an underlying reason for breastfeeding cessation.[28] Breast hypoplasia[29] (insufficient glandular tissue[30]) is associated with low milk production. However, low milk supply can also be attributed to comorbidities such as polycystic ovarian syndrome,[31] retained placental fragments, and postpartum hemorrhage.[32] Mothers report infant hunger cues as a primary source of perceived insufficient milk supply,[33] though it is not uncommon for parents to misinterpret these cues, leading to a *false* perception of inadequate supply.[27]

Oversupply

Research on hyperlactation or oversupply is limited, which restricts our understanding of the underlying causes of this condition. Breast milk oversupply can result in abnormal weight gain in an infant (more than 30 grams per day within the first 3 months of life). Conversely, oversupply is also associated with low weight gain due to only foremilk (which is lower in fat and higher in carbohydrates compared to the hind milk) being received as a child empties the breast.[34] Mothers with breast milk oversupply are at greater risk of having fussy infants with Gastroesophageal Reflux Disorder (GERD), excessive gas, latch difficulties, and breast refusal, which can result in nipple cracks and pain.[34,35]

Infant Feeding Mechanics Problems (Tongue Tie, Upper Lip Tie, Latch and Palate Issues)

Appropriate latch and synchronization of the infant's sucking and swallowing is necessary for successful breastfeeding.[36] Considering this, abnormalities in anatomical structures in infants' oral cavities (e.g. soft tissues) can also lead to breastfeeding difficulties among breastfeeding dyads. Two of these soft tissue abnormalities are tongue tie and upper lip tie.

Ankyloglossia (tongue tie) occurs in 8.0% of infants under one year old.[37] Tongue tie is an atypically thick, short, or tight lingual frenulum[36,38]- the inferior tongue membrane that supports the tongue and enables swallowing.[39] Upper lip tie is another soft tissue anomaly involving the labial frenulum attached to the maxillary arch, which prevents sufficient upper lip mobility.[40] Both upper lip and tongue ties result in difficulty in latching and breastfeeding difficulties.[41] Frenotomy is a common procedure for both lip and tongue tie and can be performed with a scalpel, scissor, or laser.[40] It is important to note that not all tongue or lip tie cases necessitate surgical intervention. The need for surgery depends on the severity of the condition and how much it affects breastfeeding for the dyad; in some cases, management may focus solely on providing education to parents.

Cleft palate is another abnormality of the oral cavity structure that can be complete or partial and might be accompanied by a cleft lip. In infants with the cleft palate, there is communication between the oral and nasal cavities, and the cleft may involve the hard palate, soft palate, or both.[42,43] Milk transfer in infants with cleft palate is typically reduced[44], likely due to inappropriate sucking among these infants.[43]

Breast or Nipple Pain

Lactating parents, particularly primiparous ones, often experience breast pain, which can influence breastfeeding frequency, duration, or exclusivity. A mixed-method study of 200 participants showed that breast pain accounted for 25% of exclusive breastfeeding barriers.[45] Several conditions may cause breast pain, such as blocked ducts and nipple fissures. Another factor that may contribute to increased breast pain, particularly in first-time parents, is early hands-on support by healthcare providers during the first few hours after delivery. (personal communication, Nathan Nickel)

Mastitis

According to the Academy of Breastfeeding Medicine, 3-20% of mothers who breastfeed struggle with mastitis depending on the definition applied and the period of lactation investigated.[46] Mastitis involves swelling, soreness, increased breast temperature, fatigue, and fever.[47] It may or may not be brought on by infection.[48,49] A prospective study involving 1075 participants showed an increased risk of mastitis among women with plugged ducts, nipple fissures, and a history of mastitis.[50]

Abscess, Blocked Ducts, Engorgement, Milk Bleb, Vasospasm

Blocked ducts, breast engorgement, and breast abscesses often co-occur in breastfeeding parents. The reported occurrence of breast abscesses in pregnancy and breastfeeding periods varies from 0.4% to 11.0%.[47,51] Bacteria (usually *Staphylococcus*) may enter the nipple from the breast skin or the newborn's

oral cavity, leading to an abscess (a painful mass of infected fluid with redness in the breast.[47,52])[53] Engorgement can also result in milk stagnation, providing favourable conditions for bacterial growth and consequently abscess.[53] Milk blebs (milk blisters) are inflammatory lesions that may co-occur with nipple dysbiosis and usually cause nipple pain.[54] Vasospasm (contraction of the arterioles in the nipple) is another cause of nipple pain.[55]

Lactation Induction

Clinicians apply lactation induction for different reasons, including infant adoption, surrogate breastfeeding, transgender women, and low milk supply. Induction can occur through non-pharmacologic and pharmacologic pathways, often in combination. Pharmacologic approaches typically include the use of a dopamine antagonist such as metoclopramide or domperidone, and non-pharmacologic pathways include nipple stimulation by hand or breast pumps.[56]

Breastfeeding Multiple Births (Twins, triplets, etc.)

Even though mothers who breastfeed multiple infants, such as twins, may be determined to breastfeed their infants, they often face extra difficulties such as fear of low milk supply and problems affecting their daily life, such as sleeplessness, stress, and burnout.[57] A study on 128 mothers with twin infants similarly demonstrated that parents of twin infants usually perceive having a low milk supply and interpret their infants' crying behaviours as a response to hunger.[58] In their study, Cinar et al. found that these parents require more professional support to meet their breastfeeding needs compared to parents of singleton infants. They also reported challenges such as their twins' poor sucking behaviour, and insufficient reassurance or information about the adequacy of their milk supply.[57] They may face additional challenges related to the increased time required for breastfeeding. For example, a study on breastfeeding cessation highlighted these parents' need to breastfeed the infants separately due to their increased sizes, making simultaneous feeding impossible. Similarly, the time commitment to pump more frequently was another challenge reported by these parents.[59]

2.3 Infant/Child Comorbidities and Breastfeeding Difficulties

Gestation at Birth

Gestation at birth can be categorized as preterm (<37 weeks), term (37-42 weeks), or post-term (>42 weeks). In 2010, 14.9 million preterm births occurred worldwide.[60] According to the 2019 Regional Health Authority Indicator Atlas, the percentage of preterm births within Manitoba remained at 7.6%

between 2007/08-2011/12 and 2012/13-2016/17.[61] A systematic review revealed that infants born early (37-39 weeks) have lower duration and initiation of breastfeeding.[62] Breastfeeding practices can differ even among term infants, depending on whether being born early-term or late-term. For instance, a study of 92,364 infants in Ontario showed that infants born at 37 weeks (early-term) are 26.0% less likely to be breastfed than infants born at 41 weeks (late-term).[63]

Low Birth Weight

Globally, 15-20% of infants have low birth weight (< 2500 grams[64]).[65,66] A longitudinal study found that infants with low birth weight (1500-2500 grams) were 28.0% less likely to be exposed to any breastfeeding and 52.0% less likely to breastfeed for six months or more compared to normal-weight infants.[67] Reduced breastfeeding in very low birth weight infants (<1500 grams) may be explained by the low milk supply in mothers.[68] Mothers of low birth weight infants reported low milk production, requiring frequent milk expression to ensure sufficient milk supply, leading to pain during milk expression. The study also revealed that these mothers might blame themselves for delivering a preterm infant, which can motivate them to exert more effort for breast milk expression, which contributes to more breast pain.[68] A study involving 37 very low birth-weight infants found that prolonged intubation in the Neonatal Intensive Care Unit (NICU), particularly with improper techniques, contributes to developing palatal grooves in these infants. The researchers further suggested that this groove could create difficulty in infant feeding by preventing adequate positive and negative pressure for effective sucking.[69]

Hypoglycemia

The Canadian Pediatric Society defines infant transitional hypoglycemia as blood glucose levels lower than 2.6 mmol/l within the first three days of life and persistent hypoglycemia as a glucose level lower than 3.3 mmol/l lasting more than three days.[70] Risk factors for neonatal hypoglycemia include small or large for gestational age, preterm birth, maternal hyperglycemia and pre-pregnancy Body Mass Index score above 25.[71] Healthcare professionals recommend breastfeeding in asymptomatic infants with measurable low glucose levels.[72] Breastfeeding is considered the best option for asymptomatic hypoglycemia, with expressed milk or formula being recommended in cases of breastfeeding difficulties.[73,74] However, for symptomatic hypoglycemia or severe cases, these oral feedings are contraindicated, and parenteral feeding of dextrose is recommended.[73,74] Therefore, hypoglycemia treatment introduces measures associated with reduced breastfeeding initiation or uptake.

Admission to NICU or Special Care Nursery

In 2002, the Canadian Institute for Health Information reported that the rate of NICU admission among newborn infants (excluding rural Manitoba, Quebec, and the territories) was almost 14.0%.[75] NICU-admitted infants have lower breastfeeding initiation rates.[76]

Failure to Thrive

Ideally, human milk is the only source of nutrition and calories for neonates in the first months of life.[77] Monitoring infant growth patterns helps healthcare providers and lactating parents assess the quality of breastfeeding or other infant feeding types. Failure to thrive is a medical condition referring to slower growth in infants, typically when weight is under the 5th percentile for age.[78] Suboptimal breastfeeding, excessive or inadequate dilution of formula during preparation, and mechanical feeding difficulties can all contribute to insufficient breast milk or formula consumption and subsequently lead to failure to thrive.[79]

Infant Gastroesophageal Reflux Disorder (GERD)

A systematic review of 24 studies found that 25.5% of infants experience GERD or regurgitation at one month of age, with its prevalence declining to approximately 3.0% by six months.[80] This study also demonstrated that the association between feeding mode and GERD in infants is unclear. The authors suggest that some studies show no association between the mode of feeding and developing GERD, and some show that direct breastfeeding is protective against the development of GERD.[80] The etiology and the underlying reasons for GERD have not been well established in the literature.[81]

Infant Excessive Gastrointestinal Gas

Excessive gas accumulation in infants can result from several factors, such as infant gut bacterial fermentation, excessive aerophagia (e.g., inappropriate feeding techniques and swallowing air), and motility disorders in the gastrointestinal lumen.[82] Long periods of supine position without burping and "stiff nipples" may also contribute to this problem.[82] As previously noted, breast milk over-supply may also increase infant gas.

Infant Behavioral Challenges (Fussiness, Sleeping Behaviour, Breastfeeding Aversion)

Infant behavioural challenges are associated with parents' feeding decisions, such as breastfeeding cessation, formula introduction, or reduced parental confidence.[83] In this section, three of these behavioural challenges are discussed: Infant fussiness (colic), infant sleeping behaviour, and breastfeeding aversion which I selected primarily based on the diagnoses of the WBC physicians. According to Wessel et al., colic is characterized by excessive crying and is defined as when the infant

"cries for more than three hours per day for more than three days a week"[84] They identified four potential underlying mechanisms for this condition: allergies, hypertonicity of the nervous system in infants, parental anxiety (particularly among primiparous parents), and intestinal abnormalities.[84] During the first few months, infants experience intermittent daytime sleep sessions, gradually decreasing as nighttime sleep stabilizes between six and twelve months.[85–87] However, not all infants develop these patterns, and 20-30% have sleep problems.[85] Various risk factors have been described for infant sleeping problems, such as maternal depression, arousing activities such as TV in the room, excessive parental interventions as a result of their intolerance to the infant crying, and parent-infant co-sleeping.[88] Breastfeeding aversion refers to the reluctance to continue breastfeeding, which can come from either the infant or the breastfeeding parent. A study involving 210 breastfeeding parents demonstrated that tandem feeding (i.e. breastfeeding two children simultaneously who are not at the same age[89]), breastfeeding while pregnant and firstborn child feeding were associated with this breastfeeding aversion.[90] Previous research has mainly focused on parent's breast aversion rather than infants.

Cow's Milk Protein Allergy (CMPA)

Cow's milk protein allergy is the immune system's reaction to one or more of the proteins in cow's milk.[91] This allergy might occur in infants who breastfeed or receive cow milk formula.[92] Even though infants who receive cow milk formula are at higher risk of developing CMPA, exclusive breastfeeding does not fully eliminate the risk because cow milk proteins from the maternal diet can be present in breast milk.[93] Depending on the type of CMPA, infants might experience gastrointestinal and skin symptoms such as regurgitation and GERD.[92,94] Whey hydrolysate or hydrolyzed formula is associated with a lower risk of developing CMPA.[93] Hydrolyzed formulas can either be partially or extensively hydrolyzed, based on the degree to which their proteins have been broken down into lower molecular weight ones.[95] A clinical trial study on 312 infants in Japan demonstrated that avoiding supplementation with cow's milk formula during at least the first three days of life will prevent developing CMPA in those infants.[96]

Infant Laryngomalacia

This condition is the insufficient development of the larynx cartilage, which collapses when the infant inhales the air.[97] It can result in respiratory problems such as snoring, difficulty in breathing, or swallowing dysfunctions.[98,99] GERD is the most common concurrent comorbidity with Laryngomalacia.[100] Infants with Laryngomalacia have difficulty breastfeeding especially coordinating the suck, swallow and breath while breastfeeding. A retrospective study on 20 infants diagnosed with

Laryngomalacia demonstrated that a semi-prone position during breastfeeding can prevent airway obstruction and improve breastfeeding in these infants.[101]

Infant Jaundice (Hyperbilirubinemia)

Jaundice (defined as serum bilirubin levels of more than 3 mg per dL[102]) occurs in about 60.0% of newborns in the USA annually.[103] The breakdown of senescent red blood cells leads to the formation of bilirubin (a yellowish pigment).[104,105] Bilirubin is initially unconjugated and insoluble in water. Following liver-mediated reactions, it becomes conjugated and is released into the intestines, where it is released into stool and urine.[105] High and uncontrolled amounts of bilirubin in severe jaundice have neurotoxic effects on affected infants.[105] There seems to exist a bidirectional association between inadequate breastfeeding and developing jaundice, where increased bilirubin levels create infant fatigue and inadequate breastfeeding,[106] and inadequate breastfeeding (e.g. delayed initiation, poor latching, breastfeeding less than eight times per day), brief breastfeeding sessions of less than 10 minutes, and low milk volume are associated with developing jaundice.[107] It should be emphasized that the precise influence of breastfeeding practices on jaundice development or amelioration remains unclear as there is conflicting research on this association.

Infant Nutrition and Growth (Dehydration or Hypernatremia)

A systematic review of 115 studies focusing on infants with breastfeeding-associated hypernatremia revealed that the affected infants are typically younger than 3 weeks old and experience weight loss exceeding 10.0%. Additionally, this review identified that hypernatremia is associated with primiparity, absence of a breastfeeding experience, breastfeeding challenges for continuation or initiation, caesarean section, high pre-gestational weight in breastfeeding parents, and lower educational level. Infants with hypernatremia might show signs of dehydration as well.[108] Diarrhea, which bacteria or viruses can cause, is the most common cause of dehydration during infancy.[109] Rotavirus is the most common viral cause of diarrhea in infants.[109]

Infant Bottle Refusal and Choking Fear

Parents may transition from direct breastfeeding to bottle feeding with expressed breast milk or formula due to psychosocial factors, such as returning to work. This transition is not always successful[110] which is defined as bottle refusal. An alternative definition for bottle refusal is nipple confusion.[111,112] This refers to the possibility that an infant might become confused when required to learn two different feeding methods. A qualitative study including 30 interviews with breastfeeding parents and analyzing 597 online

posts identified the following maternal perspectives as reasons for bottle refusal: the artificial feeling of bottle feeding compared to breastfeeding, non-nutritive benefits of breastfeeding such as maternal-infant bonding during breastfeeding, and intrinsic factors related to the infant such as their personality.[112] Parents introducing bottle feeding may experience anxiety about the risk of choking their infant while bottle feeding. Even though the WBC has noted this challenge, research on this concern remains limited.

Bottle to Breast Transition

While lactating parents are more likely to transition from breastfeeding to bottle feeding, the reverse transition also occurs. For instance, parents of premature infants might prefer to transition to direct breastfeeding after a period of bottle feeding or gavage feeding their expressed breast milk.[113] However, these parents might encounter barriers to this transition. For example, barriers such as low milk supply, lack of confidence, or inadequate support from family or others.[113]

2.4 Maternal Comorbidities and Breastfeeding Difficulties

Maternal Mental Health (Maternal Exhaustion, Anxiety, and Depression)

According to the World Health Organization, at least 13.0% of new mothers (20.0% in developing countries) deal with mental health challenges, predominantly depression and anxiety,[114] which often co-occur.[115] Pregnancy and postpartum depression are associated with a decreased length of breastfeeding,[115,116] presumably because maternal depression negatively influences the breastfeeding dyad's interaction and prevents the mother from responding to her infant's hunger cues.[117] Similarly, studies have demonstrated that women with postnatal anxiety have a decreased rate and duration of breastfeeding.[118,119] Mental and physical exhaustion in response to conditions such as excessive infant crying can result in feelings of failure for the parents and negatively influence the bonding between family members.[120] In addition to the impact of maternal mental health on breastfeeding practices, it is important to recognize that breastfeeding challenges may adversely influence already diagnosed mental health conditions. For instance, a systematic review on the association between breastfeeding practices and maternal mental health revealed that the challenges in breastfeeding was associated with negative mental health outcomes among these parents.[121]

History of Infertility

Infertility is the failure to conceive following at least one year of regular, unprotected intercourse,[122] affecting 17.5% of adults globally.[123] A study revealed that women undergoing assisted reproductive

technology had lower breastfeeding duration than those who conceived spontaneously, with prematurity and multiple births mediating this causal pathway.[124] Caesarean delivery, primiparity, anxiety during pregnancy, and NICU admission were also associated with suboptimal breastfeeding among this population.[125] In contrast, another study showed that breastfeeding duration and initiation did not vary among mothers who underwent assisted pregnancy vs those who had spontaneous conception.[126] Psychosocial aspects of infertility may also play a role, as described in a qualitative study of first-time mothers who conceived after infertility treatment, where participants attributed a special meaning to breastfeeding.[127]

History of Breast Surgery

Augmentation and reduction mammoplasty are breast enlargement and reduction surgeries, respectively.[128] Breast augmentation is among the top five most common cosmetic surgeries in the US.[129] Breast augmentation surgery is associated with lower rates of exclusive breastfeeding[130] and reduced breastfeeding during hospital discharge.[131] While controversial, previous studies have suggested that breast hypoplasia, and not the surgical augmentation of breasts, may be an underlying cause of reduced breastfeeding in the population that undergoes breast augmentation.[131,132] Breast reduction surgery has also been associated with shorter breastfeeding duration.[133] Among different breast reduction techniques, complete conservation of the column of subareolar parenchyma (a section of breast tissue) is associated with more successful breastfeeding in the future.[134] Sometimes, surgeons do not adequately inform women of lactation risks these surgeries carry, leading to guilt and frustration in parents attempting to breastfeed, necessitating the use of formula supplementation to resolve breastfeeding difficulties.[135]

Polycystic Ovarian Syndrome

According to the World Health Organization, roughly 8-13% of women of reproductive age have polycystic ovarian syndrome.[136] This endocrine disorder involves excessive androgen levels, ovarian dysfunction, and hyperinsulinemia.[137] Vanky et al. demonstrated that women with polycystic ovarian syndrome experience diminished breastfeeding rates within the first month postpartum compared to healthy controls.[31] However, breastfeeding rates did not differ between the two groups at three and six months postpartum. The authors hypothesized that the observed early breastfeeding difficulties could be rooted in hormonal dysregulation, such as increased androgen levels in this population, which are negatively associated with lactation.

Diabetes

About 422 million individuals have diabetes worldwide.[138] A systematic review showed that women diagnosed with gestational diabetes mellitus or type II diabetes have lower breastfeeding rates than healthy women.[139] Mothers with type I diabetes (an autoimmune condition) also demonstrate shorter durations of breastfeeding.[140] Poor breastfeeding outcomes among women with diabetes have been attributed to obstetric complications,[139] infant admission to NICU, and demographic factors that influence breastfeeding intention in this population, such as smoking or socioeconomic factors.[141]

Thyroid Disorder

According to the Thyroid Foundation of Canada, approximately 1 in 10 Canadians develop thyroid disorders.[142] Thyroid disorders include hypothyroidism, hyperthyroidism (thyrotoxicosis), and postpartum thyroiditis.[143] Thyroid hormones are positively associated with milk production[144], and irregularities in this hormone can disrupt lactation. For instance, hypothyroidism is hypothesized to be associated with insufficient milk supply.[143] Hyperthyroidism can lead to elevation in milk supply and milk ejection reflex dysfunction.[143] However, studies exploring thyroid disorders have primarily focused on the pre-pregnancy and pregnancy periods rather than the breastfeeding stages.

Anemia

Globally, 30.0% of women at reproductive age and 37.0% of expectant mothers have anemia,[145] defined by hemoglobin <12 gr/dL in women.[146] A study on 630 first-time mothers showed that anemia is associated with an inadequate milk supply and, consequently, early weaning.[147] Anemia-induced fatigue is also associated with the mother's responsiveness to her infant's hunger cues.[147] Another study in New Brunswick, Canada, showed that hemoglobin levels <9.5gr/dL were associated with breastfeeding cessation before four months post-delivery.[148]

Cigarette Smoking, Alcohol, and Cannabis Consumption

Lactating parents may engage in habits such as smoking and recreational drug use, of which the most common include cigarette smoking, alcohol consumption, and cannabis use ([149–151]):

Cigarette Smoking

According to the Perinatal Health Indicator report by the Public Health Agency of Canada, 4.2% of parents smoked cigarettes during pregnancy (2022).[152] The only available data for Manitoba, from a Manitoba Centre for Health Policy (MCHP) report, includes outdated data from 2007–2008, indicating that 18.0% of this population smoked cigarettes during pregnancy[24] Cigarette smoking adversely

influences breastmilk composition by reducing concentrations of fat and polyunsaturated fatty acids and increasing heavy metals (such as Cadmium[153]).[154] This finding underscores the importance of counselling breastfeeding mothers against cigarette smoking. A study showed that women smoking cigarettes during pregnancy and the postpartum period had a lower duration of breastfeeding compared to those who did not smoke cigarettes (11 weeks vs 28 weeks) and were 60.0% more likely to stop breastfeeding.[155] These negative associations are thought to be the result of 1) nicotine - reducing prolactin hormone, which regulates lactation[155]; 2) excessive crying in infants with cigarette-smoking mothers (this may result from infant's airway irritation or delay in infant development during infancy due to maternal smoking in pregnancy[156]), and 3) smoking mothers' lower intention of breastfeeding.[155]

Alcohol Consumption

Alcohol consumption by breastfeeding mothers may decrease the milk supply.[157,158] The low milk supply can be associated with the infant's low milk consumption due to the alterations in the milk flavour,[159] disruption in the infant's sleeping patterns, or prevention of antidiuretic activities[160] in the breastfeeding mother.[158] Unawareness about the detrimental impacts of alcohol on infants and misconceptions about its positive effects on milk production are among some of the incentives for drinking alcohol while breastfeeding.[161] According to the USA Centers for Disease Control and Prevention, having one standard drink per day no fewer than two hours before breastfeeding is not considered detrimental for the breastfed infant in cases when the breastfeeding mother decides to drink alcohol.[162]

Hypertensive Disorders of Pregnancy

The American College of Obstetricians and Gynecologists divides hypertension during the gestational period into four categories: 1) pre-pregnancy chronic hypertension, 2) pre-eclampsia as a comorbid condition to chronic hypertension, 3) pre-eclampsia – eclampsia, and 4) gestational hypertension.[163] A study of 1,500 participants demonstrated that mothers who experienced hypertension during pregnancy had less frequent breastfeeding than the control group.[164] The authors of this study further discussed that this lower frequency can be explained by the obstetric and neonatal complications associated with hypertension in pregnancy, such as premature birth.

Number of Parities and Previous Breastfeeding Experiences

Previous positive breastfeeding experiences and multiparity are positively associated with future breastfeeding; in contrast, negative past experiences are associated with reduced breastfeeding duration.[165] This negative experience may leave mothers with a long-lasting fear of breastfeeding or a high desire to

breastfeed future infants.[166] Primiparous mothers (vs. multiparous) are more likely to experience a more extended period between delivery and breastfeeding initiation, more breastfeeding challenges, earlier breastfeeding discontinuation,[167], and greater difficulty interpreting their infants' feeding cues.[168]

2.5 Intra-and Postpartum Interventions and Complications Related to Breastfeeding Difficulties

Depending on each patient's condition, clinicians apply interventions to improve maternal and/or child outcomes during birth. For instance, a study conducted in Australia found that infants born via caesarean section (either in-labor or pre-labor), exposed to epidural analgesia, or administered synthetic oxytocin were more likely to receive formula supplementation before hospital discharge. Furthermore, these factors were associated with a lower likelihood of exclusive breastfeeding at both 3 and 6 months postpartum.[169]

Labor Induction or Augmentation

Induction refers to implementing procedures to initiate labour, while augmentation refers to intensifying the existing contractions during labour.[170] To induce labour, clinicians usually prepare the cervix or perform "cervix ripening" by administering prostaglandins vaginally.[171] Synthetic oxytocin may also be applied to induce or augment labour.[171] Work by Zanardo et al. demonstrated that postpartum women receiving elective vaginal prostaglandin induction had increased depressive symptoms, diminished maternal-infant interaction, and lower full breastfeeding rates at one month and three months.[172] Moreover, oxytocin administration during childbirth is associated with increased formula feeding.[173] Other risks include maternal depression, decreased amounts of endogenous oxytocin in mothers, and diminished infant breastfeeding cues.[174] These risks of exogenous oxytocin could be explained by its negative feedback on endogenous oxytocin, which plays an important role in milk ejection.[173] Oxytocin may also transfer through the infant's fetal cord and blood-brain barrier and influence the infant's reflexes before breastfeeding initiation.[174]

Intravenous Fluid Administration

Breast edema or swelling contributes to breast pain[175] and latching difficulties.[176] Understanding whether high intravenous fluid doses influence breast edema and lead to breastfeeding difficulties is an important but understudied area. To my knowledge, previous studies have predominantly examined the impacts of intravenous fluid administration on infant weight loss rather than breastfeeding practices.[177–180]

Mode of Delivery and Assisted Delivery

According to the Canadian Institute for Health Information, the caesarean section rate per 100 births was 27.8% in 2022, which increased from 18.3% in 1999.[181] This percentage is consistent with the caesarean section rates reported for Manitoba and Winnipeg (27.7% and 28.0% respectively).[182] Caesarean delivery may interfere with early breastfeeding initiation by hindering early mother-infant interactions and skin-to-skin contact. Additionally, it increases the risk of postpartum infection,[183] a risk factor for early breastfeeding cessation.[184] A systematic review and meta-analysis of 53 studies showed a negative association between elective caesarean section (pre-labor) and breastfeeding before hospital discharge. It also emphasized that if mothers established successful early breastfeeding, the caesarean section did not impact breastfeeding at six months postpartum.[185] Another cohort of 2064 Taiwanese women reported that even though caesarean delivery was a risk factor for breastfeeding discontinuation at three months and one month, it was not associated with a decreased likelihood of initiating breastfeeding.[186]

Epidural Analgesia and Anesthesia

Epidural analgesia (usually comprising an anesthetic with an opioid such as Fentanyl[187]) is used predominantly for labour pain relief, while epidural anesthesia is usually used for caesarean delivery.[188] Orbach-Zinger et al. found that exposure to epidural analgesia is negatively associated with breastfeeding rates at six weeks, but only in first-time mothers.[189] In contrast, another study showed no associations between Fentanyl epidural and breastfeeding at hospital discharge and six weeks postpartum.[190] The causality of this potential relationship is unclear as it is possible that mothers requiring analgesia experience more prolonged labor and have more intrapartum interventions that could interfere with breastfeeding.[189] Additionally, women who opt not to use pain management such as analgesia may use alternative pain management strategies that help them in better adaptation to breastfeeding-related pain.[189]

Delivery Complications

Women who experience birthing complications such as postpartum hemorrhage and placental retention demonstrate a decreased likelihood of early breastfeeding initiation.[32] Postpartum hemorrhage annually affects 14 million birthing women worldwide[191] and can lead to delayed breastfeeding initiation[192] and Sheehan syndrome (necrosis or infarction in the pituitary gland following bleeding), is commonly accompanied by low milk supply.[193,194] Placental retention refers to a condition requiring manual removal of the placenta if it does not spontaneously separate from the uterus after childbirth.[195] Placenta delivery normally decreases progesterone hormone and helps milk production - therefore, its retention in the uterus is associated with low milk supply.[196]

Skin-to-skin Contact

Skin-to-skin contact involves positioning the infant on the mother's bare chest immediately after birth for around one hour or until the baby initiates breastfeeding.[197] Infants with immediate skin-to-skin contact after birth have more successful first-time breastfeeding.[198–200] It also helps the mother in gaining more confidence while holding her infant.[199] A systematic review and meta-analysis showed that skin-to-skin contact leads to more successful and longer first-time breastfeeding.[200] Moreover, it is also associated with higher self-efficacy in breastfeeding parents[199] and longer duration of first-time breastfeeding.[200] Uninterrupted skin-to-skin contact is also one of the 10 steps to successful breastfeeding that is outlined and recommended in the Baby-Friendly Initiative, launched by the World Health Organization and UNICEF.[201]

2.6 Treatment Strategies for Breastfeeding Difficulties

Treatment strategies for breastfeeding difficulties include a variety of approaches, such as education through discussions with lactating parents, prescription medications targeted to specific breastfeeding challenges, and referrals for interventions like surgical procedures for conditions such as tongue-tie or lip-tie. This section discusses some of the existing treatment strategies for addressing breastfeeding difficulties.

Education on Infant Feeding and Care

Healthcare providers such as family physicians, midwives and public health nurses can provide education and consultation for parents on topics such as breastfeeding dyad bonding, proximity (e.g. biological nurturing (holding), coaxing the infant to the breast, and room sharing) and positions (e.g. laid-back, lean-back, cradle, and football). A randomized control trial in 2018 (N=188) found that parents who had employed biological nurturing had a lower risk of breastfeeding problems, such as nipple cracks, compared to those who did not employ this hold.[202] Healthcare providers might recommend certain feeding frequencies tailored to each dyad's breastfeeding needs as part of their consultation and education. Some of these recommendations include 8-10 times of pumping per day, 10-15 minutes of pumping for each session, and cluster feeding (referring to a pattern of repetitive feeding practices with 30-minute intervals[203]), on-demand feeding, and breastfeeding every 2-3 hours. They might also educate parents on feeding methods such as triple feeding (first feeding by breast, then by bottle, and lastly by pump)[113], hand expression, Supplemental Nursing System (SNS), and top-up (referring to further feeding

after direct breastfeeding, which may include expressed breast milk or formula, depending on the infant's circumstances).

Once parents decide to opt for bottle feeding, healthcare providers will provide information and consultation for the most optimum practises. For example, educating them on responsive bottle feeding and paced bottle feeding. Paced bottle feeding refers to considering three major steps when using a bottle: 1) starting and pacing the bottle based on infant hunger cues, 2) stopping the feeding in response to infant fullness cues, and 3) encouraging infant engagement in feeding by a gentle incline of the bottle to prevent rapid flow of the milk.[204]

Domperidone

Domperidone is a dopamine antagonist and is approved for indications of gastrointestinal conditions or nausea.[205] However, it is also known to be prescribed for stimulating lactation and increasing milk supply among lactating parents despite being off-label (not-authorized) for this indication.[205] This medication is usually prescribed for parents who have a low milk supply, for example, those with preterm infants.[206] Domperidone should be prescribed with caution as it can result in modifications in the electric functioning of the heart and might lead to heart problems.[207]

Breast and Nipple Care

Breastfeeding, particularly when techniques are incorrectly applied, can result in complications such as nipple fissures and other breast-related issues. Several specialized breast care treatments are utilized for these problems. For example, All Purpose Nipple Ointment (APNO) is prescribed for nipple damage and pain[208], nipple shield is recommended for flat or inverted nipples[209], Viaderm is used for treating Candida albicans in cases of thrush affecting the nipples and breast[210], and Hydrogel is suggested for relieving nipple pain.[211].

2.7 Summary and Knowledge Gaps

Even though the breastfeeding initiation rate in Canada is high (91.0%), exclusive breastfeeding for six months remains low (38.0%), and Manitoba is no exception (42.0%).[16] The most common reasons for breastfeeding cessation are low milk supply and breastfeeding difficulties,[16] and there is insufficient specialized breastfeeding support within Manitoba. The WBC is Manitoba's sole physician-level breastfeeding and lactation medicine centre and has been operating for seven years. Understanding the demographic and medical characteristics of the WBC breastfeeding dyads would enable WBC clinicians

to tailor breastfeeding services and subsequently improve breastfeeding rates in Manitoba. No research has ever been done on the WBC data.

Although the WBC is the only clinic in Manitoba offering specialized lactation care, several clinics in other provinces provide breastfeeding support services tailored to their populations. The Newman Breastfeeding Clinic (Toronto, Ontario),[212] Well Fed Breastfeeding Clinic (Calgary, Alberta),[213] Circle Medical Breastfeeding Clinic (Calgary, Alberta), Ontario Breastfeeding Clinic (12 locations in Ontario),[214] are among those clinics. To my knowledge, there is only one study in Canada that described the patient population of a breastfeeding clinic in Quebec (Quebec City Breastfeeding Clinic). That mixed method study was conducted through 86 telephone questionnaires and 12 semi-structured interviews (2004-2005).[215] My project involves analyzing the existing electronic medical records from the WBC for the period of 2018-2023, providing insights on patient population characteristics, breastfeeding difficulties, and their associated clinical treatments and practices within this clinic. The absence of existing studies on clinic practices and patient populations among breastfeeding clinics underscores the novelty of this project, which has the potential to 1) facilitate further research and 2) inform the adaptation of WBC's services and interventions to other clinics across Canada.

In this project, I examined the WBC electronic medical records for the first time and answered the research aims and questions outlined below:

Research Aims

1) To describe the patient population referred to WBC.
2) To describe the most prevalent breastfeeding difficulties, comorbidities, diagnoses, and interventions among the WBC patient population.
3) To compare the demographic characteristics, risk factors and comorbidities among the WBC patient population with the population-level data of pregnant/breastfeeding parents in Manitoba or Canada.
4) To describe the referral sources and frequency to WBC.

Research Questions

1.1) What are the demographic characteristics of the patient population referred to the WBC?
1.2) What is the geographic distribution of the referred patient population to WBC?
2.1) What are the most common risk factors and/or comorbidities among WBC patient population?

2.2) What are the most common self-reported breastfeeding difficulties among the WBC patient population?
2.3) What are the most prevalent WBC physicians' diagnoses, and treatments within a random sample of the clinic records between 2018 and 2023?
3.1) How do demographic characteristics, risk factors, and comorbidities of WBC patients compare to population level data of pregnant/breastfeeding parents?
4.1) What type of healthcare providers refer breastfeeding dyads to the clinic?
4.2) Was there a change in the frequency of appointments with the clinic before and after the COVID-19 pandemic onset in Canada (March 2020)?

Research Hypotheses

This section presents hypotheses aligned with the research questions outlined above. As this is primarily a descriptive study, not every research question has a corresponding hypothesis:
3.1) Compared to the general population of breastfeeding parents in Manitoba, those attending the WBC are more likely to be first-time parents, live in a high socioeconomic status neighbourhood and have delivered by caesarean section.
2.1) Comorbidities, such as polycystic ovarian syndrome, diabetes, high blood pressure, thyroid disorder, anemia, and depression or anxiety are more prevalent among the WBC population compared to the general population of breastfeeding/pregnant parents within Manitoba or Canada.
4.2) The frequency of appointments with the WBC was lower during the pandemic period (March 2020 to May 2023) compared to the pre-pandemic period between June 2018 and February 2020.

Chapter 3: Materials and Methods

3.1 Study Design, Population, and Winnipeg Breastfeeding Centre

This project is a retrospective study (2018-2023). The study population includes breastfeeding dyads who are referred to the WBC to receive services associated with their breastfeeding/lactating difficulties. WBC is a consultant physician clinic located in Winnipeg, Manitoba, Canada. It is the first clinic in Winnipeg offering physician-level diagnosis and care for breastfeeding. The clinic provides referral-based services from medical doctors, midwives, and nurse practitioners, serving individuals covered under Manitoba Health Insurance and the Canadian Health Act. The clinic is also inclusive in serving the LGBTQIA2S+[1] community. Two physicians initially offered breastfeeding support in this clinic, but the practice gradually expanded. As of December 2024, the clinic's medical team includes five family physicians, one pediatric surgeon, and an International Board-Certified Lactation Consultant (IBCLC) that provide breastfeeding support for the WBC patient population.

3.2 Data Sources

This study utilized secondary data derived from the WBC. The data used in this study was not developed for research purposes but is part of the WBC Electronic Medical Records (EMRs), including: 1) intake questionnaire (completed by parents prior to their appointments with the WBC physicians), 2) visit notes (completed by the WBC clinicians), 3) referral tracking (extracted from the clinic EMRs).

The WBC account manager de-identified the three data sources by assigning internal IDs (CHR (Clinic Health Records)) to the WBC patient population and removing their identifying information (e.g. names,

[1] LGBTQIA2S+ stands for Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, Asexual, 2-sprit, and other identities and orientations.

addresses, and contact information). Afterwards, the de-identified password-protected data were securely delivered to me through Telus Health.

3.2.1 Intake Questionnaire

Drs. Katherine Kearns and Christina Raimondi (co-directors of WBC) initially designed the intake questionnaire after establishing the clinic to assess client needs before their scheduled appointments with them. This questionnaire includes dyads' demographic information, past and current medical history, intrapartum and postpartum conditions, parents' feelings about infant feeding, tangible and intangible supports (family and partner, work return, etc.), and current breastfeeding difficulties and practices. (**Table 21** - a list of questions within the survey).

3.2.2 Visit Notes

Visit notes dataset included comprehensive records of all the information discussed during appointments between the WBC physicians and breastfeeding dyads, mainly in free text format. Physicians within the clinic electronically capture this information within the clinic's EMRs system. (**Table 22** - a list of variables within this dataset).

The variables "Assessment and Plan" and "Prescribed Medications" were analyzed in this dataset. The "Assessment and Plan" variable comprised the largest portion of the free-text data and was examined in 79 randomly selected samples. To facilitate analysis, this variable was divided into the following subcategories: "Clinical Diagnosis", "Intervention (including education/discussion and prescriptions)," and "Supportive Psychotherapy." The "Intervention" subcategory primarily focused on education and discussion. Although "Supportive Psychotherapy" can be considered a type of intervention, it was analyzed separately in this study because it was explicitly indicated as such within the visit notes dataset. In addition, the visit notes dataset included a clearly defined variable, "Prescriptions," which enabled me to analyze and report it separately throughout all the records within the visit notes dataset.

3.2.3 Referral Tracking

After communicating with the WBC account manager and the clinic physicians, we found out that the referring healthcare providers only refer the breastfeeding dyads through fax (paper-based) to the WBC, and those data are stored in PDF format within the electronic medical records of the clinic dataset. This

data storage format prevents extracting information from the original referral forms - particularly the reasons for referral (i.e. the referring healthcare providers' diagnosis). Therefore, an alternative dataset titled "Referral Tracking" was provided for this study. This dataset contains information about referring healthcare providers and their occupations. Forward sortation area (FSA) codes (the first three digits of the postal code), the mother's date of birth (year), and the referring practitioner's occupation were analyzed using this dataset. FSA was used to compare the neighbourhood-level socioeconomic status of the WBC parents with the general population of Manitoba. (**Table 23** - a list of variables within this dataset).

3.2.4 Dataset Curation and Refinement

Intake Questionnaire: The initial number of records for the questionnaire dataset was 3320. Of the 3320 primary records, 90 were excluded as they were follow-up appointments, leaving 3230 records for analysis. Next, I recoded unreliable entries that showed inconsistencies in responses for specific variables. For example, in the case of drinking status, participants who selected "never drinker" but also reported a number for their drinking status were recoded to missing for this particular variable, as these responses were considered unreliable. This is reflected in the tables in the results chapter for each variable.

Visit Notes: Initially, 9294 records were provided by the clinic for this dataset. I selected a random sample of 79 records (at least one record per month (2018 – 2023)) using R programming - through a seed-setting approach as a base function in R and then screened the visit notes and only maintained the ones that included an "Assessment and Plan" section within them. Additionally, the randomly selected records from the visit notes dataset were reviewed to ensure they represented the patient's first visit to the clinic.

Referral Tracking: The total number of records for the Referral tracking dataset was 11887. After refining the records by removing the follow-up appointments, 6778 unique records remained **(Figure 1).**

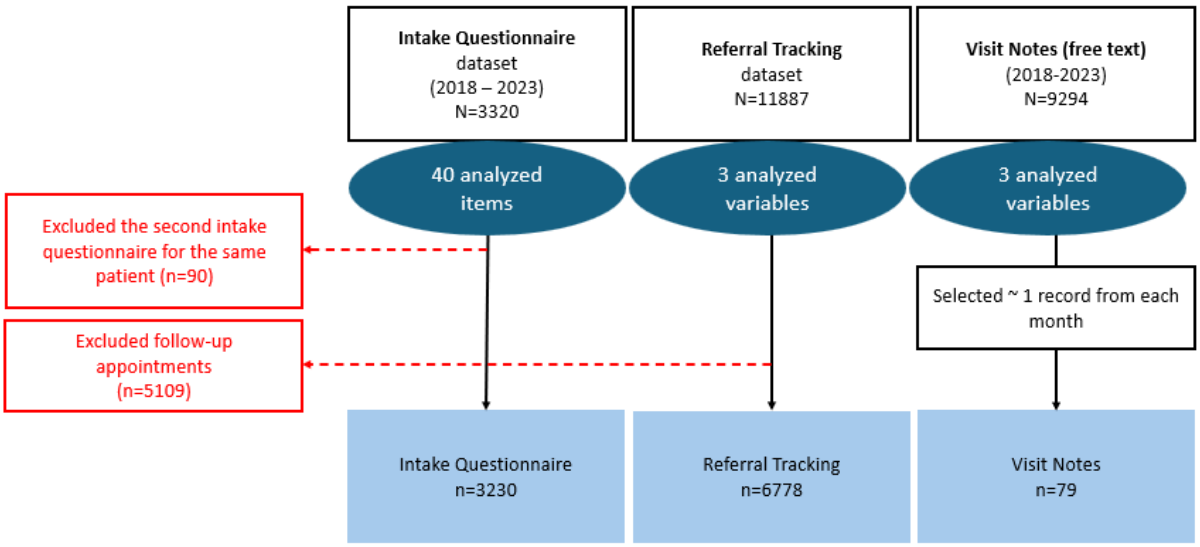

Figure 1. Data Processing and Analysis Flowchart: Structured vs. Unstructured Records

3.2.5. Data Extraction, Cleaning and Analysis

In this study, I have used the terms "structured" and "unstructured" for the following information. Structured data refers to predefined information, including dates, yes/no questions, sex, numerical data like parity, forward sortation area codes, and the occupation of referring healthcare providers. Unstructured data refers to free-text information, such as patient responses to "Please describe your concern" and "Please describe your breastfeeding experience.", the "assessment and plan", and the "prescription" variable from the visit notes.

Structured Data

Data Manipulation: Structured data included the intake questionnaire completed by WBC patients, referral tracking, and structured portions of the visit notes dataset. Cleaning and analysis were performed using R version 4.4.1 (R Core Team, 2024) and the following packages: lubridate[216], snakecase[217], broom[218], tidyr[219],ggplot2[220], sf[221], dplyr[222], tidyverse[223], stringr[224], tidytext[225], here[226], ggtext[227], gtsummary[228], openxlsx[229], reshape2[230], writexl[231], rmarkdown[232], ggrepel[233], readxl[234], knitr.[235] These packages were used for data manipulation and analysis tasks. These included standardizing responses for variables, such as converting text to lowercase letters, handling and formatting date variables (e.g., converting serial numbers to date formats), filtering and renaming variables and responses, visualizing

data by creating plots and descriptive tables, importing datasets and extraction sheets, managing spatial data (e.g., shapefiles for creating the geographic distribution maps), merging datasets, assigning codes to binary variables, and abbreviating lengthy responses in the questionnaire dataset into concise terms. **"**Dichotomized" and "check all that apply" items within the questionnaire dataset were converted into binary variables, where for "check all that apply" items, a selected response was considered "yes," and no response was extrapolated to "no."

Handling Nested Variables: Some variables within the intake questionnaire were nested, meaning that responses to certain questions depended on answers to previous ones. For example, "jaundice" and "jaundice light therapy" were nested variables - only those with a positive history of jaundice were expected to respond to the question about jaundice light therapy. Patients who answered "no" to having a history of jaundice were excluded from the denominator in the calculations for the jaundice light therapy variable. Another example was a history of diabetes among the WBC patients and types of diabetes among these patients.

Handling Missing Values: In this study, the primary goal was to describe the patient population and dataset within the clinic. Insights about the missing values may help the clinic to modify their data collection. Therefore, we decided to report the missing values for variables as they existed. Overall, the dataset had very few missing values, as most variables in the questionnaire were well-completed. The only variable with a notable percentage of missing data was the referring healthcare provider within the referral tracking dataset, which had 19.0% missing values.

Variable Creation (Emergency Caesarean Section): In consultation with WBC physicians, I determined that the percentage of emergency caesarean sections within the WBC population could be *estimated* by examining the overlap between delivery induction and caesarean section. Since induction is performed with the intent of achieving a vaginal delivery, cases where both induction and caesarean section occurred likely represent emergency caesarean sections. Therefore, to calculate the percentage of parents that had an emergency caesarean section among the WBC population, I divided the number of parents that received an induction and also underwent caesarean section over the total number of WBC population.

Unstructured Data

Unstructured Data - Assessment and Plan

The "Assessment and Plan" portion of the visit notes describes the assessment conducted by clinic physicians and the clinical history and treatment plans/discussions they provide for WBC parents. I used three broad themes to answer my research questions: *"diagnosis," "intervention (including education and discussion and prescriptions),"* and *"supportive psychotherapy."* I used a two-phase process for manually extracting the variables for these themes:

Step 1 (First-Level Categorization)

I created keywords representing common recurring themes within the lengthy free-text entries in the visit notes. I have described two examples to illustrate this process:

1) **"Professional help":** A standard entry in the visit notes on when to seek professional mental health support included items such as: 1) persistent worry and sadness, 2) disconnection from the infant, 3) excessive guilt, 4) overwhelming intrusive thoughts, 5) lack of enjoyment, and 6) thoughts of self-harm or harm toward the infant. I developed the keyword 'professional help' to represent this information for further analysis.

2) **"NURSE":** As part of the supportive psychotherapy that the WBC physicians provide, they provide recommendations to boost parents' mental health. This includes a standard entry including the following items for the parents: 1) nourishment - eat regular meals, pre-prep, pre-cook, and store, ask for help 2) understanding- listen to your body and know your limits, accept your feelings without judgement and acknowledge that it is ok and it will pass, try to think positively 3) rest- make time to relax every day, reduce your expectations of what you can do in a day 4) self care - do things you enjoy or used to enjoy, have hope and know you are not alone; being a new parent is hard; give yourself time to adjust to the latest parenthood change 5) energy/exercise - try walking, exercising, and getting out of the house. I used the keyword "NURSE" to represent this information for further analysis. **Table 24, Table 25, Table 26** in the Appendices explain all the keywords that I developed (n=68 keywords in total) for the first-level categorization.

Step 2 (Second-Level Categorization)

I grouped relevant keywords from the first-level categorization to create new variables (**Table 1, Table 2, Table 3**). This resulted in 35 variables (n=13 for diagnosis, n=18 for intervention (discussion and education), and n=4 for supportive psychotherapy). For example, the first-level keywords "safe sleep,"

“comfort breastfeeding,” “gas management,” “normal infant feeding,” “normal sleeping behaviour,” and “skin-to-skin” were grouped under the second-level variable “infant care.” The logic behind applying this grouping approach is that converting each keyword into a binary variable would create a highly dispersed distribution of these items and complicate the interpretation of the results from a clinical perspective.

As a final step, I converted the variables into binary format, assigning a value of 1 where the variable was present and 0 where it was absent. These binary variables were then analyzed in the same manner as the structured data within the questionnaire.

Unstructured Data - Prescriptions

In addition to analyzing the “Assessment and Plan” section of the visit notes dataset, I examined the “Prescription” variable. This variable was analyzed across all 9294 records in the overall dataset. However, among the 9294 records, 1129 records contained a prescription. Among those, 139 were excluded as they included irrelevant information, such as comments between the clinic staff. This provided 990 records for further analysis. Before further refinement and filtering the records, I used the previously described method for developing keywords and categorization (**Table 27** in Appendices). For example, “Jamp-domperidone 10 mg”, “Ratio-domperidone 10 mg”, “Domperidone 10 mg”**,** and **“**Bio-domperidone 10 mg” were combined as “Domperidone” or “Diclofenac 10% gel”, **“**Apo-naproxen ec 500mg”**, “**children's Tylenol 80mg” were combined as “pain and fever relief.”

Prescriptions within the WBC visit notes dataset were documented in either the infant's or the parent's record, with both sharing the same ID. To ensure each breastfeeding dyad was uniquely represented, only one record per ID was retained. Prior to removing duplicate records, all prescriptions associated with each unique ID were aggregated to ensure no data was lost. This process resulted in a final dataset of 865 records for analysis, which represented 865 dyads that received a prescription (**Figure 2**).

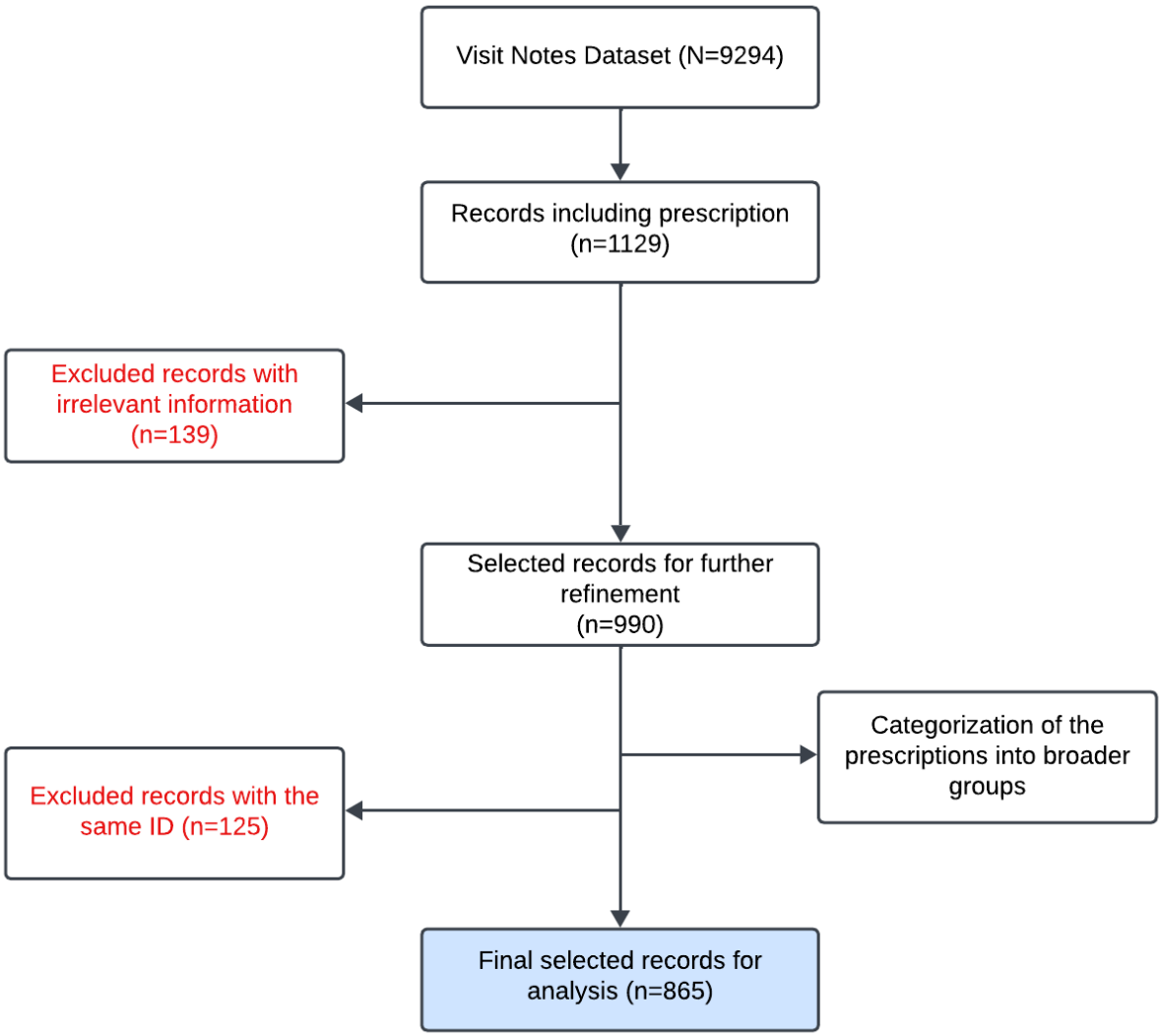

Figure 2 Data Processing and Analysis Flowchart for the Prescription Variable within the Visit Notes Dataset at the Winnipeg Breastfeeding Centre (N=9294 dyads, 2018-2023)

Table 1 Second-Level Categorization for the Clinical Diagnosis Theme within the Visit Notes Dataset

Identified Keywords		**Final Diagnosis Variables**
Bottle refusal Bottle choking fear	Bottle preference Bottle-to-breast transition	Bottle issues
Maternal exhaustion Maternal anxiety		Maternal mental health
Nipple infection Nipple pain	Flat nipple Nipple trauma	Nipple issues
Low milk supply Overactive letdown	Oversupply	Supply issues
GERD-reflux Infant gas	Puking Gastroenteritis	Infant gastrointestinal issues
Blocked ducts Engorgement Milk bleb	Mastitis cellulitis Hypoplastic breast Vasospasm	Breast issues
CMPA Laryngomalacia	Physiologic Jaundice	Infant health issues
Twin feeding	Premature twins	Twin feeding
Latch issues Inefficient feeding TT-LT	Palate anatomy issues Lip blister Inefficient feeding	Infant feeding mechanics
Infant fuss Sleepy infant	Breast aversion	Infant behavioral challenges
Questions	Induction adoption	Other considerations
Exclusive pumping Slow weight gain Weight progress uncertainty	Dehydration Infant weight drop poor weight gain	Nutrition and growth
Latch loss	Latching issues (only latches with shield)	Latch issues

TT-LT: tongue tie, lip tie
CMPA: cow's milk protein allergy
GERD: gastroesophageal reflux disorder

Table 2. Second-Level Categorization for the Intervention (Education)Themes within the Visit Notes Dataset

Identified Keywords		**Final Intervention Variables**
At breast Laid back Biological hold Coax infant to breast Lean back	Position Proximity Room sharing Switch sides	Breastfeeding positions
8-10 times of pumping per day 10-15 minutes of pumping Cluster feeding On-demand	Increase feeding frequency The normal frequency of feeding Breastfeeding every 2-3 hours Wake infant to feed every 3 hours	Feeding frequency
Galactagogue Esomeprazole Adalat NSAID PPI Amlodipine Probiotics/BioGaia	Conditional Keflex Mupirocin ointment Labetalol Accelerated protocol Zoloft B complex Magnesium	Medication apart from domperidone
APNO Nipple shield Nipple care Nipple trauma treatment	Viaderm Hydrogel 1-min pump for nipple eversion	Nipple care
Milk bled unroofing Blockage care	Manage engorgement Sunflower lecithin	Breast care
Parental pain Parental mental health Anxiety Postpartum wellbeing Seek help	Self-compassion Support Adjustment reaction Psychotherapy	Discussion on maternal mental health
Responsive bottle feeding Paced bottle feeding	Bottle rooting	Bottle feeding
Hands-on pumping Power pumping Double electric pumping Post feed pumping	Every other feeding pumping Regular pumping Once a night pumping	Pumping type
Pump info Pump care	Phalange and nipple size	Pump information
Infant cues Infant sleep interference Coping with infant fuss Safe sleep	Comfort breastfeeding Gas management Normal infant feeding/normal sleeping behaviour Skin to skin	Infant care
Tongue tie guidance	Compression	Feeding Guidance

Milk transfer assessment Tools and videos Scale High cal food intake Milk storage Self BF monitoring Galactagogue use Domperidone risks	Heat WIFMP Lactation physiology Drinking detection Swaddle and pacifier effects on infant cue detection About the usage of pacifiers Suck training exercise	
Triple feeding Hand expression SNS Calm-bottle-breast Top-up Breastfeeding simulation	Supplemental feeding Am pump fridge Breast-bottle-breast Direct feeding Combination feeding	Feeding method
Check TSH	Check iron	Medical conditions rule out
Latch and DAL		Education on latch issues
Watch and wait for the tongue tie and lip tie		Watch TT and LT
Watch and wait for jaundice (usually in cases of physiologic Jaundice).		Watch jaundice
Tongue tie and lip tie release referral		TT and LT release referral
Weight follow up		Weight follow-up

PPI: proton pump inhibitor; TT – LT: tongue tie, lip tie; NSAID: non-steroidal anti-inflammatory drug; DAL: deep asymmetric latch; TSH: thyroid stimulating hormones; SNS: supplementary nursing system; APNO: all-purpose nipple ointment; BF: breastfeeding

Biological hold or biological nurturing refers to a relaxed, laid-back position in breastfeeding, particularly for problems such as nipple pain or cracked nipple breastfeeding difficulties.[236]

Table 3. Second-Level Categorization for the Supportive Psychotherapy Theme within the Visit Notes Dataset

Identified Keywords	Final Psychotherapy Variables
Vulnerability of mental health among postpartum parents *Validation* of feeling, experience, value, intention, effort, goals *Acknowledgement* of the complexity of emotions, navigate reality and expectation. *Acceptance* of feeling without judgment, shame, labelling emotions and being curious about thoughts behind emotions. Self-compassion Wellness Postpartum wellbeing COVID-19 stressor	Emotional management
Infant-toddler management (including managing feeding needs of the current infant alongside the caregiving demands of an older toddler)	Parenting
Adjustment reaction Anxiety	Emotional status
NURSE Professional help Support	Support

Professional help refers to discussions with the patient to identify key warning signs that indicate the need for professional mental health support.
NURSE: nourishment, understanding, rest, self-compassion, exercise/energy.

3.3 Statistical Analysis

I used R version 4.4.1 (R Core Team, 2024) and the cited packages in the "Data Extraction, Cleaning and Analysis" section to analyze the data. I used the following statistical methods to address the research aims and questions:

Frequency: I performed frequency analysis to describe the demographic characteristics of the WBC breastfeeding dyads (Aim 1), as well as the most common risk factors, comorbidities, diagnoses, interventions, breastfeeding difficulties, treatments, and the referral distribution before and after COVID-19 (March 2020) (Aim 2).

Descriptive Statistics (Mean, Median, Standard Deviation, Interquartile Range, and Range): For continuous demographic variables (Aim 1), I calculated the mean, median, standard deviation, interquartile range, and range. I performed the Shapiro-Wilk test and created histograms to assess the

normality of these variables, which indicated non-normal distributions for all these continuous variables. For parity, infant age, and maternal age, both measures of central tendency and dispersion were calculated and reported to describe these variables accurately. For the number of monthly appointments, the actual appointment counts were reported to illustrate referral trends to the clinic clearly.

Comparison of the Findings with the Available Manitoba Population Data: Finally, to address my hypotheses, I compared the results of my study from the WBC patient population with population-level data of pregnant/breastfeeding parents within Manitoba or Canada. This comparison relied on available population data such as "The 2019 RHA Indicator Atlas"[61], "Health Inequities in Manitoba"[237], "Perinatal Services and Outcomes in Manitoba"[24], and Annual Statistics 2020 – 2021 (Manitoba Information Management and Analytics)[182] reports. The comparison focused on the following variables: caesarean section delivery, neighbourhood-level socioeconomic status (using the Forward Sortation Area), primiparity, polycystic ovarian syndrome, diabetes, high blood pressure, thyroid disorder, anemia, depression/anxiety, maternal age, NICU admission, epidural administration, gestation at birth, and newborn jaundice.

3.4 Developing a Geographic Distribution Map for the WBC Patients

To address my first research aim of describing the demographic characteristics of the WBC patient population and their geographic distribution, I utilized the Forward Sortation Area codes (the first three digits of postal codes) - obtained from the referral tracking dataset. The frequency and percentage of these codes were calculated using R and exported into an Excel file for further processing. I used the 2021 census boundary files,[238] Manitoba government Regional Health Authority finder tool,[239] MCHP community area and postal code information,[240] an interactive map of Canada by Prospect Influential company[241], and a list of FSA codes compiled by Canada Post[242]. From these sources, I selected the most well-known subdivision to represent each associated FSA. Selecting the most well-known subdivisions was mainly focused on the previously mentioned interactive map, the commonly used neighbourhood-level maps by MCHP, and the Forward Sortation Area codes list by Canada Post.

Next, I imported the Excel sheet and Statistics Canada boundary files into QGIS (version 3.38.3-Grenoble), an open-source Geographic Information System (GIS) software. I filtered out non-Manitoba provinces and merged the files to visualize the geographic distribution of the patient population. Finally, I used the color coding to represent the appointments and classification features to identify their prevalence

(based on percentage) in QGIS to create maps representing the Manitoba and Winnipeg regions. The primary purpose of mapping the forward sortation area codes of referred patients was to provide WBC physicians with a visual representation of the areas from which they most frequently receive referrals. This will provide insights into their patient population. Additionally, colour coding was based on the percentage of appointments and was applied to highlight the specific locations patients were referred from to help physicians identify the areas within Manitoba that most commonly refer patients to WBC.

The Winnipeg Breastfeeding Centre is the only physician-led breastfeeding support clinic in Manitoba. Winnipeg is divided into 12 distinct community areas, each with varying socioeconomic conditions. These conditions influence factors such as access to healthcare services, including breastfeeding support available to residents in different areas.

Given that patients can be referred from or reside in any of these community areas, I examined their distribution across Winnipeg and explored their neighborhood-level socioeconomic status. To accomplish this, I contacted the Manitoba Centre for Health Policy and obtained the mean Socioeconomic Factor Index (SEFI) for each community area, based on 2021 census data from Statistics Canada. (**Table 7**).

Chapter 4: Results

4.1 Study Population

The secondary data utilized in this study included records from the intake questionnaire (n=3320), visit notes (n=9294), and referral tracking datasets (n=11887). As described in Methods **(Figure 1),** these records were further screened and randomly sampled, resulting in 3230, 79, and 6778 final records for analysis, respectively.

The mean parity among parents was 1.6 (SD ± 1.0, Range [0.12]). The mean age for parents attending WBC was 34.8 years (SD ± 4.7, Range [16-50]). The mean infant age was 8.7 weeks (SD ± 11.4, Range [0, 205]) (**Table 4**).

Table 4. Demographic Characteristics of Breastfeeding Dyads at the Winnipeg Breastfeeding Centre

Demographics	n	Mean ± SD	Median	Q1-Q3	Range
Parent's age	3574	34.8 ± 4.7	35	[32, 38]	[16-50]
Infant age (weeks) - overall	3230	8.7 ± 11.4	6	[3, 10]	[0-205]
Among those 0-12 weeks old	2754	5.3 ± 3.0	5	[3, 7]	[0-12]
Parity	3230	1.6 ± 1.0	1	[1, 2]	[0-12]

Infant age and parity are from the intake questionnaire.
Parent age is from the referral tracking dataset.
See appendix for complete details of this questionnaire.
The sex variable was excluded because the visit notes dataset - the only dataset containing this variable - inconsistently captured either parent or infant's sex. Therefore, it was not feasible to distinguish between parent and infant for analysis.

4.2 Geographic Distribution of the Referred Patients to WBC and Their Socioeconomic Status Compared to the General Population in Manitoba.

The patient population within the clinic were mostly referred from Manitoba (n=6666/6713, 99.3%), with a few referred from British Columbia (n=1, <0.1%), Ontario (n=13, <0.2%), Alberta (n=3, <0.1%), or Nunavut territory (n=3, <0.1%) **(Table 5)**. Of the Forward Sortation Area codes, 0.4% (n=25) could not be assigned a location, according to Statistics Canada[243] census data.

Within Manitoba, about three quarters of the patients were referred from Winnipeg Regional Health Authority (n=5035, 75.0%), with the remainder originating from Southern Health Sante Sud (n=1005, 15.0%), Interlake-Eastern Regional Health Authority (n=545, 8.1%) or other Regional Health Authorities (n=81, 1.2%) **(Table 6, Figure 3)**. Within the Winnipeg Regional Health Authority, the most common referral locations were Fort Garry (n=878, 13.1%), River East (n=810, 12.1%), and Saint Boniface (n=620, 9.2%) (**Table 7, Figure 4**). The most common referral locations within Interlake-Eastern Regional Health Authority were Gimli (n=174, 2.6%), Wanipigow (n=142, 2.1%), and Selkirk (n=102, 1.5%). The most common referral locations within Southern Health Santa Sud were Steinbach (n=411, 6.1%), and Winkler (n=280, 4.2%).

Given that 75.0% of the WBC population resides in the Winnipeg Regional Health Authority, I utilized community-area-level SEFI data from the Manitoba Centre for Health Policy as well to assess the socioeconomic status and distribution of patients across Winnipeg (**Table 7**). Within Winnipeg, the mean SEFI among community areas where the WBC population resides ranges from -0.9 to +1.0. All Winnipeg community areas referring WBC patients have negative SEFI values (indicating better socioeconomic status) except for Point Douglas (+1.0) and Downtown (+0.6), which indicate worse socioeconomic conditions.

The top three common residential areas for patients - Fort Garry, River East, and Saint Boniface - collectively account for 34.4% of appointments and all have negative SEFI values, reflecting better socioeconomic status. In contrast, Point Douglas and Downtown, with worse socioeconomic conditions, represent less than 10.0%.

Additionally, when comparing the community area map of Winnipeg with the map of Winnipeg based on SEFI scores, the darkest areas on the community area map (representing the frequent appointments) correspond to the darkest areas on the SEFI map (indicating the highest socioeconomic status). These findings suggest that individuals living in areas with better socioeconomic status may have greater access to WBC services (**Figure 4**).

Table 5. Geographic Distribution of the Breastfeeding Dyads Referred to the Winnipeg Breastfeeding Centre (N=6713, excluding the missing Forward Sortation Area codes)

Province/Territory	n	%
Manitoba	6666	99.3
Ontario	13	0.2
Calgary	3	<0.1

Nunavut	3	<0.1
British Columbia	1	<0.1
No data	25	0.4

Table 6. Geographic distribution of the Breastfeeding Dyads Referred to the Winnipeg Breastfeeding Centre by Regional Health Authority (N=6713)

Geographic Area	**n**	**%**
Winnipeg Regional Health Authority	5035	75.0
Southern Health-Santé Sud	1005	15.0
Interlake-Eastern Regional Health Authority	545	8.1
Prairie Mountain Health	61	0.9
Northern Regional Health Authority	20	0.3
Ontario	13	0.2
Alberta	3	<0.1
Nunavut	3	<0.1
British Columbia	1	<0.1
No data	25	0.4

From the referral tracking dataset.
Missing Forward Sortation Area codes were removed from the analysis (n=62)

Table 7 Geographic Distribution of Winnipeg Breastfeeding Centre Dyads by Community Area and Associated SEFI Values (N=6713)

Community Area	**n**	**%**	**Mean SEFI**
Fort Garry	878	13.1	-0.6
River East	810	12.1	-0.1
St. Boniface	620	9.2	-0.5
St. James-Assiniboia	463	6.9	-0.2
Seven Oaks	461	6.9	-0.3
St. Vital	389	5.8	-0.4
River Heights	353	5.3	-0.5
Point Douglas	330	4.9	1.0
Assiniboine South	298	4.4	-0.9
Downtown	235	3.5	0.6
Transcona	169	2.5	-0.2

From the referral tracking dataset. This table focuses solely on the population from the community areas within Winnipeg.
SEFI: socioeconomic factor index; lower values indicate higher socioeconomic status (range -5 to +5).

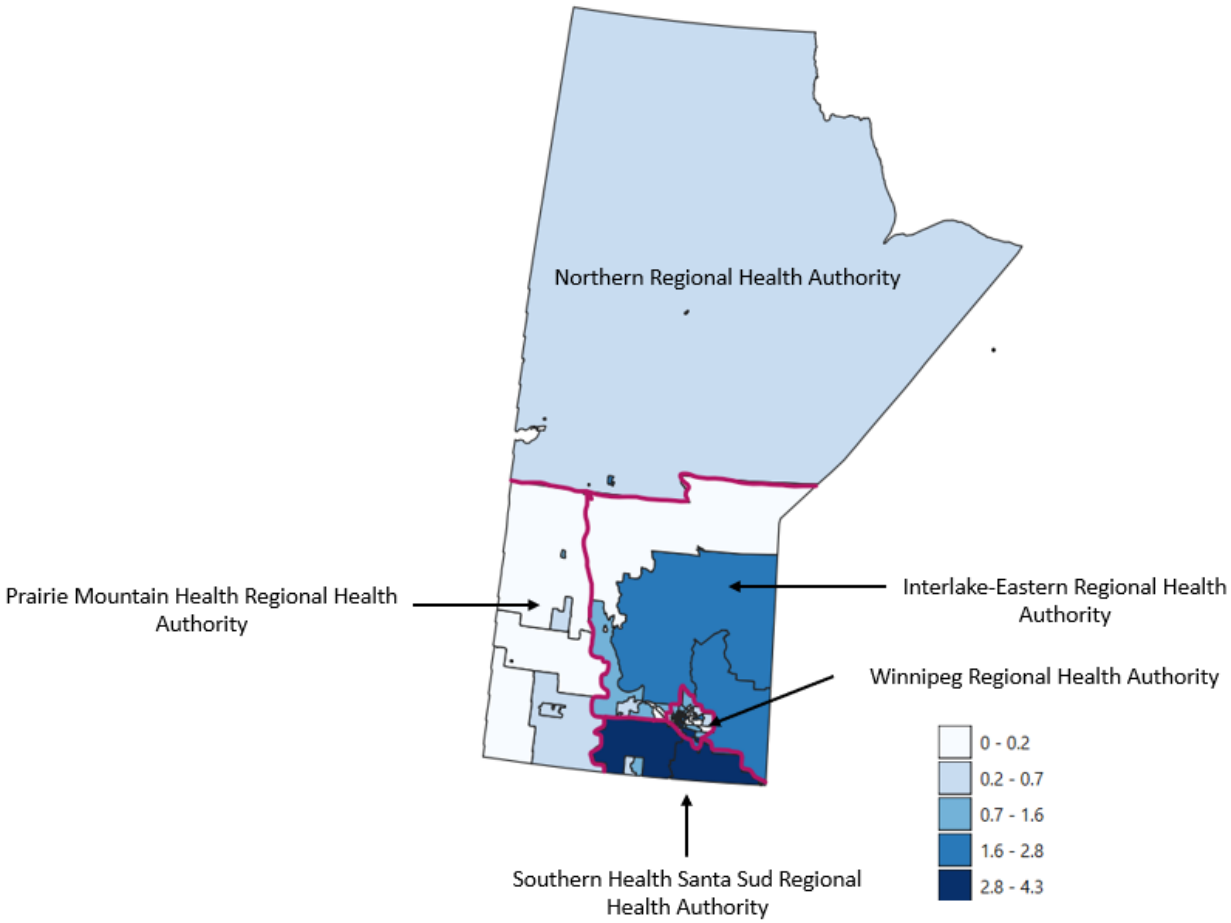

Figure 3 Geographic Distribution of the Breastfeeding Dyads Referred to the Winnipeg Breastfeeding Centre by Regional Health Authority (N=6713)

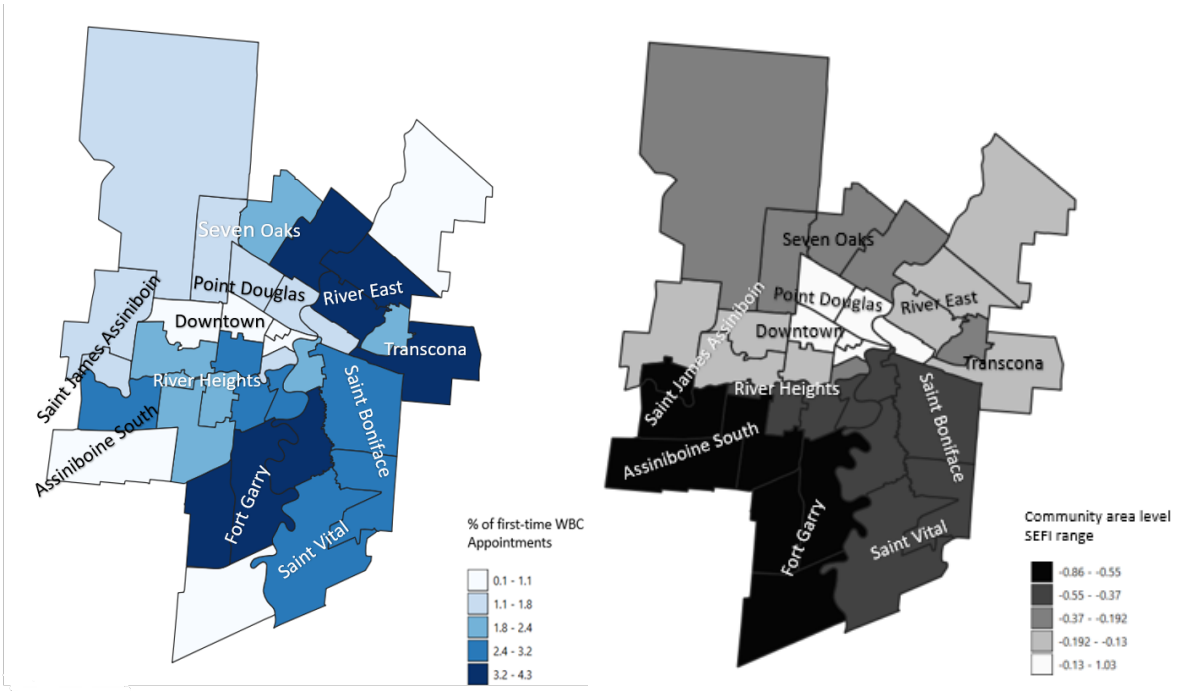

Figure 4 Geographic Distribution of the Breastfeeding Dyads Referred to the Winnipeg Breastfeeding Centre by Community Areas within Winnipeg and Socioeconomic Factor Index (SEFI) (N=6713)

4.3 Environmental Exposures, Behaviours, and Comorbidities Among Dyads

This section describes environmental exposures, behaviours, and comorbidities pertaining to the lactating parent, infant, or both. These characteristics include those that existed prior to pregnancy, during the pregnancy, postnatal period, and at birth.

Lactating Parent Characteristics - Smoking, Alcohol and Recreational Drug Use

Almost half of clinic patients (n=1242/3220, 38.6%) did not report their cigarette (tobacco) smoking status, while 37.6% (n=1212/3220) reported never smoking, and 0.2% (n=6/3220) were smokers (**Table 8**). The high percentage of non-responses regarding tobacco smoking may be attributed to the stigma associated with smoking during pregnancy/breastfeeding or the design of the questionnaire. Specifically, the questions related to cigarette and alcohol use included a note advising respondents to skip the question if it did not apply to them. This instruction may suggest that individuals who did not respond were likely non-smokers. I have recommended restructuring this question in (**5.6. Recommendations for Data Collection in WBC)**.

One-third of patients did not report their drinking status (n=1064/3150, 33.8%) while 23.4% (n=737/3150) were never drinkers and 23.3% (n=735/3150) were current drinkers. The mean number of alcoholic drinks per week among former or current drinkers was 2.2 (SD ± 2.2, Range [1,35]). Only 0.8% (n=25/3230) of the patients used recreational drugs; of which, 96.0% (n=24/25) selected the “other” response option, and only 1 person (4.0%) selected over-the-counter cough/cold medicine (**Table 8**).

Table 8. Behaviors and Habits of Breastfeeding Dyads at the Winnipeg Breastfeeding Centre

Parent's Behaviours	**n**	**%**
Tobacco smoking history (N=3220)		
Skipped the question	1242	38.6
Never smoker	1212	37.6
Not smoker	453	14.1
Former smoker	240	7.5
Current smoker (daily)	37	1.1
Current smoker (occasionally)	13	0.4
Smoker	6	0.2
Unknown	8	0.2
Smoking material (N=296)		
Cigarette	270	91.2
E-cigarette	49	16.6
Cigarillos	11	3.7
Cigar	6	2.0
Chewing tobacco	3	1.0
Pipe	1	0.3
Number of smoking materials consumed (N=274)		
1	210	77.5
2	54	19.9
3	6	2.2
4	1	0.4
Alcohol consumption status (N=3150)		
Skipped the question	1064	33.8
Never drinker	737	23.4
Current drinker	735	23.3
Former drinker	613	19.5
Recreational drug		
Recreational drug use (N=3230)	25	0.8
Recreational drug type (N=25)		
Other	24	96.0
OTC cough / cold medicine	1	4.0
Cocaine	0	0
Heroin	0	0
LSD	0	0
Methamphetamine	0	0
Opioid	0	0
Sedatives	0	0
Stimulants	0	0
Steroids	0	0

All variables within this table are from the intake questionnaire dataset.
See appendix for complete details of this questionnaire.
LSD: Lysergic Acid Diethylamide

4.4 Delivery-Associated Factors, Comorbidities, and Interventions

Majority of the patients (n=2016/3230, 62.4%) were within the term gestational age of 38-41 weeks. 28.2% (n=910/3230) had a caesarean section, and 6.2% (n=199/3230) had a vaginal delivery with assistance. Of the patients, 38.6% (n=1247/3230) reported being induced during delivery, while 11.1% (n=360/3,230) were estimated to have undergone an emergency caesarean section. A substantial portion of the parents (n=1433/3230, 44.5%) reported no delivery complications. Manual placenta removal (n=901/3230, 28.0 %), high blood pressure (n=321/3230, 10.0 %), and too much bleeding (postpartum hemorrhage) (n=292/3230, 9.1%) were the most common delivery complications. The highest proportion of parents (n=1531/3217, 47.6%) reported/described one delivery complication, while 44.5% (n=1433/3217) had none, and only 7.9% reported more than one delivery complication (**Table 9**).

The most common delivery interventions were intravenous fluid administration (n=1981/3221, 61.5%) and Epidural administration (n=1931/3221, 60.0 %). Only 17.6% (n=568/3221) of the parents received no delivery interventions. 21.4% (n=690/3221) received one and 60.9% (n=1963/3221) received more than one delivery intervention (**Table 9**).

Table 9 Delivery Associated Factors, Complications, and Interventions for Breastfeeding Difficulties Among Breastfeeding Dyads at the Winnipeg Breastfeeding Centre

Delivery-Associated Practices	**n**	**%**
Gestational age (N=3230)		
Less than 34 weeks	53	1.6
34 to 37 weeks	243	7.5
37-38 weeks	568	17.6
38-41 weeks	2016	62.4
41 weeks or above	350	10.8
Method of delivery (N=3230)		
Vaginal	2121	65.7
Caesarian-section	910	28.2
Emergency Caesarian-section	360	11.1
Vaginal with assist (forceps or vacuum)	199	6.2
Delivery induction (N=3230)	1247	38.6
Delivery complications (N=3217)		
Manual placenta removal	901	28.0
High blood pressure	321	10.0
Too much bleeding	292	9.1
Pushing more than 3 hours	246	7.6
Fever or infection	201	6.2
Shoulder dystocia	87	2.7
Seizure	24	0.7
Hemolysis, elevated liver enzymes, and low platelet count	17	0.5
None of the above conditions	1433	44.5
Number of delivery complications (N=3217)		
0	1433	44.5
1	1531	47.6
2	205	6.4
3	45	1.4
4	2	0.1
5	1	0.0
Delivery interventions (N=3221)		
IV fluids	1981	61.5
Epidural	1931	60.0
Fentanyl	1112	34.5
Antibiotics	833	25.9
None of the above interventions	568	17.6
Number of delivery interventions (N=3221)		
0	568	17.6
1	690	21.4

2	968	30.0
3	749	23.3
4	246	7.6

Variables from the intake questionnaire. See appendix for complete details of this questionnaire.

4.5 Lactating Parents' Medical Conditions and Medical History

WBC patients were asked to report both medical history and existing medical conditions. Almost one-fifth of patients described experiencing infertility (n=574/3230, 17.8%). 4.9% (n=161/3230) of parents reported a past breast surgery, and among those with a history of breast surgery, almost similar proportions of parents had undergone augmentation (n=62/161, 38.5%) and reduction (65/161, 40.4%) (**Table 10**).

More than half of patients reported no diagnosed conditions (n=1863/3215, 57.9%). Depression and/or anxiety were the most prevalent among parents (n=645/3215, 20.1%). The least commonly diagnosed medical condition was diabetes type 1 (n=15/3215, 0.5 %) (**Table 10, Figure 5**).

40.6% (n=1312/3230) of parents used medications for their existing medical conditions. 31.5% (n=1018/3230) of the parents had a breastfeeding experience; among those, 60.5% (n=616/1018) had experienced a breastfeeding difficulty in the past. Less than half of the patients (n=1497/3230, 46.3%) experienced gestational breast change (**Table 10**).

Table 10. Medical Conditions Among Breastfeeding Dyads at the Winnipeg Breastfeeding Centre

Breastfeeding Dyad's Medical History	**n**	**%**
Lactating parents' Medical Conditions		
History of infertility (N=3230)	574	17.8
Currently taking medication (N=3230)	1312	40.6
Breast surgery (N=3230)	161	4.9
Augmentation (N=161)	62	38.5
Reduction (N=161)	65	40.4
Other (N=161)	34	21.1
Lactating parents' diagnosed medical conditions (N=3215)		
Depression or anxiety	645	20.1
Thyroid disorder	283	8.8
Anemia	228	7.1
Polycystic ovarian syndrome	219	6.8
High blood pressure	210	6.5
Diabetes	162	5.0
Gestational diabetes	121	4.0
Diabetes type 2	26	0.8
Diabetes type 1	15	0.5
None of the conditions	1863	57.9
Number of diagnosed conditions (N=3215)		
0	1863	57.9
1	1037	32.3
2	243	7.6
3	65	2.0
4	7	0.2
Lactating parents' previous breastfeeding experience (N=3230)	1018	31.5
Previous breastfeeding difficulty (N=1018)	616	60.5
Infants' Medical Conditions		
Low blood sugar (N=3230)	367	11.4
NICU admission (N=3230)	309	9.6
Jaundice (N=3230)	1257	38.9
Jaundice light therapy (N=1257)	260	20.7

Variables from the intake questionnaire. See the appendix for complete details of this questionnaire.

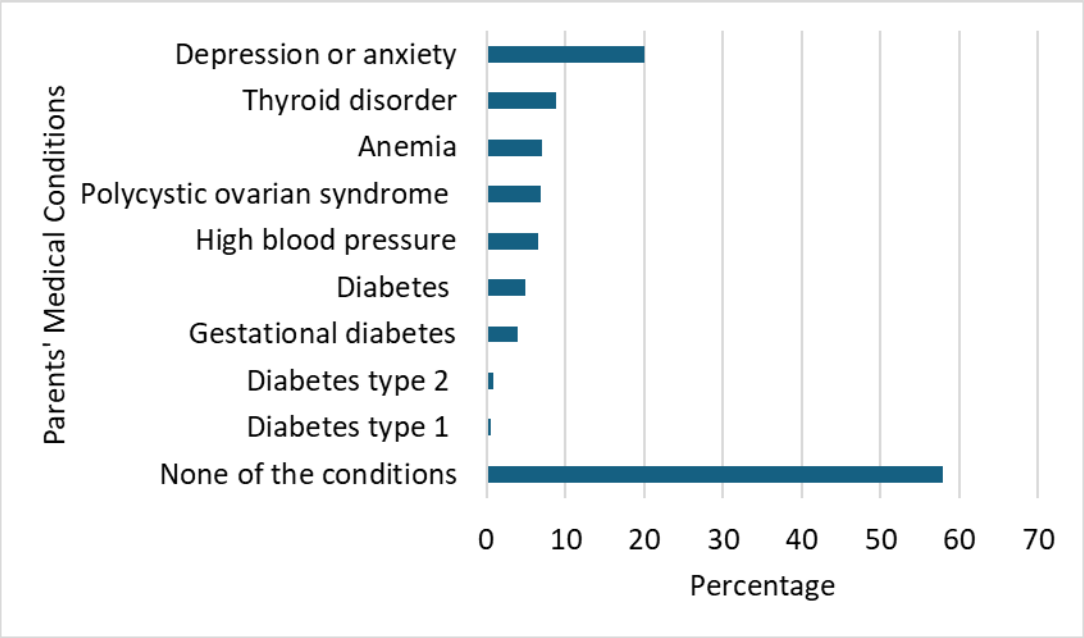

Figure 5 Parents' Medical Conditions Among Patients at the Winnipeg Breastfeeding Centre (N=3215, 2018-2023).

4.6 Breastfeeding Infant's Medical Conditions and Medical History

Almost one-tenth of infants visiting WBC (n=309/3230, 9.6%) were admitted to the NICU after birth. 38.9% (n=1257/3230) of infants had jaundice, and among those, 20.7% (n=260/1257) underwent Jaundice light therapy. 11.4% (n=367/3230) of the infants had low blood sugar after birth (**Table 10**).

4.7 Breastfeeding Difficulties and Diagnoses

Breastfeeding difficulties were captured in two ways: patient-reported difficulties and clinical diagnoses by WBC clinicians (**Table 12**). Breastfeeding difficulties reported by patients were analyzed using the intake questionnaire dataset completed by parents. Clinically diagnosed problems were examined by reviewing the 'Assessment and Plan' section in the visit notes dataset. Although the visit notes dataset included a column for diagnostic codes, these codes were not used for analysis, as they lacked the specificity needed for infant feeding diagnoses. **Table 11** provides a list of all the diagnostic codes included in the visit notes dataset records. Of all the records, only around one-third (n=3176/9294, 34.2%) included a diagnostic code. 65.8% (n=6118/9294) of the records did not include any diagnostic codes. In

addition, all the records that included a diagnostic code had only one code and did not have multiple codes recorded.

Table 11 Diagnostic Codes Recorded within the Visit Notes Dataset of Winnipeg Breastfeeding Centre (N=9294 records)

Diagnostic Code	Code Definition	n	%
Breast and Nipple Issues			
879.1	Open wound breast complicated	8	<0.1
879.0	Open wound of breast	23	0.3
611.79	Other signs and symptoms in breast	167	1.8
611.0	Inflammatory disease of breast	42	0.5
611.72	lump or mass in breast	34	0.4
611.82	Hypoplasia of breast	2	<0.1
611.9	Unspecified breast disorder	6	<0.1
Lactation and Feeding Problems			
779.31	Feeding problems in newborn	1331	14.3
676.80	Other disorders of lactation, unspecified as to episode of care or not applicable	1074	11.6
779.34	Failure to thrive in newborn	3	<0.1
Infant Behaviour and Development			
799.22	Irritability	19	0.2
780.91	Fussy infant	3	<0.1
780.50	Sleep disturbance, unspecified	1	<0.1
783.1	Abnormal weight gain	17	0.2
750.0	Tongue tie	15	0.2
Maternal Mental Health and Adjustment			
300.00	Anxiety state, unspecified	193	2.1
648.40	Mental disorders of mother, unspecified as to episode of care or not applicable	2	<0.1
309.9	Unspecified adjustment reaction	227	2.4
Other Medical Conditions or Checkups			
530.11	Reflux esophagitis	1	<0.1
780.79	Other malaise and fatigue	1	<0.1
787.01	Nausea with vomiting	1	<0.1
1129	Candidiasis of unspecified site	2	<0.1
528.5	Diseases of lips	1	<0.1
V20.2	Routine infant or child health check	3	<0.1

Patient-Reported Breastfeeding Difficulties

The most common patient-reported problems were concerns regarding milk supply (n=1763/3230, 54.6%), nipple pain (n=1416/3230, 43.8%), and concerns about tongue tie (n=957/3230, 29.6%). A similar percentage of parents reported experiencing one (n=1146/320, 35.5%) or two (n=1196/3230, 37.0%) breastfeeding difficulties. Almost one-fifth of the patients (n=658/3230, 20.4%) reported experiencing three breastfeeding difficulties. The least common patient-reported difficulty was feeding a twin or more (n=58/3230, 1.8%) (**Table 12**, **Figure 7**).

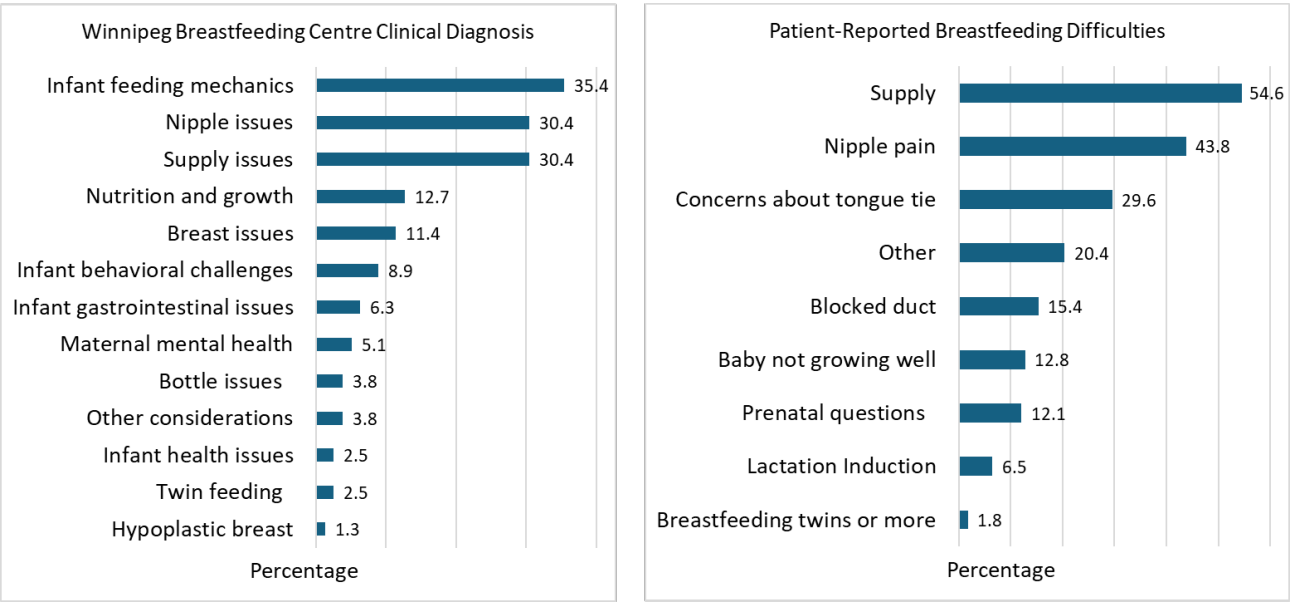

Figure 6 Comparing the Prevalence of Patient-Reported Breastfeeding Difficulties with Winnipeg Breastfeeding Centre Physicians' Diagnoses (N (patient-reported breastfeeding difficulty)=3230, N (WBC clinical diagnosis)=79, 2018-2023)

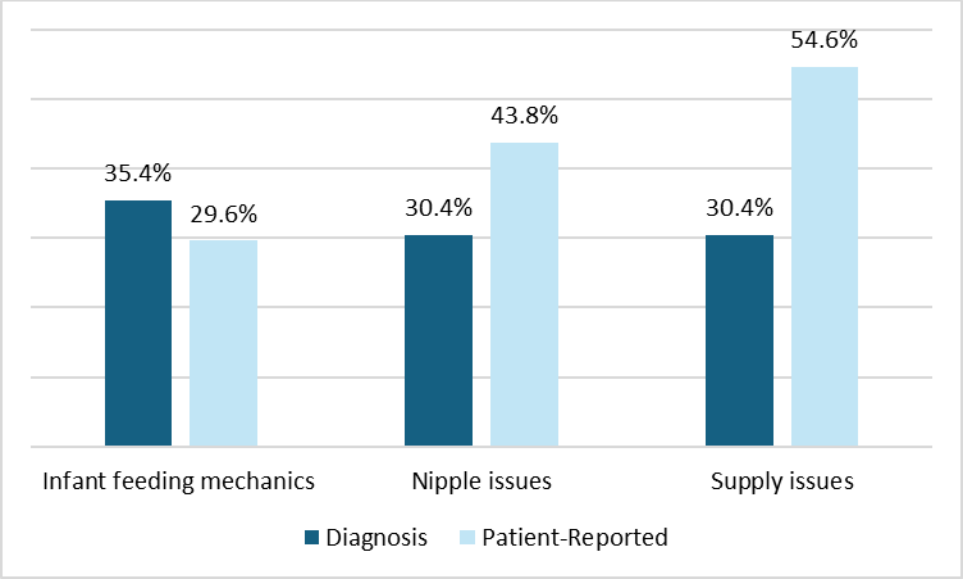

Figure 7 Comparing the Prevalence of the Top Three Patient-Reported Breastfeeding Difficulties with Winnipeg Breastfeeding Centre Physicians' Diagnoses (N=79, 2018-2023)

Clinical Diagnoses

The most common clinical diagnoses related to child feeding mechanics, parent nipple issues, and milk supply, all of which showed similar prevalence (~1/3 of patients). Child feeding mechanical issues were recorded in 35.4% (n=28/79) of patients attending WBC, and included latch or palate issues, inefficient feeding, lip blister, tongue tie or lip tie. Diagnoses related to parent nipple injury were recorded in 30.4% of patients (n=24/79) and involved nipple infection, nipple pain, flat nipple, nipple trauma. Supply issues were recorded in 30.4% (n=24/79) of the patients and included low milk supply, overactive letdown, and oversupply. Hypoplastic breast was the least common clinical diagnosis captured in the clinic visit notes (n=1/79, 1.3%). Many patients only had one clinical diagnosis (n=34/79, 43.0%) although more than a third had two concurrent diagnoses (n=27/79, 34.2%) and some had three or more (n=11/79, 14.0%). Notably, detecting a diagnosis was not feasible in 8.9% (n=7/79) of the visit notes, highlighting a key challenge associated with free-text data collection (**Table 12**).

Table 12. Patient-Reported Breastfeeding Difficulties and Physician Diagnoses at the Winnipeg Breastfeeding Centre

Diagnoses and Patient-Reported Difficulties	**n**	**%**
Patient-reported breastfeeding difficulties (N=3230)		
Milk supply	1763	54.6
Nipple pain	1416	43.8
Concerns about tongue tie	957	29.6
Blocked duct	497	15.4
Infant not growing well	415	12.8
Prenatal questions	390	12.1
Lactation induction	211	6.5
Breastfeeding twins or more	58	1.8
Other	776	24
Concurrent patient reported difficulties (N=3230)		
1	1146	35.5
2	1196	37.0
3	658	20.4
4	189	5.9
5	34	1.1
6	6	0.2
9	1	0.0
Clinical breastfeeding difficulty diagnoses by WBC physicians (N=79)		
Infant feeding mechanics	28	35.4
Nipple issues	24	30.4
Supply issues	24	30.4
Nutrition and growth	10	12.7
Breast issues	9	11.4
Infant behavioral challenges	7	8.9
Infant gastrointestinal issues	5	6.3
Maternal mental health	4	5.1
Bottle issues	3	3.8
Infant health issues	2	2.5
Twin feeding	2	2.5
Hypoplastic breast	1	1.3
Other considerations	3	3.8
Number of clinical diagnoses (N=79)		
1	34	43.0
2	27	34.2
3	10	12.7
4	1	1.3
Not available (diagnosis not documented in the visit notes)	7	8.9

4.8 Physician-Led Breastfeeding Treatment Strategies

The visit notes unstructured data revealed three main themes in the treatment strategies that the WBC physicians apply: education/discussion, supportive psychotherapy, and prescribed medications or supplies (**Table 13**).

Education/Discussion

Treatment strategies described within the visit notes were primarily focused on discussions and education. The most common topics of education were “infant care” (n=61/79, 77.2%), “guidance on infant feeding” (n=59/79, 74.7%), and discussions on “latch issues” (n=58/79, 73.4%) (**Table 13**). Discussions around "infant care" encompassed a range of topics such as detecting infant hunger cues, methods for waking infants to initiate breastfeeding, and understanding and coping with typical fussing and sleeping patterns. Additional topics of infant care addressed creating a safe sleep environment, the benefits of comfort breastfeeding (i.e., breastfeeding beyond nutritional needs for purposes of bonding), and strategies for managing infant gas. The importance of skin-to-skin contact between parent and child was also discussed. Guidance about infant feeding involved providing information on topics such as the effects of pacifier usage, suck training exercises, risks of domperidone, and milk storage. Discussions around latch issues included education about achieving deep asymmetric latch among dyads.

Supportive Psychotherapy

Within the supportive psychotherapy theme, I identified four primary sub-themes. Items in this section were grouped based on their contextual relevance, and the sub-themes were labelled as follows: emotional status, emotional management, professional support, and parenting. The most common supportive psychotherapy theme was discussions around emotional status (n=34/79, 43.0%) including discussions of anxiety and adjustment reactions among lactating parents (**Table 13**). 31.6% (n=25/79) of the parents received supportive psychotherapy on emotional management (e.g. self-compassion and postpartum well-being) and 32.9% (n=26/79) received education on when to seek professional support for mental health. The least common theme of supportive psychotherapy was parenting (i.e., managing both infants and toddlers simultaneously (n=1/79, 1.3%).

Prescribed Medications or Supplies

Of all the 9294 records within the visit notes dataset, only 12.1% (n=1129/9294) included a prescription

representing 10.5% (n=865/8244) of the WBC breastfeeding dyads (**Table 13**). The most common prescriptions were domperidone (a dopamine antagonist for indications of gastrointestinal conditions or nausea which is also prescribed for milk supply increase in breastfeeding parents)[205] (n=511/865, 59.1%), topical treatments (e.g. nipple ointments) (n=141/865, 16.3%), and breastfeeding supplies (including breast pumps and their associated equipment, breast wound pads, thumb braces for conditions such as De Quervain's Tenosynovitis[1], and nipple shields) (n=92/865, 10.6%). Other less common prescriptions included antibiotic and antiviral medications, antifungal medications, calcium channel blockers (prescribed for nipple vasospasm), mental health medications, and proton pump inhibitors (prescribed for gastrointestinal conditions). In discussions with the WBC physicians, it was noted that over-the-counter items, such as pain relief medication and formula, are occasionally prescribed for specific populations, including First Nations individuals, as these items are covered under the Non-Insured Health Benefits program. This may account for the relatively low percentage of such prescriptions observed in the data.

Table 13. Treatment Strategies by the Physicians at the Winnipeg Breastfeeding Centre

Treatment Strategies	**n**	**%**
Education/Discussion (N=79 dyads)		
Infant care	61	77.2
Guidance on infant feeding	59	74.7
Education on latch issues	58	73.4
Bottle feeding	47	59.5
Feeding method	43	54.4
Nipple care	38	48.1
Feeding frequency	37	46.8
Breastfeeding positions	32	40.5
Pump information	24	30.4
Medication apart from galactagogues	23	29.1
Pumping type	22	27.8
Maternal mental health	13	16.5
Tongue tie/lip tie release referral	9	11.4
Watch tongue tie/lip tie	9	11.4
Breast care	4	5.1
Medical conditions rule out	3	3.8
Weight follow-up	3	3.8
Watch jaundice	1	1.3
Number of education discussion themes provided by the WBC physicians (N=79 dyads)		
0	1	1.3
1-3	14	17.7
4-6	26	32.9

7-9	26	32.9
10-14	12	15.2
Supportive psychotherapy (N=79 dyads)		
Emotional status	34	43.0
Professional support	26	32.9
Emotional management	25	31.6
Parenting	1	1.3
Number of supportive psychotherapy themes provided by the WBC physicians (N=79 dyads)		
0	38	48.1
1	15	19.0
2	7	8.9
3	19	24.0
Prescriptions (N=865 prescriptions)		
Domperidone	511	59.1
Topical_treatment	141	16.3
Supplies (pump, etc.)	92	10.6
Hormonal_medication	58	6.7
Antibiotic_and_antiviral_medication	41	4.7
Calcium_channel_blocker	28	3.2
Antifungal_medication	27	3.1
Proton pump inhibitor	20	2.3
Mental_health_medication	14	1.6
Physiotherapy referral	11	1.3
Galactagogue	3	0.3
Pain_and_fever_relief	3	0.3
Massage referral	3	0.3
Dietician referral	2	0.2
Formula	1	0.1
Number of prescriptions provided by the WBC physicians (N=8244 dyads)		
0	7379	89.5
1	779	9.4
2	82	1.0
3	4	0.1

All variables from the 79 randomly selected records of the visit notes dataset except the prescription and the number of prescriptions which are analyzed using all the records within the visit notes dataset.

4.9 Number and Type of Appointments with the WBC: Change Over Time and During COVID-19

The number and type of WBC appointments before, during and after the COVID-19 pandemic is shown in **Table 14.** I considered March 2020 as the beginning of the public health restrictions for the COVID-19 pandemic and May 2023 as the end of COVID-19 pandemic. The median frequency of the monthly appointments to the clinic within pre-pandemic period (June 2018 – February 2020) was 29 (Range: 13-39]) per month, and all were done in person. During the pandemic period (March 2020 – May 2023), the median monthly appointments to the clinic increased to 61 (Range: [38 -87]), with 40% occurring virtually. Following the pandemic, the median number of monthly appointments to the clinic increased to 64.5 (Range: [46-71]) with a decrease to the percentage of virtual appointments to 18.1%. These numbers demonstrate that WBC received a large increase in monthly appointments after the start of the COVID-19 pandemic restrictions compared to the pre-pandemic period, with a continued gradual increase following the pandemic.

This increase in the monthly appointments received by the WBC during the COVID-19 pandemic and its continuation of increase during post-pandemic period could be explained by three reasons: 1) the WBC has progressively expanded its team since the clinic's establishment, incorporating three additional family physicians, a pediatric surgeon, and an International Board-Certified Lactation Consultant (IBCLC). While this expansion occurred *gradually*, it may partly account for the observed increase in appointment frequency within the WBC over time, 2) in discussion with the WBC physicians, I found that during the pandemic, public health centres did not provide services for the parents and were not available due to the public health restrictions which led to a higher referral to the WBC during that time, 3) service provision through virtual access, such as telephone-based consultations, may have been a contributing factor to the increase in the number of appointments during the pandemic as well. (**Table 15, Figure 8**)

Table 14 Prevalence and Frequency of Appointment Types within the Winnipeg Breastfeeding Centre

Date Range	In-Person (n)	In-Person (%)	Virtual (n)	Virtual (%)	Total (n)
Jun 2018 – Feb 2020	1344	100.0	0	0.0	1344
Mar 2020 - May 2023 (pandemic)	3281	60.0	2179	40.0	5460
June 2023 – Nov 2023	758	81.9	168	18.1	926

From visit notes dataset – only dataset that included the type of appointment with the clinic.

Table 15 Distribution of Monthly Appointments to Winnipeg Breastfeeding Centre

Date Range	Mean ± SD	Median	Q1 – Q3	Range
June 2018 - February 2020 (pre-pandemic)	27.2 ± 9.0	29.0	[19-34]	[13-39]
March 2020 - May 2023 (pandemic)	60.3 ± 10.3	61.0	[52-66.5]	[38-87]
June 2023 - November 2023 (post-pandemic)	62.3 ± 9.2	64.5	[59.75-68.5]	[46-71]
June 2018 -November 2023 (entire study period)	50.0 ± 18.4	53.0	[35.75-63.75]	[13-87]

From the intake questionnaire. See the appendix for complete details of this questionnaire.

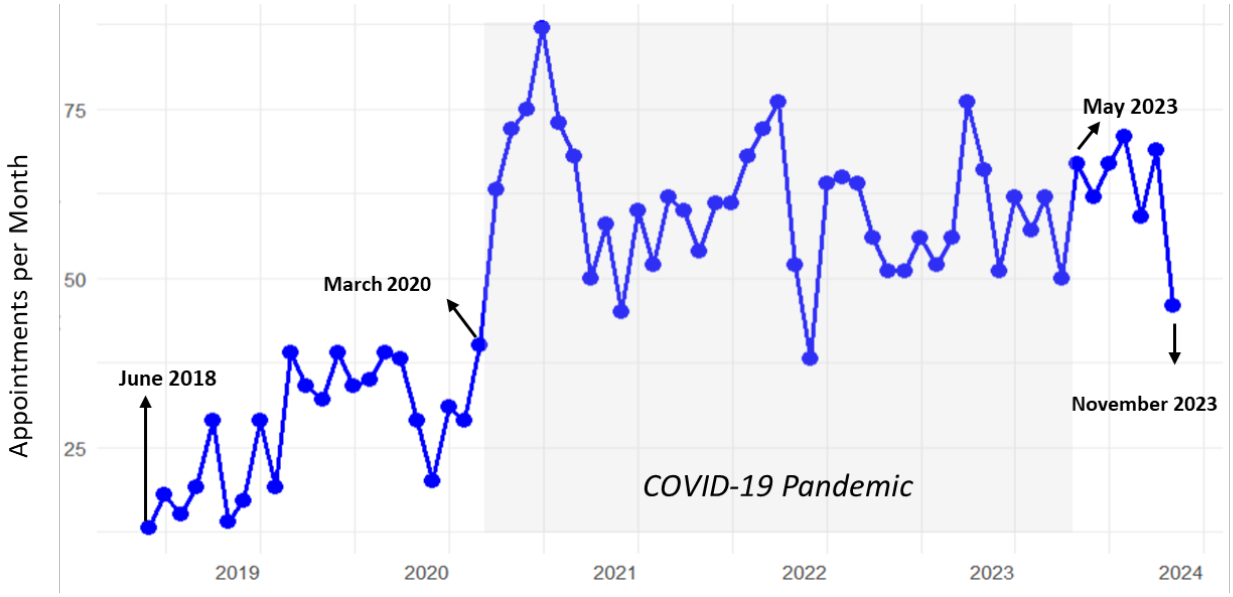

Figure 8 Monthly Frequency of Appointments with the Winnipeg Breastfeeding Centre (2018-2023)

4.10 Referring Healthcare Provider

Most referrals to WBC were by medical doctors (n=5402/6778, 79.7%), while only 0.1% (n=10/6778) of the patients are referred by midwives, and 1.1% (n=75/6778) by nurse practitioners. It should be highlighted that 19.0% (n=1291/6778) of the values for the referring healthcare providers were missing (**Table 16**, **Figure 9**).

Table 16. Healthcare Providers Referring Breastfeeding Dyads to the Winnipeg Breastfeeding Centre (N=6778)

Provider-Type	n	%
Physician	5402	79.7
Missing values	1291	19.0
Nurse practitioner	75	1.1
Midwife	10	0.1

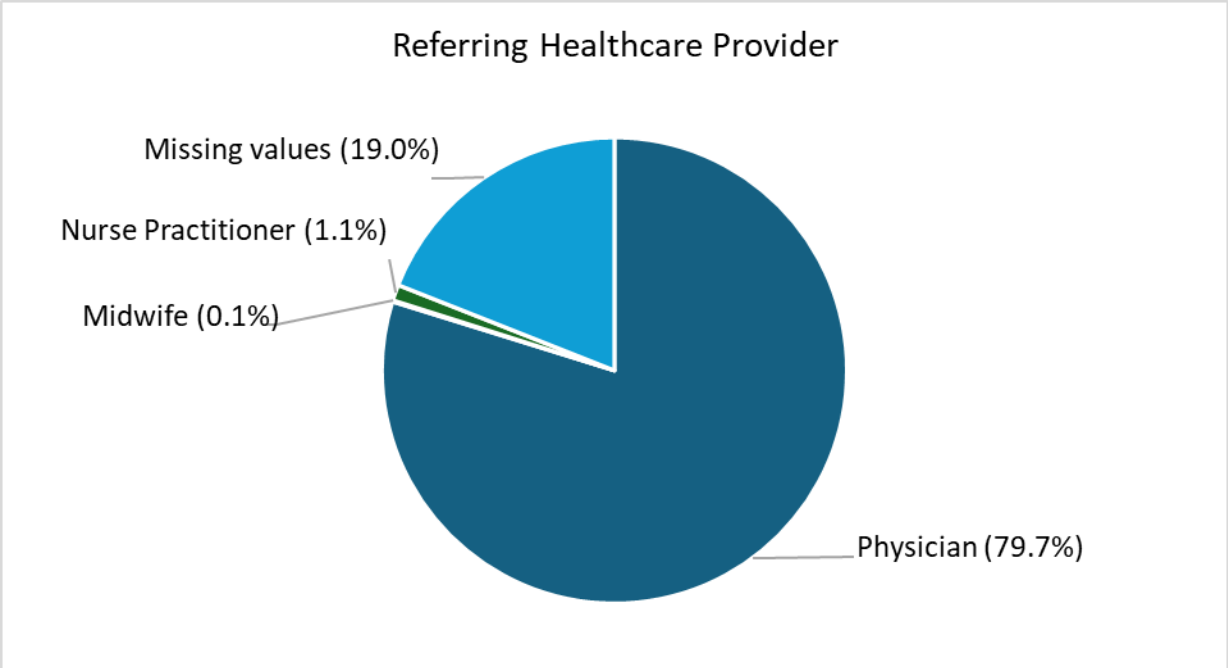

Figure 9 Prevalence of Healthcare Providers Referring Breastfeeding Dyads to the Winnipeg Breastfeeding Centre (N=6778)

4.11 Antenatal Preparation for Breastfeeding

The intake questionnaire included items to capture data on breastfeeding preparation (seeking breastfeeding education) among parents during the antenatal period (from conception to delivery). Of the parents surveyed, 28.9% (n=935/3230) did not prepare for breastfeeding before delivery. Almost one third of the parents (n=1137/3230, 35.2%) reported seeking breastfeeding education through "online reading" followed by 26.8% (n=865/3230) who relied on friends' experiences. Only 9.1% (n=293/3230)

registered for in-person classes, but 83.6% (n=245/293) of those who attended found the classes helpful (**Table 17**).

Table 17. Antenatal Breastfeeding Preparation Reported by the Patients at the Winnipeg Breastfeeding Centre (N=3230)

Breastfeeding Preparation	n	%
Online resources	1137	35.2
Friend's breastfeeding experience	865	26.8
In-person class	293	9.1
Breastfeeding class (reported as helpful) (N=293)	245	83.6
None of the above	935	28.9

From the intake questionnaire. See the appendix for complete details of this questionnaire.

4.12 Breastfeeding Resources and Support in the Postpartum Period

Successful breastfeeding following delivery requires both parental intention to initiate breastfeeding and adequate support. Such support may be provided by hospital staff, including nurses and midwives, family members or derived from external factors, such as societal attitudes toward breastfeeding or considerations related to returning to work. Furthermore, during the postpartum period, parental living conditions, including the sleeping arrangements of the breastfeeding dyad changes. This section discusses these factors that the WBC parents reported.

Feeding Practices and Attitudes - Hospital Practices

73.6% (n=2377/3230) of the parent-child dyads received skin-to-skin contact and neonate-to-breast latch in the first hour after birth, and 71.0% (n=2294/3230) received breastfeeding help at the hospital in their postpartum period. 39.9% (n=1289/3230) of the dyads received supplementation advice at the hospital (**Table 18**).

Feeding Practices and Attitudes - Outside Hospital Practices

More than half of the patients (n=1853/3230, 57.4%) reported "ok with using formula only if needed". However, 20.2% (n=651/3230) indicated that they do not want to use formula. In most of the patients (n=2333/3230, 72.2%), parents reported that they had already introduced a pacifier, though 14.8% (n=477/3230) were unsure if they should (**Table 18**).

Nearly all (95.6%, n=3089/3230) of the patients reported owning a pump or planning to get one. Almost one quarter of the patients (n=999/3230, 30.9%) reported breastfeeding at the breast, along with supplementing with expressed milk and or formula. A lower percentage (n=693/3230, 21.5%) reported breastfeeding at breast and supplementing with pumped or expressed breast milk. About one-quarter of the parents (n=854/3230, 26.4%) reported exclusive breastfeeding at the breast, with the remainder feeding mostly formula in a bottle (n=244/3230, 7.6%), pumping breastmilk in a bottle because of latching difficulties (295/3230, 9.1%) or other types of feeding. (**Table 18**).

Support Conditions for the Lactating Parents During Postpartum Period

In the postpartum period, 23.2% (n=750/3230) of parents reported experiencing excessive guilt or sadness. A large majority, 87.0% (n=2810/3230) received support from extended family in their decision to breastfeed. 94.3% (n=2908/3230) indicated their life partner supported breastfeeding. Additionally, 95.5% of parents reported that their husband/wife or common-law partner was the primary support person living with them. Regarding returning to work, 73.0% of parents reported planning to return to their pre-pregnancy job one year or later after giving birth. A small percentage (n=68/3230, 2.1%) reported planning not to take time off after delivery (**Table 18**).

Infant Postpartum Conditions and Weight Follow-up

According to a National Guideline Alliance (UK), clinical assessment is required if the infant weight loss in postpartum exceeds 10.0%.[244] Given this threshold, only 6.9% of the infants in the WBC had a weight loss exceeding 10.0% (**Table 18**). Most infants (n=2281/3230, 70.6%) slept in the same room with their parents but on a different surface.

Table 18. Feeding Practices and Psychophysical Health in Postpartum Period Among Patients at the Winnipeg Breastfeeding Centre

Postpartum-Associated Practices	**n**	**%**
Commercial formula supplementation advised at hospital (N=3230)	1289	39.9
In-hospital breastfeeding support (N=3230)	2294	71.0
Performed parent-child skin-to-skin and latch in the first hour after birth (N=3230)	2377	73.6
Previous breastfeeding experience (N=3230)	1018	31.5
Previous breastfeeding difficulty (N=1018)	616	60.5
Gestational breast changes (N=3230)	1497	46.3
Feeling about formula (N=3230)		
Ok with using only if needed	1853	57.4
No issues with using it	726	22.5
Do not want to use it	651	20.2
Pacifier Use (N=3230)		
I have already introduced a pacifier	2333	72.2
Not sure if I should or not	477	14.8
I have not introduced a pacifier	420	13.0
Feeding status (N=3230)		
Exclusively at the breast	854	26.4
At the breast and supplements of pumped/expressed breast milk	693	21.5
Pumped breastmilk in a bottle, infant is not latching to the breast	295	9.1
At the breast and supplements of expressed milk and/or formula	999	30.9
Mostly formula in a bottle	244	7.6
Other	145	4.5
Breast pump - ownership or plans of ownership	3089	95.6
Infant sleep location (N=3230)		
Same room as parent(s), separate sleep surface	2281	70.6
Same room as parent(s), same sleep surface	596	18.5
Different room from parent(s)	301	9.3
Other	52	1.6
Infant weight loss in the first few days of life (N=3226)		
less than 8%	2052	63.6
8-10%	952	29.5
10% or more	222	6.9
Support from extended family (N=3230)	2810	87.0
Life partner support (N=3085)		
Yes	2908	94.3
No	19	0.6
Indifferent	158	5.1
Support person living with the parent (N=3230)		
Husband or common law	3067	95.0

No support	61	1.9
Wife or common law	18	0.5
Other	84	2.6
Parental leave plan (N=3230)		
One year or longer	2358	73.0
Less than one year	576	17.8
Not planning to work outside the home	228	7.1
Not taking time off	68	2.1

Data are from the WBC intake questionnaire. See the appendix for complete details of this questionnaire.

4.13 Comparison of the Demographic and Medical Profile of WBC Parents with Population-Level Data

One of the research aims of this project is to compare the demographic characteristics, risk factors, and comorbidities among the WBC population with those of the general population of breastfeeding/pregnant parents in Manitoba or Canada. Through this comparison, I aim to identify factors that may serve as risk factors specific to the WBC population.

Maternal Profile and Delivery Characteristics in the WBC Population

The WBC patient population includes a relatively high proportion of primiparous parents, with 57.9% (n=1870/3230) being primiparous, which is higher compared to the general population of new parents in Manitoba (37.2% to 39.5%) and Winnipeg (41.8%) (**Table 19**).[245]

Overall, The WBC clinic population is older than the general population of new mothers in Manitoba. WBC patients ranged from 16 to 50 years, with a median age of 35, with 37.4% falling between the ages of 35–39. In comparison, only 16.9% of new mothers in the general Manitoban population were 35-39 years old (**Table 19**).

In the WBC clinic dataset, 28.2% (n=910/3230) of patients self-reported their child being delivered by caesarean section, closely aligning with national rates of 27.9% (Public Health Agency of Canada, 2015/2016) and 33.9% (Canadian Institute for Health Information, 2022).[152,246] The gestational age distribution at birth among the WBC population closely aligns with national-level data. For instance, the percentage of births occurring at less than 37 weeks of gestation was 9.1% (n=296/3,230) in the WBC cohort, slightly higher than the 8.1% reported for the Canadian population.[247] Given the slight differences between the WBC population with the Canadian data, it seems that the WBC serves a population with a higher prevalence of preterm birth (less than 37 weeks).

Comorbidities Among Parents

6.5% (n=210/3215) of WBC parents reported being diagnosed with high blood pressure as a pre-existing medical condition, while 10.0% (n=321/3217) experienced high blood pressure as a delivery complication. In comparison, according to the national Discharge Abstract Database, pre-exiting hypertension among pregnant individuals increased from 0.46% to 0.51% from 2004/05 to 2010/11.[248] According to the same report, within Manitoba, 5.4% of pregnant parents had gestational hypertension (without proteinuria). These comparisons demonstrate that the WBC population shows a higher prevalence of pre-existing hypertension compared to the national and provincial-level data statistics for this medical condition.

Anemia was reported by 7.1% (n=228/3215) of the WBC patient population. While specific data on the prevalence of anemia in Manitoba, Winnipeg, or Canada are unavailable, globally 29.9% of women of reproductive age were diagnosed with anemia in 2019 (**Table 19**).[249] This suggests that anemia may be less prevalent among the WBC patient population than the broader global prenatal population.

Among the WBC patient population, 20.1% (n=645/3215) were diagnosed with depression or anxiety. In comparison, according to the data from 2006-2007 by Public Health Agency of Canada, 15.5% of parents experiences depressive symptoms during pre-pregnancy period and 7.5% during their postpartum period (**Table 19**) suggesting that the WBC patient population seems to comprise a higher percentage of parents with depression.

In the WBC population, 4.0% of the parents had gestational diabetes. According to a snapshot of diabetes prevalence provided by the Public Health Agency of Canada (2023), the prevalence of gestational diabetes was 10.0% within Canada.[250] This comparison indicates that gestational diabetes is not a common comorbidity within the WBC population, as their prevalence is lower than the national average. According to World Health Organization, 8-10% of reproductive-age women have polycystic ovarian syndrome which is higher than the percentage among the WBC population (n=219/3215, 6.8%).[136]

Among delivery-related factors, 9.6% (n=309/3,230) of infants in the WBC population were admitted to the NICU following birth, compared to 5.6% in 2001/02 and 1.7% in 2008/09 for Manitoba newborns overall, as reported in the Perinatal Services and Outcomes Report by the Manitoba Centre for Health Policy. Similarly, the prevalence of epidural administration was 60.0% (n=1931/3221) in the WBC patients, compared to 38.8% in Manitoba during 2007/08–2008/09, according to the same report. These

findings suggest that both NICU admissions and epidural use are more common among the WBC population than in the general Manitoba birthing population.[245]

Jaundice, a neonatal condition, was reported in 38.9% (n=1257/3230) of the WBC population. In comparison, the incidence of severe neonatal hyperbilirubinemia in Canada, as documented by the Canadian Paediatric Surveillance Program, was less than 0.1% (1 in 2480 births). The higher prevalence in the WBC population may be attributed to differences in reporting criteria, as the surveillance program focused exclusively on severe hyperbilirubinemia, while the WBC data included all cases of jaundice. Supporting this distinction, only 20.7% of those with jaundice in the WBC population underwent jaundice light therapy, suggesting that most cases were less severe.[251] Assuming that only the proportion of infants in the WBC population who received light therapy (~8.0%) represents cases of severe jaundice, the prevalence of severe jaundice in the WBC population is much higher than the national prevalence reported for the Canadian population. This suggests that the WBC serves a population with a higher proportion of infants experiencing severe jaundice.

Table 19. Comparison of the Demographic Characteristics, Medical Conditions, and Delivery-Associated Practices of the Breastfeeding Dyads at the Winnipeg Breastfeeding Centre with Population-Level Data

Comorbidities/Demographics	**WBC Population (2018-2023)**	**Manitoba/Canada Population or Global Level Population**	**Corresponding Report Year**
Caesarean section delivery	28.2% (n=910/3230)	Canada: 27.9% Canada: 33.9%	*Year: 2015/16[10]* *Year: 2022 [11]*
Maternal age (years)	25-29 years: 10.5% (n=375/3574) 30-34 years: 34.3% (n=1227/3574) 35-39 years: 37.4% (n=1337/3574) 40-50 years: 15.6% (n=559/3574)	Manitoba: 25-29 years: 28.6% 30-34 years: 32.3% 35-39 years: 16.9% 40-50 years: 3.8%	*Year: 2020/2021[1]*

Primiparity	57.9% (n=1870/3230)	Manitoba: 37.2% to 39.5%. Winnipeg: 41.8%.	*Year: 2001/02-2006/07 [2]* *Year: 2007/08–2008/09 [2]*
High blood pressure	As a pre-existing condition: 6.5% (n=210/3215) As a delivery complication: 10.0% (n=321/3217)	Canada: ~ 0.5% Manitoba: 5.4% - gestational hypertension without proteinuria.	*Year: 2004/05 – 2010/11 [4]*
Thyroid disorder	8.8% (n=283/3215)	US: 15.5% of pregnant parents (gestational hypothyroidism) US: 17.0% of women of 15-44 years old (Iodine deficiency)	*Year: 2005-2008 [12]* *Year: 2001-2006 [12]*
Anemia	7.1% (n=228/3215)	Globally: 29.9% - reproductive age women	*Year: 2019[3]*
Depression/anxiety	20.1% (n=645/3215)	Canada: Depressive symptoms Pre-pregnancy: 15.5% Post-partum: 7.5%	*Year: 2006-2007 [9]*
Polycystic Ovarian Syndrome (PCOs)	6.8% (n=219/3215)	Canada: 8.0-10.0% - reproductive-age women	Not available (embedded within the key facts) *[6]*
Diabetes	Gestational diabetes: 4.0% (n=121/3215)	Canada: Gestational diabetes: 10.0%	*Year: 2022 [5]*

NICU admission	9.6% (n=309/3230)	Manitoba: 5.6 - 1.7%[1]	*Year: 2001/02 – 2008/09 [1]*
Epidural	60.0% (n=1931/3221)	Manitoba: 38.8%	*Year: 2007/08 – 2008/09 [1]*
Gestational age	Less than 37 weeks: 9.1% (n=296/3230)	Canada: Less than 37 weeks - 8.1%	*Year: 2018 – 2023 [7]*
	37-41 weeks: 80.0% (n=2584/3230)	Canada: 37-41 weeks - 91.5%	
	41 weeks or above: 10.8% (n=350/3230)	Canada: 42 weeks or more – 0.3%	
Jaundice	38.9% (n=1257/3230) (8.0% = severe jaundice)	Canada: 1 in 2480 live births ~ 0.04%[2]	*Year: 2002 – 2004 [8]*

[1] Annual Statistics, 2020-2021, Manitoba Health, Provincial Information Management and Analytics.
[2] Maureen Heaman, Dawn Kingston, Michael E. Helewa, Marni Brownell, Shelley Derksen, Bogdan Bogdanovic, Kari-Lynne McGowan, and Angela Bailly, Perinatal Services and Outcomes in Manitoba, Manitoba Centre for Health Policy, Department of Community Health Sciences, Faculty of Medicine, University of Manitoba, November 2012.
[3] World Health Organization. (n.d.). Anemia in women and children. (who.int).
[4] Public Health Agency of Canada, Fact sheet, Maternal hypertension in Canada. 2014-10-09.
[5] Public Health Agency of Canada. Snapshot of diabetes in Canada, 2023 (Canada.ca).
[6] World Health Organization. Key facts, Polycystic Ovary Syndrome, 28 June 2023 (who.int).
[7] Statistics Canada. Vital statistics (birth Database).
[8] Sgro, M., Campbell, D., & Shah, V. (2006). Incidence and causes of severe neonatal hyperbilirubinemia in Canada, Canadian Medical Association Journal, 175(6), 587–590. **https://doi.org/10.1503/cmaj.060328.**
[9] Public Health Agency of Canada, Pregnancy and Women's mental health in Canada, 2014.
[10] Public Health Agency of Canada, Care during labour and birth, 2018.
[11] Canadian Institute for Health Information, Perinatal Health Indicators, 2024.
[12] Endocrine Facts and Figures, Endocrine Society (2015)

1. This represents the admission within the first 28 days following birth.
2. This study focused on severe hyperbilirubinemia

Chapter 5: Discussion

5.1 Summary of Findings

In this study, I analyzed three data sources embedded within the WBC electronic medical records, including an intake questionnaire (n=3230), referral tracking dataset (n=6778), and visit notes (n=79). The mean maternal and infant age among the WBC breastfeeding dyad were 34.8 ± 4.7 years and 8.7 ± 11.4 weeks, respectively. The mean number of parities was 1.6 ± 1.0. Almost 99.0% of the WBC population were referred from within Manitoba, with the highest proportions from River East, Saint Boniface, and Fort Garry within the Winnipeg Regional Health Authority. Almost 80.0% were referred by medical physicians and less than 2.0% by registered nurses and midwives.

The most common self-reported breastfeeding difficulties among the WBC population were milk supply issues, nipple pain, and concerns about tongue tie, which aligned with the most common WBC physician diagnoses, including infant feeding mechanic challenges (e.g. tongue tie, palate issues), nipple issues (e.g. fissure, inverted nipple), and supply issues.

Treatments within the WBC were primarily based on discussion and education with the parents. Most common discussions included topics such as how to achieve an appropriate latch, guidance on infant feeding, and infant care (e.g. coping with infant fuss). In addition, more than half of the parents received supportive psychotherapy focusing on emotional management (e.g. adjustment reaction), emotional status (e.g. self-compassion), parenting (managing both toddlers and breastfeeding infants), or when to seek professional mental health support.

When comparing the common WBC breastfeeding dyad's comorbidities with the available population-level data, the clinic population demonstrates a higher prevalence of NICU admission, neonatal jaundice, preterm birth (less than 37 weeks), maternal high blood pressure (either as a pre-existing medical condition or a delivery complication), depression, and epidural administration during delivery. These findings may suggest that breastfeeding parents with these conditions might experience greater breastfeeding difficulties than the general population of breastfeeding/pregnant parents.

Prior to analyzing the WBC data, I hypothesized that the majority of the WBC population would be primiparous and of high socioeconomic status. The findings of my study are consistent with this

hypothesis. However, it is important to recognize that, although most parents were referred from locations associated with high socioeconomic status, their residence in these areas does not necessarily indicate that they themselves possess high socioeconomic status. Additionally, I hypothesized that the prevalence of caesarean section among WBC population would be higher compared to the general population of pregnant/breastfeeding parents. This hypothesis was not supported, as the study results revealed that most WBC parents delivered through vaginal delivery (65.7%).

I also hypothesized that conditions such as polycystic ovarian syndrome, diabetes, high blood pressure, thyroid disorder, anemia, and depression or anxiety would be more prevalent among the WBC population compared to the general population of pregnant/breastfeeding parents. However, my results did not fully support this hypothesis when comparing population-level data with WBC data except for depression and high blood pressure where WBC population had a higher prevalence of these conditions.

My final hypothesis proposed that the number of appointments to the WBC decreased following the onset of the COVID-19 pandemic in March 2020 compared to the pre-pandemic period in Canada. However, this hypothesis was not supported by the results, which indicated that the frequency of appointments increased by 110.3% during the pandemic (March 2020 – May 2023) compared to the pre-pandemic period (June 2018 – February 2020).

5.2 Comparison with the Literature

Demographic Characteristics

Over half (57.9%) of the WBC parents were primiparous, which is higher than the Manitoba's population (37.2-39.5%).[252] The WBC predominantly serves an older parent population, with the most common parent age group being 35–39. In comparison, Manitoba's maternal population is younger, with the largest age group being 30–34 years. The high prevalence of both primiparity and older age among WBC breastfeeding dyads aligns with existing literature showing lower breastfeeding rates, including exclusive breastfeeding among first-time parents aged 35 and older.[253]

Geographic Locations and Socioeconomic Status

In examining the WBC patient population's geographic referral origins, unsurprisingly almost all the individuals accessing this clinic services were referred from within Manitoba. Among the five Regional Health Authorities in Manitoba, most patients resided in Winnipeg, Southern Health-Santé Sud, and Interlake-Eastern health regions, all of which have high area-level socioeconomic status. Fort Garry,

River East, and Saint Boniface in Winnipeg; were the locations with the most common referrals. The top three most common community areas in Winnipeg - Fort Garry, Saint Boniface, and River East - have better socioeconomic status and account for nearly one-third of appointments. In contrast, Point Douglas and Downtown, which have poorer socioeconomic conditions, make up less than one-tenth of referrals. The smallest proportion of in-province clients resided in the Northern Health region (with low area-level socioeconomic status). This likely reflects the limited access this population has to the WBC.

Previous studies have also reflected on the low access to healthcare services in rural areas within Canada, particularly northern regions. For example, data from the 2000–2001 Canadian Community Health Survey indicate that 12.5% of respondents reported experiencing unmet healthcare needs in the 12 months preceding the survey. This percentage was significantly higher among the northern region residents (15.0%).[254] Distance and transportation from Northern regions to Winnipeg create challenges in accessing healthcare services.[255] For example, the nearest location to Winnipeg within Northern Manitoba is Grand Rapids, located approximately 400 kilometres away.

In addition to parents' socioeconomic status, which influences access to breastfeeding support and practices, other social determinants also affect breastfeeding success. Hector et al. developed a conceptual framework outlining factors influencing breastfeeding.[25] According to this framework, breastfeeding practices are shaped by factors at three levels: individual (e.g., parent and infant), group (e.g., family, workplace, and social environment), and society (e.g., cultural beliefs and norms regarding breastfeeding). In this regard, access to WBC, such as transportation and long distance, costs of transportation, weather conditions (especially in winter) or limited access to the internet for virtual appointments, might play a role in access to this clinic, particularly by the population residing in northern regions. In addition, not having supportive family members or friends or referring healthcare providers' unawareness about the existing breastfeeding support services might be other barriers to accessing breastfeeding support, which have both been cited by a previous study.[256]

Environmental Exposure in Parents (Tobacco, Alcohol, and Recreational Drugs)

In the clinic population, 1.7% identified as smokers (either everyday smokers, occasional smokers, or smokers), while 23.3% identified as current drinkers. A substantial proportion of individuals (almost 1 in 3 patients) chose not to answer questions about smoking and drinking status. I speculate that the high percentage of non-response for these variables may be due to two factors: 1) the stigma associated with disclosing such behaviors, and 2) the inclusion of an option "skip this question if it does not apply to

you," within the questionnaire, which may have led individuals who do not smoke or drink to skip these questions. Unfortunately, simultaneously including response options such as "never smoker" or "never drinker" alongside this note created ambiguity, which complicates the interpretation of these variables. Revisions to the structure of these variables within the questionnaire have been suggested in the recommendations section of this thesis. Only 0.8% of the clinic population reported recreational drug use, which was limited to "over-the-counter cold medications" and "other" option.

Data on these behaviours during the breastfeeding period among Manitoba parents remains limited. However, the Canadian Community Health Survey provides information on cannabis and alcohol consumption during pregnancy.[257] The data indicates that 18.0% of parents aged 25–44 reported consuming alcohol during pregnancy, 5.0% reported using cannabis during pregnancy, and 6.0% reported using cannabis while breastfeeding. Notably, none of these behaviors were observed among parents aged 15–24 in the study. When comparing these statistics, it becomes evident that the WBC population has a lower prevalence of current drinkers. However, since cannabis use was not documented in the WBC data, a comparison with population-level data is not possible. This underscores the importance of collecting data on cannabis use, which is addressed in the recommendations section of this thesis.
It is important to note that parental behaviours, including drinking habits, often shift between pregnancy and the postpartum period, making direct comparisons of these percentages inappropriate.

Delivery Complications

Delivery complications are associated with shorter breastfeeding duration, likely due to associated pain, and as the number of these complications increases, breastfeeding duration further decreases.[258] Most WBC parents reported no delivery complications (44.5%). This percentage aligns with a study involving 284 parents who stopped breastfeeding within the first 6 months of postpartum, where 47.8% had no complications during delivery.[258]

Manual placental removal (28.0%), high blood pressure (10.0%), and postpartum hemorrhage (9.1%) were the most prevalent delivery complications among WBC patients. Similarly, postpartum hemorrhage has been previously cited among the most common delivery complications[258] and according to Perinatal Services and Outcomes in Manitoba, it is the leading maternal morbidity in the Manitoban population.[252] Manual placental removal, often performed to remove retained placental fragments, is essential as retained fragments can disrupt lactogenesis and are a clinical cause of postpartum hemorrhage.[196,259] Thus,

the high prevalence of both manual placental removal and postpartum hemorrhage as reported delivery complications among WBC parents is clinically coherent.

While this study did not include formal regression analysis, the link between retained placental fragments and disruptions in lactogenesis may explain why low milk supply is the most frequently reported breastfeeding issue among WBC population. In addition, the low percentage of shoulder dystocia as a delivery complication (2.7%) within the WBC patient population can be explained by the low prevalence of Diabetes (5.0%) among the population, a known risk factor for shoulder dystocia.[260] Similarly, the low prevalence of HELLP (Hemolysis, Elevated Liver Enzymes, and Low Platelet Count) syndrome (0.5%) is clinically reasonable, as this condition typically occurs in response to severe preeclampsia.[261]

Mode of Delivery and Delivery Interventions

More than half (65.7%) of parents reported vaginal delivery, followed by 28.2% who reported caesarean delivery and 6.2% who had assisted vaginal delivery. The percentage of caesarean sections among the WBC population almost aligns with the 2022 Canadian Institute for Health Information's Discharge Abstract data with 33.9% of deliveries being caesarean section[152] and the percentage reported by the Public Health Agency of Canada for 2015/16 (27.9%).[246] A prospective study of 7825 mother-infant dyads, followed for nine months, found that caesarean and assisted deliveries were risk factors for shorter breastfeeding duration.[262] 11.1% of the WBC population had an emergency caesarean section delivery. A study of breastfeeding parents (N=3026) found that induced vaginal delivery and emergency caesarean section were associated with a reduced likelihood of breastfeeding for six months. Spontaneous vaginal delivery showed the longest average breastfeeding duration (45.2 weeks), while emergency caesarean section had the shortest (21.5 weeks), with planned caesarean and induced vaginal deliveries falling in between.[263]

In contrast to delivery complications, where most patients reported no complication, the majority of the WBC reported receiving at least one delivery intervention. This highlights the high prevalence of intervention during delivery. The most common reported delivery interventions were intravenous fluid administration (61.5%), Epidural (60.0%), and Fentanyl (34.5%). Most parents underwent 2 delivery interventions (30.0%). The Perinatal Services and Outcomes in Manitoba Report (2012) indicates that the proportion of women who underwent vaginal delivery and received epidural anesthesia was 38.8% (2007/08 - 2008/09).[252] The high percentage (60.0%) of epidural use among the WBC population can be explained by the high percentage of vaginal delivery in the WBC population (65.7%). However, it is

important to take into account that Epidural anesthesia can be applied to both caesarean section delivery and vaginal delivery. Therefore, a potential avenue for future research involving WBC data could include linking each mode of delivery with the specific type of neuraxial anesthesia administered and, consequently, the breastfeeding difficulties. Another potential explanation for the higher percentage of epidural use among the WBC population compared to population-level data, as discussed with WBC physicians, could be the higher proportion of patients from Winnipeg because this urban center likely offers greater access to epidural services compared to rural areas.

Interestingly, antibiotic administration was the least prevalent, despite its common prophylactic role in preventing infections such as post-cesarean[264] and perineal wound infections in operative vaginal deliveries.[265] This low prevalence may be due to antibiotics often being administered with other intravenous fluids rather than separately or possibly due to patients' lack of awareness regarding specific drugs administered during delivery. Intravenous fluid administration in the intrapartum period is associated with breast edema and, consequently, breast pain in the postpartum period.[175] There are conflicting findings regarding the association between Epidural administration during delivery and breastfeeding success, with positive, negative, and no associations.[187]

17.6% of the parents selected "none of the above" option in the questionnaire for delivery interventions variable. However, it is important to understand that this does not necessarily indicate the absence of any interventions. There could be other interventions in the delivery e.g. artificial rupture of the membrane (amniotomy) that were applied for the parent but were not included in the questionnaire option. Therefore, to comprehensively capture all existing complications and interventions, including an "other," option allows parents to specify additional relevant details.

Medical and Breastfeeding History

59.4% of the population reported no current medication use and a similar proportion (57.9%) reported no diagnosed medical conditions. Even though these percentages appear almost similar, they can not be compared or interpreted directly as not everyone with a medical condition may take medication, and conversely, not everyone taking medication may have a medical condition.

17.8% of the parents reported a history of infertility. This relatively high prevalence of infertility could be explained by the mean age (34.8 ± 4.7 years) of WBC patient population. According to the Perinatal Services and Outcomes in Manitoba Report (2012), there is an association between the number of parents that give birth after 30 years old and the use of infertility drugs.[252]

Depression or anxiety (20.1%), Thyroid disorder (8.8%), and Anemia (7.1%) were the most common diagnosed medical conditions. The inclusion of diverse counselling and supportive psychotherapy measures within the patient-physician appointments is warranted, given the high prevalence of depression and anxiety among the WBC patient population.

Anemia is another medical condition documented in the WBC intake questionnaire among parents. When comparing the prevalence of anemia in the WBC population to global population-level data, 7.1% of the WBC parents reported having anemia. The relatively low prevalence of anemia in the WBC population may be attributed to their greater access to healthcare and nutrition, given that most of them resided in areas with higher socioeconomic status. Most of the existing literature studies the impacts of breastfeeding on infant iron[266,267] rather than maternal iron status. Further investigation is needed to determine the prevalence of anemia among the Manitoba population and its impacts on infant feeding practices.

Previous Breastfeeding Experience

Only 31.5% of patients had prior breastfeeding experience; among those, 60.5% reported previous breastfeeding difficulties. This finding aligns with existing literature, which suggests that negative past breastfeeding experiences are often associated with challenges in future breastfeeding practices.[165] Future research should aim to determine whether previous breastfeeding challenges and related diagnoses are predictive of similar challenges with subsequent children, or if entirely different issues may emerge.

Medical Conditions in Parents

In this study, the prevalence of diagnosed high blood pressure (6.5%) was slightly higher than that observed in the general population (0.5%). The prevalence of high blood pressure as a delivery complication (10.0%) was also higher than gestational hypertension (5.4%) among Manitoba population. Depression and anxiety were reported in 20.1% of WBC parents, which is also higher than the Canadian Maternity Experience Survey, where prevalence of depressive symptoms was 7.5% and 15.5% during postpartum period and pre-pregnancy period respectively.[268] Gestational diabetes prevalence among WBC patients (4.0%) was almost half of that observed among the national level data (10.0%). These findings contradict my hypotheses, which anticipated higher prevalence rates of these conditions among the WBC population except for the depression and high blood pressure where it is more common among the WBC population compared to the Canada's population of parents.

As previously discussed, most WBC patient population are from neighbourhoods with higher socioeconomic status. It is plausible that this higher socioeconomic status contributes to a lower prevalence of chronic and gestational conditions. This assumption aligns with existing literature suggesting that individuals with higher socioeconomic status are less likely to develop pre-gestational diabetes and hypertension.[269] Additionally, since most of the WBC population resides in non-northern regions, they likely had greater access to prenatal care, including more frequent and consistent visits during pregnancy. Such access may have facilitated better management and control of gestational conditions, including hypertension and gestational diabetes.

Breastfeeding Difficulties and WBC Diagnoses

The International Classification of Disease (ICD) provides diagnostic codes for breastfeeding difficulties such as hypogalactia (092.4), suppressed lactation (092.5), and galactorrhea (092.6). While these codes address specific breastfeeding issues, almost all other codes primarily focus on broader infant feeding difficulties. This has been discussed by the WBC physicians as well. For instance, neonatal difficulty in feeding at breast (P92.5), feeding problem of newborns (P92), slow feeding of infants (P92.2), feeding difficulties (R63.3), and unspecified disorders of lactation (092.70), only represent general information on infant feeding.[270] Additional codes for infant feeding problems exist, but they mostly focus on these issues from a broader perspective. The lack of sufficient specific diagnostic codes for breast and breastfeeding issues is also evident in the clinic's data collection. Only 34.2% (n = 3176/9294) of visit notes records included a diagnostic code, while more than half of the records did not include a diagnostic code for the specific problems.

The top three parent-reported breastfeeding difficulties were breast milk supply (54.6%), nipple pain (43.8%), and concerns about tongue tie (29.6%). Previous literature has also cited low milk supply[17,271,272] or a perception of low supply[273] and nipple pain[273] as the most common patient-reported breastfeeding difficulties. Inconvenience/fatigue resulting from breastfeeding has been reported among the common difficulties as well.[16,17] This suggests that including an option of “breastfeeding-associated fatigue” in the WBC intake questionnaire might provide a more comprehensive capture of breastfeeding problems among the clinic population.

An important point worth considering is that the limited citation of tongue tie among common breastfeeding difficulties in the past may stem from its association with breastfeeding pain, as nipple pain can be a downstream effect of tongue tie. Additionally, insufficient training and awareness of tongue-tie

diagnosis among healthcare providers may further contribute to its underreporting and management in clinical practice and research.[274]

Most WBC patients reported either one (35.5%), two (37.0%), or three (20.4%) breastfeeding difficulties as reasons for their appointment with the clinic. Similarly, a previous study on breastfeeding parents (n=532) examining the association between breastfeeding outcomes and patient-reported difficulties found that 92% of the parents indicated more than one breastfeeding difficulty.[272] Due to methodological limitations, we were unable to clarify if WBC clients were able to recognize the same number of breastfeeding problems as the physicians performing the diagnoses and if the physicians identified a comparable number of breastfeeding issues during client visits. Furthermore, studies specifically examining whether parents encounter *multiple* breastfeeding difficulties are relatively limited. Most WBC patient population were assigned with one diagnosis (n=34/79, 43.0%), two (n=27/79, 34.2%), or three (n=10/79, 12.7%) by WBC physicians.

The most prevalent WBC physician diagnoses were infant feeding mechanics challenges (n=28/79, 35.4%), nipple issues (n=24/79, 30.4%), and supply issues (n=24/79, 30.4%). These findings align with a previous study describing a breastfeeding clinic in Quebec where both clients and physicians reported similar diagnoses of nipple pain, low supply, and latching problems.[215]

Although the top three patient-reported difficulties and physician-diagnosed difficulties pertain to similar topics, there is a difference in their respective prevalence, particularly concerning milk supply. Among parents reporting breastfeeding difficulties, 54.6% identified milk supply as a reason for referral, whereas only 30.4% of the randomly selected records from the visit notes dataset documented a diagnosis of a supply issue. This 25-percentage-point discrepancy could be attributed to differences in parents' perceptions of milk supply. Parents may perceive their milk supply as low, even without clinical evidence to support this belief. Perceived low milk supply is clinically important as it can be a reason for breastfeeding cessation. According to a previous review study, about 35.0% of parents indicate perceived low milk supply as a reason for cessation of breastfeeding.[275]

Another commonly reported breastfeeding difficulty was nipple pain and related nipple issues. While 43.8% of parents reported experiencing nipple pain, the prevalence of diagnosed nipple issues was 30.4%. This discrepancy may be attributed to the multifactorial nature of nipple pain. Nipple pain can result from various breastfeeding challenges such as tongue-tie, latch difficulties, or broader breast-related conditions

like mastitis. Still, since this is a readily observable symptom, parents might be more likely to report nipple pain.

An important observation from the WBC data is that 8.9% of records (n=7/79) lacked an identifiable clinical diagnosis, highlighting the need for separate, structured recording of diagnoses within the visit notes.

Treatments Strategies

The primary WBC care approach involves providing parents with discussion-based breastfeeding and educational support for infant behaviour. This is consistent with a systematic review of breastfeeding interventions that identified education and counselling as key methods in addressing breastfeeding challenges.[276] Counselling is also positively associated with any or exclusive breastfeeding within the first five months after delivery.[277] The visit notes unstructured data revealed three main categories of treatment strategies within WBC: education/discussion, supportive psychotherapy, and prescribed medications or supplies.

Education/Discussion (Among 79 Records)

The most common topic of education was infant care (77.2%), where parents received guidance on managing infant fussiness and gas and identifying infant cues. This focus on infant care equips parents to interpret common behaviors, such as crying or fussiness, accurately. These behaviors are often mistaken as signs of low milk supply and can influence feeding decisions and breastfeeding confidence.[83] For example, frequent crying increases the likelihood of introducing complementary food to infants between zero and four months old.[278] In addition, crying has been stated as a common reason for breastfeeding cessation among parents.[83]

The second and third most common education topics were guidance on infant feeding (74.7%) and discussions around latch issues (73.4%). Guidance on infant feeding included education on milk transfer assessment, using heat and compression for milk flow and engorgement, sharing tools and videos, and discussing lactation physiology. Discussions around latch issues included education on how to achieve a deep latch during breastfeeding.

Educational interventions on breastfeeding are crucial. For example, studies show a negative association between poor sucking technique and breastfeeding difficulties, as well as between pacifier use, thumb

sucking, and breastfeeding itself, underscoring the importance of parental education for infant feeding and infant care.[279]

Interestingly, 20.3% of WBC parents received counselling on six educational items, 12.7% on seven items, and 11.4% on eight items. Research indicates that combining multiple educational and supportive interventions is more effective for professional breastfeeding support than single-method approaches.[280] A qualitative study involving nine breastfeeding parents and seven caregivers identified several barriers to breastfeeding, including doubts about managing breastfeeding difficulties (e.g., positioning), conflicting guidance from others, and breastfeeding problems such as nipple trauma, which can create “suffering” amongst parents.[281] These findings underscore the importance of education and counselling. La Leche League[282], the breastfeeding hotline[283], and the resources provided by Healthy Parenting Winnipeg[284] represent key sources of breastfeeding support in Manitoba. The La Leche League in Winnipeg offers free virtual meetings for parents and their support persons, titled "Breastfeeding Essentials Prenatal Class," with scheduled times listed on its website.[282] In addition to these resources, community support programs also provide information on breastfeeding support, although their primary focus is not breastfeeding.[285,286] A list of centers offering these services, both within Winnipeg and in other regions of Manitoba is available on the Manitoba Health Government website. Furthermore, Baby’s Best Chance, a resource developed by Perinatal Services BC, offers guidance on pregnancy and infant care and is accessible through the Manitoba Health Government website.[287]

While these publicly funded breastfeeding support resources are available, common educations within WBC primarily address infant care and parent education. This raises important questions about whether these resources are underutilized due to a lack of awareness, accessibility challenges, or perceptions of practicality among parents. In this context, WBC appears to address a critical gap in breastfeeding support services.

Supportive Psychotherapy (Among 79 Records)

Cognitive Behavioral Therapy (CBT), Interpersonal Psychotherapy (IPT), and supportive psychotherapy are among the common psychotherapeutic interventions for perinatal distress.[288] Supportive psychotherapy mainly focuses on strengthening the ego and competency among individuals.[288] WBC visit notes showed that supportive psychotherapy was the most common psychotherapy intervention used by clinic physicians. This modality has been reported as the most common approach in the postpartum period for parents experiencing postpartum depression.[289] Although supportive psychotherapy focuses on

concepts such as encouragement and engagement, a clear definition of this intervention is absent in the literature.[288] Improvement in major depressive disorders in postpartum women is associated with a higher number of sessions for supportive psychotherapy.[290] Providing multiple sessions for supportive psychotherapy sessions in the WBC is not possible, which is understandable given that this intervention falls outside the clinic's primary scope. In relation to supportive psychotherapy, 31.6% of WBC parents received therapy focused on emotional management, covering topics such as vulnerability, emotional validation, and acknowledgment of postpartum feelings. Another 43% received support centred on emotional well-being, addressing issues like managing anxiety and adjustment reactions (a temporary mental disturbance triggered by overwhelming stress).[291] Additionally, 32.9% were guided on support resources, including the NURSE framework. The NURSE framework (Nourishment, Understanding feelings, Rest, Self-Care, and Energy) provides basic self-care practices that overwhelmed parents often find hard to manage.

Reminding parents of these basics such as self-care, exercise, and spending time outside is especially helpful during the postpartum period when parents adjust to their additional responsibilities and meet their infants' breastfeeding needs. Notably, nearly half of the WBC patients (51.9%) received one or more types of supportive psychotherapy. These percentages appear high compared to the self-reported prevalence of depression or anxiety (20.1%) in the questionnaire. The higher percentage of supportive psychotherapy provided within the clinic may be explained by two reasons: 1) in this clinic, physicians use supportive psychotherapy to address a broader range of issues beyond depression or anxiety, 2) WBC physicians often utilize supportive psychotherapy to counsel parents on adapting to life changes following delivery, such as adjusting to new conditions, 3) additionally, as part of the supportive psychotherapy consultations, guidance on accessing mental health support is frequently included. This suggests that the clinic adopts a proactive approach to implementing supportive psychotherapy.

Even though the visit notes records were selected randomly to represent the WBC population, comparing the prevalence of depression or anxiety from the questionnaire dataset with the prevalence of psychotherapy methods documented in the visit notes may not be appropriate in this context, particularly considering the low number of visit notes samples compared to the questionnaire dataset records.

Prescribed Medications or Supplies (Across All Visit Notes Records)

In examining all prescriptions documented within the WBC visit notes - including medications, medical equipment, and therapy referrals - only 10.5% of dyads (n=865/8244) received a prescription. The most

common prescriptions among these dyads were domperidone (59.1% of prescriptions), topical treatment (16.3% of prescriptions), and breastfeeding supplies (10.6% of prescriptions). These prescriptions align closely with the most common breastfeeding difficulties, namely low milk supply and nipple pain. Although 59.1% of the prescriptions were for domperidone, this equates to only 6.1% (n=511/8244) of all the WBC dyads, according to the visit notes dataset.

The relatively low prescription of domperidone aligns with recent changes in clinical approaches to prescribing this drug for milk supply issues. In 2014, the European Medicines Agency reviewed the safety of domperidone prescriptions and, due to its association with QT interval prolongation, it recommended limiting doses to a maximum of 30 mg per day.[292] The QT interval refers to one of the waves within the electrocardiogram of the heart, representing the resting period for the heart ventricles following a previous activation.[293] The previously mentioned recommendation has influenced domperidone prescription. For instance, a study in Australia examining the prevalence of domperidone prescriptions for parents of very preterm infants found a significant decrease in prescription trends following the new regulations in 2014.[294] Details regarding the side effects of domperidone were documented in the WBC visit notes and discussed during appointments where it was prescribed.

Appointments with the WBC: Growth Overtime and During COVID-19

March 2020 was identified as the starting point of the COVID-19 pandemic as an emergency in Canada for analyzing the frequency of appointments at WBC. Between June 2018 to November 2023, there was an increase in the number of appointments to the WBC. Before the pandemic, from June 2018 to February 2020 the median number of monthly appointments was 29.0. Following the onset of the pandemic in March 2020 until May 2023 (the end of the COVID-19 as a public health emergency), this median rose to 61.0 appointments per month. I speculate two reasons for this increase in the number of appointments to this clinic during COVID-19: increased awareness and virtual access.

Increased Awareness: The WBC was established in 2017 and has been operating as the sole physician-led breastfeeding clinic for approximately seven years. This extended period of service provision may explain why primary healthcare providers have become more aware of this specialized support service for parents over the years, potentially leading to more frequent patient referrals to the clinic.

Virtual Access: The availability of virtual and telephone appointments during the COVID-19 pandemic may have facilitated a higher number of appointments with the WBC by allowing patients to access support despite in-person restrictions. Before the COVID-19 pandemic, all appointments within the WBC

were conducted in person. However, during the pandemic, 40% of appointments transitioned to a virtual or telephone-based format. This shift highlights the impact of incorporating virtual access to healthcare services during that period. According to Statistics Canada, from April 2021 to August 2022, 50.9% of consultations with family doctors or nurse practitioners occurred via phone and 4.8% via video meetings. For specialist consultations, these figures were 31.3% for phone and 2.7% for video meeting.[295] Additionally, discussions with WBC physicians revealed that during the COVID-19 pandemic, telephone and video consultations were introduced to accommodate parents who were unable to attend the clinic in person. However, assessing breastfeeding difficulties remotely posed challenges, as such evaluations often require a thorough physical examination by the physician. This limitation may have contributed to shorter consultation durations and an increased number of appointments.

Even though the number of appointments to WBC increased during the pandemic, this number kept increasing following the end of the pandemic, demonstrating the overall growth of the service provision within this clinic during the past years. For example, the median number of appointments to the clinic after COVID-19 (June 2023 – November 2023) was 64.5, which is still higher than the number of appointments before and during the pandemic.

Discrepancy Between the Number of Referrals (Based on the Referral Tracking Dataset) Versus Appointments (Based on the Intake Questionnaire Dataset)

When comparing the number of records within the referral tracking dataset (n=6778) with the intake questionnaire dataset (n=3230) following the exclusion of the follow-up appointments, the referral tracking notably has a higher number of records. Three possible explanations for this discrepancy are as follows:

- **Non-Attendance Following Referral to WBC:** It is possible that even though the breastfeeding dyads were referred to WBC, they did not attend their scheduled appointments at the clinic.
- **Incomplete Questionnaires:** While parents may have attended their appointments, they might not have completed the intake questionnaire before their visit.
- **Broader Timeframe of the Referral Tracking Dataset:** The referral tracking dataset does not specify a timeframe. It may span a broader timeframe (2017–2024) compared to the intake questionnaire dataset, which covers 2018–2023.

Referring Healthcare Providers

According to the list of physicians provided by the College of Physicians and Surgeons of Manitoba

website, as of November 2024, there are 1447 family physicians within Manitoba.[296] According to the 2023 annual report of the College of Registered Nurses of Manitoba, there were 13890 registered nurses in Manitoba in 2023.[297] According to information obtained from the College of Midwives of Manitoba, as of November 2024, there are currently 53 registered practicing midwives and 30 registered non-practicing midwives in the province. It is interesting that given the higher percentage of registered nurses in Manitoba (13890 in 2023),[298]than physicians (3334 in 2023/2024),[299] physicians made 79.7% of referrals for WBC patients, nurse practitioners made 1.1%, and midwives made only 0.1%. I speculate that expertise in breastfeeding support among midwives and nurses may explain this distribution of referrals across healthcare providers. Nurse practitioners and midwives often possess specialized training and competencies in breastfeeding support and managing breastfeeding complications. This expertise may contribute to the relatively low percentage of referrals from these providers, as they may address breastfeeding issues independently rather than referring patients to the clinic. This speculation can be supported by a national study on the Maternity Experience Survey (MES) in Canada that found receiving prenatal care from family physicians or midwives is associated with higher likelihood of breastfeeding initiation, intention and six-month exclusive breastfeeding.[300] In addition, in discussion with the WBC physicians, I found out that midwives provide consistent visits to new parents for six weeks through home visits, and provide breastfeeding support, which can explain why there are almost 0.0% of referrals to this clinic by midwives. This suggests that midwives address breastfeeding challenges directly during their visits, reducing the need for additional referrals to the clinic. A potential explanation for the low percentage of referrals from nurse practitioners to the WBC could be that nurse practitioners often collaborate with physicians and may not independently refer parents to the WBC.

After removing follow-up appointments, a high portion of the referring healthcare provider data remains missing (19.0%). Two possible explanations for this issue are as follows:

- **Self-Referrals:** Although WBC physicians schedule appointments through referral by other healthcare providers, it is possible that some patients arrange appointments without an official referral. This seems likely, given that “prenatal questions” appear as an option in the intake questionnaire for breastfeeding difficulties, suggesting that some patients may have initiated contact themselves.
- **Documentation or Data Entry Errors:** Due to the fax-based referral system, details about the referring provider may not have been recorded or transferred correctly, resulting in missing information.

High Number of Follow-up Appointments within the Referral Tracking Dataset

The referral tracking dataset initially contained 11887 records, including information on the referring healthcare providers' occupations. After screening and removing 5109 follow-up appointments, the dataset was reduced to 6778 records for analysis, indicating that nearly half of the initial records were follow-up visits. I speculate two reasons for this high number of follow-up appointments to this clinic:

- **Ongoing Nature of Breastfeeding Support:** This high proportion of follow-ups highlights the ongoing nature of breastfeeding support, as breastfeeding challenges are often complex and require sustained intervention. In this regard, a new model of outpatient lactation care has recently been proposed, advocating for routine breastfeeding check-ups similar to well-baby check-ups rather than scheduling visits only when problems arise. This approach highlights the need for lactation support as a continuous and proactive process rather than a single appointment.[301]
- **Assessment of Intervention Outcomes:** As previously discussed, the WBC employs a multifaceted approach to addressing breastfeeding difficulties by applying multiple interventions. A possible explanation for the high number of follow-up appointments could be the need to evaluate the effectiveness of these interventions and to assess whether WBC physicians are achieving the desired outcomes for each breastfeeding dyad.

5.3 A Jurisdictional Scan of Available Breastfeeding Clinics in Canada

In a jurisdictional scan of breastfeeding clinics across Canada, I identified four clinics in Alberta and Ontario that provide specialized support for breastfeeding dyads. I compared their services to those offered by the WBC. Similar to the WBC, all clinics had International Board-Certified Lactation Consultants (IBCLCs) on their teams, highlighting the critical role of IBCLCs in breastfeeding support. The teams at these clinics commonly included family physicians, IBCLCs, and pediatricians, demonstrating the multidisciplinary approach to lactation and breastfeeding care.

Three of the four clinics allowed self-referrals in addition to referrals from healthcare providers, unlike the WBC, which accepts appointments exclusively through referrals. Self-referred patients at these clinics often faced either higher fees or longer wait times. Similar to the WBC, services provided by physicians at these clinics were covered by provincial health insurance, but IBCLC services were not government-funded, emphasizing on the current privately paid lactation support in Canada.

While all clinics use fax-based referral systems, the Ontario Breastfeeding Clinic additionally offers online referrals through digital forms (Google form), enhancing accessibility. Appointment durations across these clinics typically ranged from one to three hours, depending on the nature of the visit (initial consultation or follow-up) and whether the patient cared for singleton or multiple infants. The review also revealed that two clinics offered home visit services, prenatal classes, and lactation consultations (**Table 20**).

Table 20. Comparison of Breastfeeding Support Services Across Other Existing Clinics with the Services at the Winnipeg Breastfeeding Centre

Clinic Name	**Winnipeg Breastfeeding Centre**	**Newman Breastfeeding Clinic**	**Well Fed Clinic**	**The Circle Medical Breastfeeding Clinic**	**Ontario Breastfeeding Clinic**
Clinic URL	www.wpgbreastfeedingcentre.com	www.ibconline.ca	www.wellfedclinic.com	www.circlemedical.ca	www.ontariobreastfeedingclinic.ca
Team	1 pediatric surgeon and pediatric urologist. 5 family physicians, 2 of whom are certified as IBCLC.	6 IBCLC and 2 pediatricians	12 family physicians who are either certified as IBCLC or are in the process of obtaining this certification.	Nurse lactation consultants and family physicians	14 IBCLCs and 2 medical doctors
Referral	Required	Required	Self-referrals accepted (longer wait times (2-3 weeks)	Self-referrals accepted	Self-referrals accepted (additional costs apply)
Format	Fax	Fax	Fax	Fax	Fax

					Online (Google form)
Referring Healthcare Provider Type	Medical doctors Nurses Midwives	Medical doctors Nurses Midwives	Medical doctors Nurses Midwives	Medical doctors Nurses Midwives	Medical doctors Nurses Midwives
Duration of Appointments	Varies depending on the cases (Not available on the website)	Singleton infant: 90 minutes - 1 hour Twin infants: 1-3 hours	First appointment: 1 hour Second appointment: Not available	Not available	1 hour
Services	Lactation consultation	Lactation consultation Prenatal classes (3 hours)	Lactation consultation	Lactation consultation	Lactation consultation and Prenatal classes Home visits
Locations	Winnipeg Manitoba	Toronto Ontario	Calgary Alberta	Calgary Alberta	Ontario, multiple locations (list of locations available on their website)
Wait Times (as of November 2024)	1 – 2 weeks	24 hours – 1 week	Not available	Not available	Not available
Insurance Coverage	Services covered by Manitoba Health	IBCLC services: not covered by	Services covered by Alberta Health Services	Services covered by Alberta Health Services	Services not covered by

	Ontario Health Insurance Plan. Pediatrician services: covered by Ontario Health Insurance Plan.	Ontario Health Insurance Plan

IBCLC: International Board-Certified Lactation Consultants.

5.4 Challenges - Adaptations Associated with Data Provision and Analysis

Winnipeg Breastfeeding Centre Data Were Used for the First Time in This Study: As previously mentioned, this study represents the first instance of analyzing data from the WBC for research purposes. While this is a notable strength of the study, the novelty of using this data for research presented certain challenges, particularly with obtaining de-identified data. The initial datasets provided were not properly de-identified according to the procedures in our ethical approvals. To address this issue, I submitted a major deviation form to the ethics boards and, together with my advisor, held meetings with WBC physicians and the clinic account manager to resolve the matter. Although these challenges delayed the data acquisition process by 2 months, they provided valuable lessons, emphasizing the difference between using data for clinical practices and data usage for research purposes.

In Manitoba, Referrals to Healthcare Providers are Primarily Conducted Through Fax, Resulting in Paper-Based Documentation: Family physicians typically send referral faxes and then upload them into the EMRs in .pdf file format. In the early stages of the project development, some of our research questions and hypotheses required us to have access to the referral forms stored at WBC. After discussions with the WBC data manager, we learned that the WBC used paper-based referral documentation. This presented a significant barrier because the data collected through fax cannot be electronically extracted and stored in a readily analyzable format. This required us to adjust our research questions and hypotheses, particularly those associated with referral diagnoses. The following questions/hypotheses or portions of them were deleted due to this barrier (deleted sections are highlighted in red):

Modified Research Question: What are the most prevalent WBC physicians' diagnoses and ~~referral diagnoses~~?

Modified Research Question: Was there a change in the number of referral ~~diagnoses~~ before and after the COVID-19 pandemic onset in Canada (March 2020)?

~~**Deleted Research Question:** What are the most prevalent incongruent diagnoses of breastfeeding difficulties between referring health care providers and WBC physicians?~~

Modified Research Question: What type of healthcare providers refer lactating parents to the clinic?
~~***Deleted Research Question:*** Does the level of diagnosis agreement with WBC physicians differ between referring healthcare provider types?~~

~~***Deleted Research Question:*** Most referral diagnoses are incongruent with WBC diagnoses, and there will be a particularly high incongruence of tongue tie diagnosis.~~
~~***Deleted Hypothesis:*** Midwives' diagnoses demonstrate the highest concordance with WBC physicians compared to other provider types.~~

5.5 Strengths, Limitations, and Future Directions

5.5.1 Strengths

First Time Using WBC Data and Involvement of WBC Physicians: This study is the first to use data from Manitoba's only clinic dedicated to breastfeeding support, which provides a unique and rich dataset for research. This study was designed in collaboration with WBC physicians. The primary research objectives and aims were developed over repeated consultation with Drs. Kearns and Raimondi.

First-Time Reporting the Breastfeeding Difficulties within the Population of Manitoba: Despite existing data on the most common reasons for breastfeeding cessation on a national level,[16] there are no data on breastfeeding difficulties among the Manitoba population. This is the first study reporting the most common breastfeeding difficulties locally in Manitoba.

Comprehensive Insights: The study offers detailed information on patient demographics, medical factors, breastfeeding challenges, and treatments, creating a well-rounded understanding of the WBC's patient population.

Practical Application: Unlike many studies that remain purely theoretical, this research includes findings that can be directly applied in clinical settings, particularly WBC, to improve patient care and support practices.

Containing Both Patient-Reported Difficulties and Clinical Diagnoses: The majority of existing research solely focuses on either patient-reported difficulties or clinical diagnoses. However, this study included both patient-reported difficulties and physician diagnoses simultaneously.

5.5.2 Limitations

Referral Process Constraints: As discussed above, the fax-based referral process restricted our ability to explore some of our initially planned research questions, particularly those involving information from referring healthcare providers.

Inconsistent Patient IDs Across Datasets: The lack of a consistent ID system across datasets prevented us from linking the clinic's intake questionnaire with the visit notes and the referral tracking datasets. Linking these data sources could enable a broader and more robust scope of analysis. For example, while I could examine whether the percentage of the top three breastfeeding difficulties and diagnoses aligned, integrating all records would facilitate a more comprehensive evaluation of the alignment at the individual level. Additionally, linking datasets opens new avenues for research. For instance, the referral tracking dataset includes the parent's birth year. By connecting it with the questionnaire dataset, it becomes possible to explore whether specific issues, such as breastfeeding challenges or the prevalence of caesarean sections, are more common within certain age groups or populations. Another research direction involves linking first three digits of postal codes within the referral tracking dataset with variables such as medical conditions. This integration could provide insights into access to healthcare and its relationship with medical conditions among parents residing in different regions of Manitoba.

Questionnaire Limitations: Some clinic questionnaire items would likely benefit from revision of question phrasing, response options and how patients are able to respond to each item. For instance, incorporating a note such as "skip this item if it does not apply to you" for questions regarding topics like recreational drug use, while simultaneously providing response options such as "not a smoker" or "never a smoker," created challenges in distinguishing between genuinely non-applicable responses and missing data during analysis. The recommendations section of this thesis addresses this issue by suggesting specific adjustments to the questionnaire design.

Risk of Potential Misclassification During Manual Data Extraction of the Visit Notes Dataset: Breastfeeding difficulties, unlike other medical conditions, lack standardized and specific enough diagnostic codes. I categorized the clinical diagnosis variable in this study by reviewing the physicians' free-text notes. This process required my subjective interpretation of the notes and categorizing certain variables within groups and themes, introducing the potential for misclassification bias[302] during the classification process. Even though a second review of the categorization was not conducted, careful attention was given to ensuring that the themes and variables were categorized consistently throughout the process. This is particularly important to note as, for future research, there could be a standard development of diagnosis variables prior to extracting and grouping the information embedded within the visit notes dataset.

Underrepresentation of Particular Interventions and Diagnoses within the Visit Notes Dataset: As part of the manual data extraction and categorization process (see Methods chapter), I initially created keywords to represent the content of the visit notes and subsequently grouped them together, using a single variable to represent all items within the same group. While this approach streamlined the analysis, it may have led to an underrepresentation of specific keywords or items within the visit notes dataset.

Inability to Differentiate Prescriptions for Parent or Infant: Within the visit notes dataset, data was entered either in the infant section or the parent section of the electronic medical records system. However, since both the parent and infant shared the same ID, it was not possible to determine whether certain prescriptions were associated with the infant or the parent within the dyads. A recommendation to address this limitation has been included in the recommendations section.

Inclusivity Limitations: The pronoun variable in the clinic questionnaire was collected in a free-text format, which limited meaningful analysis for this study. Additionally, many existing Manitoba population reports primarily focus on data from lactating parents who identify as women, limiting inclusive comparisons with our study's results.

5.5.3 Future Research Directions

Following this initial descriptive analysis of WBC data, several directions for future research could be pursued:

Exploring Co-Occurring Patient-Reported Difficulties and Treatment Strategies: Further research could examine which breastfeeding difficulties, interventions, and risk factors commonly occur together among the WBC population.

In-Depth Study of Postpartum Environment and Practices: The intake questionnaire includes variables related to postpartum environment and practices, such as infant sleeping arrangements, family and partner support, and prenatal factors like breastfeeding preparation. Future studies could focus on these variables to explore their associations with different breastfeeding difficulties.

Longitudinal Analysis: In this study, follow-up appointments were excluded, and the research questions were addressed exclusively through initial visits. Given the presence of follow-up visits, future research could adopt a longitudinal design to incorporate both initial and follow-up appointments, enabling a more comprehensive examination of patient outcomes over time.

Further Robust Statistics: An additional future application of the clinic's stored data could involve conducting predictive modelling or regression analysis to identify variables that serve as statistically significant predictors or are associated with specific breastfeeding challenges.

5.6. Recommendations for Data Collection in WBC

Data collection at the WBC was not primarily designed for research purposes. This posed challenges in the deidentification and procurement of the datasets and analysis of clinic data. Before presenting specific recommendations for each dataset, I have outlined three general comments regarding the use of the WBC dataset. These recommendations are intended to support improvements in the WBC intake questionnaire, either to enhance service provision for breastfeeding dyads or to facilitate future research utilizing this data.

Enhancing Data Collection for Visit Notes: Adopting a more structured approach to collecting visit notes could improve the quality and usability of this dataset for future research.

Data Pairing: Pairing the datasets together within the clinic's electronic medical records through unique identifiers facilitates further data analysis across all three datasets.

Capturing Referring Diagnoses: Although this study did not compare referring diagnoses with WBC physician assessments due to limitations of the fax-based referral process, creating a method to capture

referring diagnoses reliably would be valuable for future research to understand the alignment between referral diagnoses and WBC diagnoses.

Differentiation Between the Visit Notes Associated with the Parent or the Infant: Within the visit notes dataset, the data is included for either the infant or the parent without clearly specifying whether it pertains to the infant or the parent. Additionally, the fact that both the parent and infant share an identical ID in this clinic complicates the analysis. For instance, one of the variables within the visit notes is "prescriptions." Since both the parent and infant share the same ID, it was not possible to determine specifically whether a prescription was recorded for the infant or the parent. To address this issue, adding an additional column to the dataset, such as "corresponding dyad individual," and specifying whether the data pertains to the parent or infant, would greatly facilitate this analysis.

Questionnaire Dataset

Variable - Smoking and Drinking History: The "Smoking" and "Drinking" history variables prompt respondents to "skip" the question if they do not think it applies to them. This contradicts the response option "never drinker" or "never smoker" for these items within the intake questionnaire.

> **Recommendation #1:** Include explicit "Prefer not to answer" or "does not apply to me" response options for smoking and drinking history. This approach allows those working with the data to differentiate between non-responses (missing data), those who did not think the questionnaire item applied to them, and individuals without a history of consuming/using alcohol or tobacco products.

> **Recommendation #2:** The smoking status question includes the following response options: "current everyday smoker," "current someday smoker," "former smoker," "never smoker," "not smoker," "smoker," and "unknown." The simultaneous inclusion of "not smoker," "never smoker," and "former smoker" is potentially confusing for respondents. Additionally, the "unknown" option complicates data interpretation. We recommend replacing "unknown" with "I do not remember" and removing "not smoker" from the list of options.

Variable - Recreational Drug Use: This variable presents two concerns:

1. Stigma - Only 25 out of 3230 WBC population responded to the question about recreational drug use. Among these, 24 selected 'other,' and only one person reported using 'over-the-counter cough/cold medicine.' The low response rate and absence of reported recreational drug use beyond cold medicine (despite eight available options: cocaine, heroin, LSD (Lysergic Acid Diethylamide), methamphetamine,

opioids, sedatives, over-the-counter cough/cold medicine, stimulants, steroids, and others) may indicate stigma associated with this question.
2. Limited scope - The question on recreational drug use addresses only current use, potentially overlooking any history of previous recreational drug consumption.

Recommendation #3: Provide a space for the WBC patient population to write the drug they consume rather than choosing “other” as a response option.

Recommendation #4: Include a note clarifying that information related to recreational drug use will remain confidential within the clinic and, if used for research purposes, will be analyzed anonymously.

Recommendation #5: Add a response option to capture cannabis consumption.

Variable - Preferred Pronoun: The preferred pronoun questionnaire item responses contained a low prevalence of pronoun-related information. This was likely the result of 1) using open-ended text boxes and 2) misinterpretation of the item. For example, respondents incorrectly entered their names or other irrelevant information. We recommend the following improvements:

Recommendation #6: Provide a clear and concise explanation of the intended purpose of ”preferred pronoun”.

Recommendation #7: Convert “preferred pronoun” into a structured format with options to facilitate analysis and enable more comprehensive data exploration.

Recommendation #8: Include a "prefer not to respond" option to offer respondents the option to opt-out from responding to the “preferred pronoun” variable.

Variable - Diagnosed Medical Condition: One of the options included in the questionnaire for diagnosed medical conditions is "depression or anxiety." However, given that depression and anxiety are distinct diagnoses, each with its diagnostic criteria, combining them into a single category may limit the depth of understanding and clarity in analyzing these conditions individually.

Recommendation #9: Divide depression and anxiety and include them as separate options.

Variable - Breastfeeding Difficulty: One of the options in the questionnaire dataset for breastfeeding difficulties is “twin or more feeding.” The associated percentages for this option can be interpreted in two

ways: 1) it represents the proportion of parents with twin or multiple infants within the WBC population, all of whom experience feeding difficulties, or 2) it reflects the percentage of parents with twins or multiples who specifically report breastfeeding challenges, suggesting there may be additional parents with twins that do not have feeding problems. To address this ambiguity, we recommend revising the questionnaire first to ask whether parents have twins, triplets, or other multiples, followed by a separate question explicitly inquiring if they are experiencing breastfeeding difficulties.

> **Recommendation #10:** Add a question to identify whether parents have twins, triplets, or other multiples, along with a follow-up question to determine if they are encountering breastfeeding challenges *specifically* related to having twins/multiples.

Variables - Delivery Complications and Interventions: Both the delivery complications and interventions variables include a "none of the above" option. However, selecting this option does not necessarily indicate that parents have not experienced any complications or interventions; rather, it may suggest that they encountered types not listed. Therefore, it is crucial to include an "other" option along with a space for specifying the particular intervention or complication for these variables.

> **Recommendation #11:** Include an “other” option with space for free-text entry for the delivery intervention and delivery complications variables as this may provide a more comprehensive capture of patient experiences. Selecting “none of the above” does not necessarily indicate an absence of complications or interventions during the delivery process.

Variable - Breastfeeding Problem/Concern: One of the reasons for breastfeeding difficulties or cessation has been reported to be fatigue associated with breastfeeding, which has been discussed in the discussion section. This option is absent in the clinic's intake questionnaire.

> **Recommendation # 12:** Add an option of either “breastfeeding-associated fatigue” or “fatigue” to the following question within the intake questionnaire: “What is the breastfeeding problem/concern you would like help with?”

Visit Notes Dataset

Variable - Assessment and Plan: Recording information of WBC patient population in free-text format poses several challenges:

1) Assessing all records in free-text format is impractical for large datasets.

2) Extracting diagnoses from extensive free-text entries can be confusing and may result in misinterpretation.

Recommendation #13: Create separate columns for diagnoses, interventions, and treatment plans to facilitate data analysis. Additionally, it is important to clarify how template-based entries in the visit notes are communicated to WBC patient population.

Even though the existing diagnostic codes within the International Classification of Diseases (ICD) are not specific enough for infant feeding issues, there are still codes available for conditions such as tongue-tie, hypogalactia, and suppressed lactation that could be used to document supply issues and tongue-tie. When examining the prevalence of diagnostic codes used within the visit notes for tongue-tie, only 0.2% of the records included a code for this condition, despite its higher prevalence.

Recommendation #15: Record breastfeeding-related diagnoses more frequently using the existing codes where applicable.

Referral Tracking Dataset

Variable - Referral Healthcare Provider: 19.0% (n=1291/6778) of the referral healthcare provider types were missing in the referral tracking dataset. During discussions with the WBC physicians, I discovered that the missing values for the referring healthcare provider variable resulted from its data not being extracted directly from the referral form and inconsistent data entry within the system for this variable.

Recommendation #16: Record referring healthcare provider variable consistently in the designated area to ensure a more comprehensive and accurate analysis of this variable for future.

Recommendations for Manitoba Health System

It is important to recognize that, in addition to implementing the above recommendations, system-level changes are also necessary. A few examples are provided below.. To address this, I have outlined the following recommendations:

Interoperability Between Electronic Medical Records (EMRs): One of the key barriers identified in this study, which has been also highlighted by the WBC physicians is the lack of interoperability among

electronic medical records. A specific example of this issue is the reliance on fax-based referral processes rather than electronic data exchange between healthcare providers within clinics.

Team-Based Breastfeeding Care: The government should support team-based breastfeeding care by integrating International Board-Certified Lactation Consultants (IBCLCs) into clinical settings. Currently, IBCLCs operate under a fee-for-service model, which limits clinics such as WBC from hiring them. Incorporating IBCLCs into the healthcare system would facilitate triage and improve access to breastfeeding support. To address this gap, government funding or alternative payment models are necessary to enable the hiring of a higher number of IBCLCs within the clinics.

Remuneration for longer appointment durations: My analysis showed that a primary component of support provision at WBC involves education and discussion with patients, which requires dedicating significant time to each appointment. Given this time-intensive care model, it is essential for the government to consider increasing remuneration for healthcare providers delivering breastfeeding support to ensure high-quality care.

Adoption of ICD-11 (Internation Classification of Disease) codes in Manitoba: As of now (February 2025), the most recent version of the International Classification of Diseases (ICD) is ICD-11, which provides a more comprehensive and detailed classification of health conditions, including breastfeeding difficulties.[303] Despite the availability of updated coding systems, Manitoba continues to use ICD-9. Manitoba Health should adopt the updated ICD coding system to improve the classification and documentation of breastfeeding difficulties. This would enable clinics within Manitoba to use the updated codes as well, which would facilitate the analysis of the existing data for future research.

5.7 Conclusions

In conclusion, the WBC primarily serves a population of older, primiparous parents compared to the general Manitoba population, with a higher proportion residing in urban areas of Manitoba, particularly Winnipeg, and living in neighbourhoods with higher socioeconomic status. The clinic plays a critical role in addressing a wide range of breastfeeding challenges, with low milk supply, nipple pain, and tongue-tie concerns being the most commonly reported issues. When comparing physician-diagnosed breastfeeding difficulties to those reported by parents before their visit, it was observed that low milk supply was reported more frequently by parents than it was diagnosed by physicians. This discrepancy suggests that the perception of low milk supply may not always correspond to clinical diagnoses, highlighting the

importance of education and counseling in addressing parental concerns. The clinic's approach focuses on providing treatment, education, and emotional support to help parents navigate breastfeeding challenges, enhance their confidence, and make informed decisions. However, breastfeeding education should be delivered through public health systems, with the WBC functioning as a specialized care center for complex cases.

Despite being a physician-led clinic, a very low percentage of parents are prescribed domperidone for low milk supply, with the majority being managed through education and counseling. The WBC also provides emotional support to help parents cope with stress and anxiety related to breastfeeding, addressing both physical and psychological needs.

When comparing the medical conditions of breastfeeding dyads served by the WBC to Manitoba or Canada-wide population-level data, certain factors such as depression/anxiety among parents, NICU admissions, and epidural use appear to be risk factors for breastfeeding difficulties in this population. Beyond these conditions, the WBC patient population appears to have fewer complex medical conditions. Since its establishment in 2017, the WBC has seen a consistent increase in referrals, including pre-pandemic, during the pandemic, and post-pandemic. Most referrals come from physicians, suggesting a need for additional training among medical professionals to enhance breastfeeding support.

Looking ahead, there is a critical need to improve data collection practices at the WBC. Given the extensive data collected over a long period, it is essential to adopt a more structured and standardized format for documenting patient information in visit notes. Additionally, implementing a system of reliable patient identifiers will facilitate data linkage and support more robust future analyses. These improvements will enhance the clinic's ability to continue providing high-quality care to Manitoban families.

Appendices

Table 21 Variables within the Intake Questionnaire Completed by Individuals Accessing WBC Services

Variable	Response
Which pronouns do you prefer? *	*Open-ended text*
Did you struggle with infertility?	1. Yes 2. No
Have you ever had breast surgery?	1. Yes 2. No
What type of breast surgery?	1. Reduction 2. Augmentation 3. Other
Were there breast changes in your pregnancy?	1. Yes 2. No
How many children have you given birth to?	*Open-ended text*
Have you breastfed any other children?	1. Yes 2. No
Did you have any difficulties with previous breastfeeding?	1. Yes 2. No
Please describe your previous breastfeeding experience. *	*Open-ended text*
Have you been diagnosed with any of the following conditions?	1. Polycystic ovarian syndrome 2. Diabetes 3. High blood pressure 4. Thyroid disorder 5. Anemia 6. Depression or anxiety 7. None of the above
Which type of Diabetes?	1. Diabetes only in pregnancy 2. Type 1 Diabetes 3. Type 2 Diabetes
Do you take any medications?	1. Yes 2. No
Which medications do you take? *	*Open-ended text*

Smoking history: 1. status	Status responses: 1. Current everyday smoker 2. Current someday smoker 3. Former smoker 4. Never smoker 5. Not smoker 6. Smoker 7. Unknown
2. type	Type responses: 1. Cigarette 2. Cigar 3. E-cigarette 4. Pipe 5. Cigarillo 6. Chewing Tobacco
3. Started smoking*	*Open-ended text*
4. Number of Cigarettes per day*	*Open-ended text*
5. Number of packs per day *	*Open-ended text*
6. Number of attempts to quit*	*Open-ended text*
Drinking history: 1. Status	1. Current drinker 2. Former drinker 3. Never drinker
2. Number of standard drinks per week	*Open-ended text*
Do you use recreational drugs?	1. Yes 2. No
What type of recreational drugs?	1. Cocaine 2. Heroin 3. Lysergic Acid Diethylamide (LSD) 4. Methamphetamine 5. Opioids 6. Sedatives 7. Over the counter cough/cold medicine 8. Stimulants 9. Steroids 10. Other
Were you induced?	1. Yes 2. No
How many weeks pregnant were you at time of birth?	1. Less than 34 weeks 2. 34 to 37 weeks 3. 37 to 38 weeks 4. 38 to 41 weeks 5. 41 weeks or above

Which of the following were used during your delivery?	1. Intra venous fluid 2. Antibiotics 3. Epidural 4. Fentanyl 5. None of the above
What was the method of delivery?	1. Vaginal 2. Caesarean-section 3. Vaginal with assistance (forceps, or vacuum)
Any delivery complications?	1. Too much bleeding 2. Fever/infection 3. Pushed for over 3 hours 4. Shoulder dystocia (infant stuck at the shoulder) 5. High blood pressure 6. Hemolysis, Elevated Liver enzymes and Low Platelet count (HELLP) 7. Seizure 8. Placenta needed to be removed by the doctor 9. None
Did your baby go skin to skin and latch in the first hour after birth?	1. Yes 2. No
Did someone at the hospital help you breastfeed?	1. Yes 2. No
What was the baby's birth weight?	*Open-ended text*
How much weight did baby lose in the first few days after birth?	1. Less than 8% 2. 8-10% 3. 10% or more
Did someone advise you to supplement with formula at the hospital?	1. Yes 2. No
Did baby have jaundice?	1. Yes 2. No
Was baby treated for jaundice with light therapy?	1. Yes 2. No
Did baby have low blood sugar?	1. Yes 2. No
Was baby admitted to special care nursery or NICU?	1. Yes 2. No

What is the breastfeeding problem / concern you would like help with?	1. Breast milk supply 2. Nipple pain 3. locked ducts 4. Baby not growing well 5. Worried about tongue tie 6. Twins or more 7. Inducing lactation 8. Prenatal questions 9. Other
What other problems/concerns? *	*Open-ended text*
Please describe your concern. *	*Open-ended text*
How many weeks old is the baby?	*Open-ended text*
How is a baby being fed?	1. Exclusively at the breast 2. At the breast plus supplements of pumped/expressed breast milk 3. At the breast plus supplements of expressed milk and/or formula 4. Pumped breast milk in a bottle, baby is not latching to the breast 5. Mostly formula in a bottle 6. Other
Please describe how the baby is being fed*	*Open-ended text*
How do you feel about formula?	1. Do not want to use it 2. Ok with using if needed only 3. No issues with using it
How do you feel about pacifiers?	1. I have not introduced a pacifier 2. I have already introduced a pacifier 3. Not sure if I should or not
My baby currently sleeps	1. In my room on a separate sleep surface 2. In my room on the same sleep surface 3. In a different room from me 4. Other
Do you have a support person living with you?	1. Husband or common law 2. Wife or common law 3. Other 4. No support person
Do you own or plan on getting a breast pump?	1. Yes 2. No
Do you feel your life partner is supportive of breastfeeding?	1. Yes 2. No 3. Indifferent
Do you feel your extended family are supportive of breastfeeding?	1. Yes 2. No 3. Indifferent

Do you plan to return to work?	1. In one year or longer 2. In less than one year 3. I am not taking time off work 4. I do not plan on working outside the home
Do you feel excessively guilty or sad since giving birth?	1. Yes 2. No
Did you take a breastfeeding class or prepare in some way to breastfeed?	1. In-person class 2. Online reading 3. Talked to friends about their experiences 4. None of the above
Did you find the class helpful?	1. Yes 2. No

Variables marked with an (*) were excluded from the analysis for the following reasons: 1) free text format of the data, 2) irrelevance to the main aims of the project, and 3) inconsistent records for the associated variable, such as smoking history variable.

Table 22. Variables within the Visit Notes Dataset

Variable	Response
Appointment date	*Open-ended text*
Appointment type*	1. Breastfeeding virtual/phone consult 2. In-clinic breastfeeding consult
WBC breastfeeding dyads	Female Male
Assessment and plan	*Open-ended text*
Diagnosis	
Education	
Supportive psychotherapy	
Prescription	*Open-ended text*
Diagnosis code*	*Open-ended text*
Diagnosis description*	*Open-ended text*
First three digits of the postal code	*Open-ended text*

Variables marked with an asterisk (*) were excluded from the analysis for the following reasons: (1) insufficient specificity, such as diagnosis codes and descriptions that primarily referenced broad categories like "breastfeeding difficulties". 2) irrelevance to the project aims, such as the appointment type.
The WBC collects the full postal code, but they truncated that and provided me with the first three digits of postal code (forward sortation area code).

Table 23. Variables within the Referral Tracking Dataset

Variable	Response
First three digits of the postal code	*Open-ended text*
Mother's date of birth	*Open-ended text*
Referring practitioners' occupation	1. Medical Doctor (MD) 2. Nurse Practitioner (NP) 3. Midwife

The "first three digits of the postal code" was excluded from the analysis because this was analyzed in the Visit Notes dataset. In the referral tracking dataset, referring practitioners' occupations were recorded consistently and involved one of the three predefined options. I categorized cases where no practitioner type was specified as missing information.

Table 24. First-Level Categorization of the Data within the Visit Notes By "Education and Discussion" Intervention

Definitions	Variable
How to know the infant is drinking: 1) Listen to swallow 2) Jaw movement 3) Signs of satiety 4) Tension release 5) Closing eyes 6) Longer, more frequent pauses 7) Wet and poop diaper 8) Weight gain	Infant human milk swallowing detection
Review that swaddle and pacifier interfere with reading infant cues.	Swaddle and pacifier use
1) Baby comforting at the breast OR 2) Calming the infant before breastfeeding	Comfort breastfeeding
Bottle feeding with the following criteria: 1) Slow flow nipple 2) Protect suck, swallow, breathe in infant 3) Infant control rate and volume	Bottle feeding
Providing information for the parents regarding: 1) Pump care 2) Pump size 3) Private insurance coverage	Pump info
Review safe sleep and provide handouts such as reviewing the 7 rules of safe sleep.	Safe sleep
Refers to discussing the following methods for coping with infant fuss: 1) Skin to skin 2) Movement, swing swaddle 3) Sucking 4) Music/white noise 5) Watch awake windows 6) Review normalcy of fuss and spit-up in the first 8 weeks. 7) Babywearing 8) Try burping, changing diaper, undressing 9) Normalcy of fussy evenings 10) The fussy period peaks at 6-8 weeks 11) Purple crying/colic management 12) Trial of BioGaia 13) Frequent burping if fussy at the breast and clicking a lot.	Coping with infant fuss
Written Infant Feeding Management Plan, which usually includes videos and tools for breastfeeding difficulties	WIFMP (written infant feeding management plan)
To wake up baby: 1) Skin to skin 2) Diaper change 3) Wake baby 4) Cool clothes	Infant sleeping intervention

5) Tickle toes 6) Undress	
Try putting on the breast every 2-3 hours	Breast (2-3hrs)
Watch and wait approach for TT and LT	Watch TT-LT (tongue tie – lip tie)
Refers to one or more of the following: 1) Keep moist with Lanolin, breastmilk, coconut oil or olive oil, saline soak 2) Can use Saran Wrap to trap moisture and act like a mechanical barrier 3) Remove trauma: ensure deep asymmetric latch 4) Breast pad 5) Do not wash your nipple 6) Nonstick dressing 7) Keep clean with saline soaks: mix 1 cup warm water and 1/2 tablespoon salt in a small glass - 2-3 times a day	Nipple care
Discussion around the following items for achieving deep asymmetric latch: 1) Review positions that are most comfortable for mom and work well with her breast anatomy, speed of letdown 2) Hold the baby at the shoulder blades, not the back of the head 3) Position baby tummy to tummy, baby's hands on either side of breast 4) Align baby's nose to mom's nipple and wait for baby to open wide. When the baby has opened wide, bring the baby forward onto the breast. 5) Nipple pointing toward the roof of the mouth 6) Check that the baby's lips are flanged out; if they are not, pull the baby's chin downward. To deepen the latch, draw the baby's hips/body closer to the mom's body. 7) To deepen the latch, let baby's head extend enough so that the chin touches the breast and baby's nose is free to breathe 8) Ensure there is no pain. If pain persists beyond 30 seconds, unlatch and retry. 9) Watch the shape of mom's nipple when unlatching. It should be round. A round nipple has been deep in the baby's mouth to the level of the soft palate, and milk will flow freely without trauma. A creased/ lip sticked nipple means a shallow latch - resulting in poor milk transfer and a traumatized nipple. 10) Encourage mom to practice latching in various positions until comfortable and confident.	Latch – deep asymmetric latch
1) Listening for swallowing 2) Monitor infant weight along the baby's growth curve 3) Review normal voids/stools 4) Normal infant feeding behaviours reviewed: Reviewed 4th trimester. 5) Need and normalcy of frequent feeds. 6) Better neurologic development to cuddle/hold baby. 7) Feeding on Demand and responsively - weight gain min 20g/day. 8) Avoid feeding schedules for less than 4 months old.	Milk transfer assessment
1) Tongue tie release procedure risks and benefits reviewed 2) Review of post-tongue release exercises 3) Review of suck training exercises 4) Handout/ Website with info provided"	TT guidance
Waiting for improvement	Watch jaundice

Wake baby every 3 hours to breastfeed	Wake-baby-3 hours
Access to a scale (infant, food, luggage, or fish scale work). Expect weight gain to be 20-30 grams/day or 150 grams per week until 4 months of age.	Scale
Pump 8 times a day	8-pump
Pump for 10-15 minutes	10-15 pump
Pump 1-2 times a day	1-2 pumping
Bring to breast every feed for at least 5-10 mins/side	5-10 min bf on each side
Pump once at night	1-night pump
Pump 8-10 times a day	8-10 pump
The infant will be referred to have a tongue tie released	TT-LT release referral
Discussion regarding the domperidone risks, such as QT prolongation and arrhythmia. Recommendation for weaning: by 1 tablet (10 mg) every 3-7 days	Domperidone risks
Milk removal 8-10 times per day	8-10 milk removal
Heat massage pre-pump	Heat
Weight will be followed up in the next appointments.	Weight f-u
1) Warm compress to the area affected before feeds. 2) Push behind the blockage while feeding the infant to clear it. 3) Do warm water and massage in the shower. 4) Use NSAIDs for pain. 5) Consider physiotherapy and ultrasound. 6) Do not let breasts become too full or engorged.	Blockage care
High-calorie foods include avocado oil, nut butter, and 10% fat yogurt.	High cal food
Make sure that the infant roots for the bottle when bottle feeding them.	Bottle rooting
1) Work on infants spending time on the chest and at the breast - especially when they are hungry. 2) Express some breast milk onto the nipple and into their mouth if they open. 3) Skin-to-skin contact. If they are fussy at the breast, bring them back to the center, calm them down, and try again. 4) Ensure they root for the bottle every feed to get used to opening wide for food. 5) Change the flow during bottle feeding to get them used to the normal flow at the breast.	Breastfeeding simulation
Discussion regarding benefits of milk vs formula.	BM (breast milk) benefits
Switch from evening bottle feeding to morning breastfeeding.	Pm-am milk shift
Every other feed-pumping	EOF (every other feed) pumping
Offer breast after calming on the bottle.	Calm bottle-breast
Ask for help.	Seek help
Same room sharing for sleep courage	Room sharing
Pump 10-15min after the first-morning feed and store in the fridge.	Am pump fridge
This refers to pumping for 1 hour with 10 min on and 10 min off.	Power pumping
Nipple trauma treatment	Nipple trauma tx
Switch sides up to 4 times.	Switch sides
Discussion regarding milk storage.	Milk storage

Limit pacifier to car and sleep.	Limit pacifier
After both breasts, if the baby is not calm, offer a paced bottle - try 30ml, then go back to the breast.	Breast-bottle-breast
Calm baby before placing on the breast	Calm before breast
Discuss the benefits of biological hold or share educational videos for the parents.	Biological hold
1) Mom should try to get as comfortable as possible, and self-compassion helps keep mom calm and open to keep trying. 2) Skin to Skin. 3) Bathe together. 4) Let baby comfort, sleep near the breast, and offer often. 5) Do not push a crying baby on the breast; calm the baby first and offer again when calm. 6) Try offering the breast at the beginning of a bottle feed, in the middle and near the end of a feed.	Coax baby to breast.
Pump for a minute to help manually extract nipples.	1-min pump for nipple extraction
Discussion regarding managing infants and toddlers at the same time.	Infant-toddler management
Discussion of the added stressor of the COVID-19 Pandemic during their family's postpartum time and how this can impact bonding and mental health and limit support systems available.	COVID-19 stressor
Induction of lactation for adopted infant	Induction-adoption

Table 25 First-Level Categorization of the Data within the Visit Notes By "Prescription" Intervention

Definition	**Variable**
Nexium and Pantoloc	PPI (Proton Pump Inhibitor)
Increase Omega 3 for the mother and probiotics for the infant	Omega3-probiotics
If the breast pain condition or infection persists, Keflex will be initiated.	Conditional Keflex
This protocol is used when there is a need for immediate milk production. What is the process? OCP (oral contraceptive) + domperidone for 1 month. Then, OCP is stopped while domperidone is continued, and pumping occurs every 3 hours.	Accelerated protocol
Refers to one or more of the following: Fenugreek, Blessed thistle, Oats, Hydration, Goats Rue, Moringa, Oats, lactation cookies	Galactagogue

Table 26 First-Level Categorization of the Data within the Visit Notes By "Supportive Psychotherapy" Intervention

Definition	Variable
Review the importance of support	support
Vulnerable mental health	vulnerability
Validation of feeling, experience, value, intention, effort, goals	Validation
Acknowledge the complexity of emotions, navigate reality and expectation	acknowledgement
Acceptance of feeling without judgment, shame, labelling emotions and being curious about thoughts behind emotions	Acceptance
Emotional regulation methods: mindfulness, set boundaries, ask help.	Self-compassion
Sleep nutrition and physical movement outside in nature connect to the community for mental health.	Wellness
When to seek professional help: 1) Worry and sadness become the main feeling 2) The mother becomes disconnected from the baby 3) Excessive guilt 4) Intrusive thoughts become scary and overwhelming 5) Mother does not have enjoyment any more 6) Thoughts of self-harming or harming the infant	Professional help
1) Nourishment - Eat regular meals. Pre-prep, pre-cook, and store. Ask for help 2) Understanding- Listen to your body and know your limits. Accept your feelings without judgement and acknowledge that it is ok and it will pass. Try to think positively. 3) Rest- Make time to relax every day. Reduce your expectations of what you can do in a day. 4) Self Care - Do things you enjoy or used to enjoy. Have hope and know you are not alone; being a new parent is hard; give yourself time to adjust to the latest parenthood change. 5) Energy/Exercise - Try walking, exercising, and getting out of the house.	NURSE
1) Self-care/self-compassion. 2) Sleep and calling on support systems are important. 3) Discussion about the transition into motherhood and the mixed feelings we can have, which is normal. 4) Discuss how to respond to opinions and advice that may be unsolicited and unwanted. 5) Discuss online info, how to filter through information, and which sites are reliable.	Postpartum wellbeing

7) Finding a community of supportive friends and family, even online, can be helpful. 8) Discussion about trying to do something she enjoys and time for herself.

Table 27. Prescriptions within Winnipeg Breastfeeding Centre Visit Notes Dataset

Previous variable	New variable
Jamp-domperidone 10mg Ratio-domperidone 10mg Domperidone 10mg Bio-domperidone 10mg	Domperidone
Taro-mupirocin 2% Bactroban 2% ointment Bactroban 2% Triamcinolone ointment 0.1% Triamcinolone ointment Triamcinolone 0.1% Triamcionolone 0.1% All purpose nipple cream All purpose nipple ointment Betaderm ont 0.05% Betaderm crm 0.05% Cloderm 0.1% cream Lamisil 1% topical cream Betamethasone ont 0.05%	Topical treatment
Breastpump- double electric Double electric pump Double electric breast pump - medical Double electric supplies Double supplies appliance / medical equipment Breastpump- electric Double electric supplies Breast pump Double breast pump Breast pump double electric Nursicare breast pads Nursicare wounds pads Thumb braces Nipple shield	Supplies

Freemie pumping cups Flange size 20mm for breast pump flange size 20mm for supplies Wrist braces for de quervain's tenosynovitis	
Zoloft 25 mg Zoloft 50 mg Sertraline 50 mg Sertraline 25 mg Sertraline 100 mg Pms-nortriptyline 25mg Trazodone 50 mg Fluoxetine 20 mg Vyvanse 10mg	Mental health medication
Fluconazole 150 mg Dom-fluconazole 100mg Micozole 2% Clotrimazole cream usp 1% Mint-itraconazole 100mg Micatin cream - 2% Pms-nystatin suspension 100000 unit/ml 100000unit Ratio-nystatin 100000unit	Antifungal medication
Teva-cloxacillin 500mg Cloxacillin sodium for injection 500mg Cephalexin 500 mg Septra ds 800 mg-160 mg Keflex 500 mg Valacyclovir 1000mg	Antibiotic and antiviral medication
Diclofenac 10% gel Apo-naproxen ec 500mg Children's tylenol 80mg	Pain and fever relief
Lecithin 1200mg Mother's milk tea	Galactagogue
Yasmin 21 3 mg-0.03 mg Yasmin 28 3 mg-0.03 mg Tri-cyclen lo 28 Synthroid tab 100mcg 100mcg Micronor tablets 28-day 0.35mg Micronor 0.35 mg Apo-cabergoline 0.5mg Metformin 500 mg Metformin long acting 1 g Apo-metformin er 1000mg Apo-metformin - tab 500mg	Hormonal medication
Esomeprazole 20mg Nexium powder Omeprazole Pantoprazole 40mg	PPI

Pantoprazole magnesium 40 mg	
Nifedipine er 30mg Adalat xl - srt 30mg	Calcium channel blocker
Registered dietician - starting solids Registered dietician	Dietician
Massage therapy Massage therapy Massage – lactation	Massage
Physiotherapy Physiotherapy Physiotherapy/ cranial sacral therapy - dx torticollis/ jaw asymmetry Physiotherapy or osteotherapy or chiropratic care - torticollis with asymmetric jaw Physiotherapy - dequarvain's tenosynovitis Physiotherapy – torticollis Physiotherapy - de quervains tenosynovitis Physiotherapy - blocked milk duct Cranial sacral therapy Cranial sacral therapy or chiropractic care	Physiotherapy
Infant soy formula - ready to serve	Formula

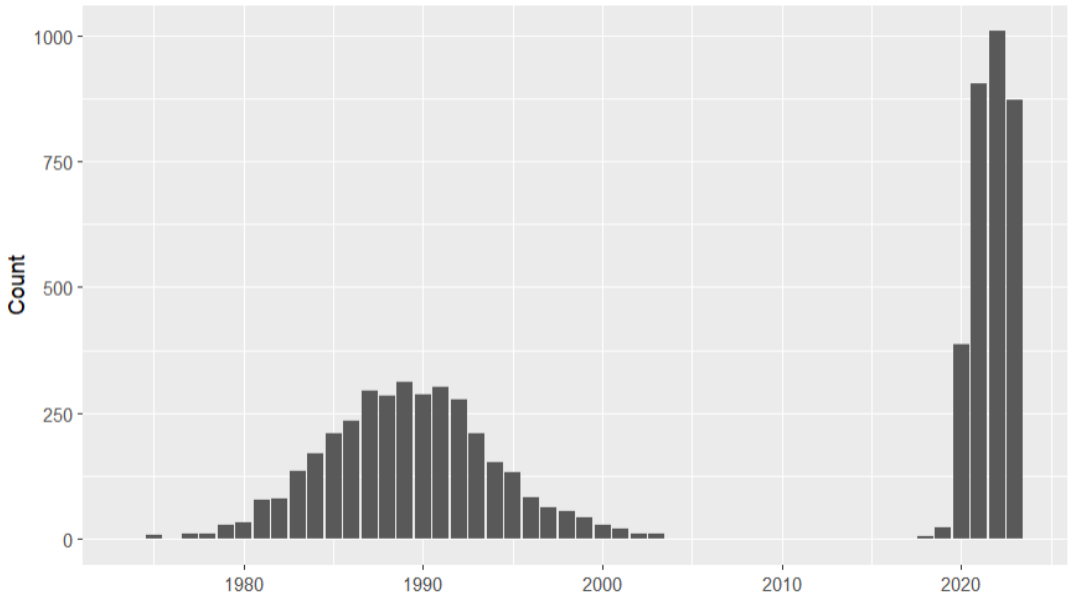

Figure 10 Frequency of Year of Birth Among Winnipeg Breastfeeding Centre Lactating Parent Population (Mean parent age (years): 34.8 ± 4.7 and Mean infant age (weeks): 8.6 ± 10.8, N=6778 records; 2018-2023)

Table 28 Indications for the WBC Prescribed Medication

Medication	**Indication**
Galactagogue	Low milk supply
Esomeprazole	Proton Pump Inhibitor, Gastroesophageal Reflux Disorder in infants[304]
Calcium channel blockers, such as Adalat, Amlodipine	Raynaud's phenomenon or vasospasm of the nipple[305]
Nonsteroidal Anti-Inflammatory Drugs	Pain relief
Keflex (Cefalexin)	Mastitis[306]
Mupirocin ointment	Prevention of infection in nipple cracks/fissures[307]
Labetalol	β-adrenoceptor blocker, hypertension[308]
Accelerated protocol	Lactation induction (Administering Oral Contraceptive Pills (OCP) in combination with domperidone for one month. After this period, OCP is discontinued, while domperidone is maintained, and pumping is initiated at three-hour intervals.)
Zoloft (Sertraline)	Selective Serotonin Reuptake Inhibitor (SSRI), antidepressant medication[309]

References

1. Binns C, Lee M, Low WY. The long-term public health benefits of breastfeeding. Asia Pac J Public Health. 2016;28(1):7–14.

2. Ames SR, Lotoski LC, Azad MB. Comparing early life nutritional sources and human milk feeding practices: personalized and dynamic nutrition supports infant gut microbiome development and immune system maturation. Gut Microbes. 2023 Dec 31;15(1):2190305.

3. Allen J, Hector D. Benefits of breastfeeding. New South Wales Public Health Bull. 2005;16(4):42–6.

4. Heinig MJ, Dewey KG. Health advantages of breast feeding for infants: a critical review. Nutr Res Rev. 1996 Jan;9(1):89–110.

5. Arenz S, Rückerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity--a systematic review. Int J Obes Relat Metab Disord J Int Assoc Study Obes. 2004 Oct;28(10):1247–56.

6. Gómez-Sanchiz M, Cañete R, Rodero I, Baeza JE, González JA. Influence of breast-feeding and parental intelligence on cognitive development in the 24-month-old child. Clin Pediatr (Phila). 2004 Oct;43(8):753–61.

7. Babic A, Sasamoto N, Rosner BA, Tworoger SS, Jordan SJ, Risch HA, et al. Association Between Breastfeeding and Ovarian Cancer Risk. JAMA Oncol. 2020 Jun 11;6(6):e200421.

8. Chen H, Wang J, Zhou W, Yin H, Wang M. Breastfeeding and Risk of Rheumatoid Arthritis: A Systematic Review and Metaanalysis. J Rheumatol. 2015 Sep;42(9):1563–9.

9. Pinho-Gomes AC, Morelli G, Jones A, Woodward M. Association of lactation with maternal risk of type 2 diabetes: A systematic review and meta-analysis of observational studies. Diabetes Obes Metab. 2021 Aug;23(8):1902–16.

10. Nguyen B, Jin K, Ding D. Breastfeeding and maternal cardiovascular risk factors and outcomes: A systematic review. PloS One. 2017;12(11):e0187923.

11. Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50302 women with breast cancer and 96973 women without the disease. Lancet Lond Engl. 2002 Jul 20;360(9328):187–95.

12. World Health Organization. Breastfeeding [Internet]. Available from: https://www.who.int/health-topics/breastfeeding#tab=tab_2

13. Zong X, Wu H, Zhao M, Magnussen CG, Xi B. Global prevalence of WHO infant feeding practices in 57 LMICs in 2010–2018 and time trends since 2000 for 44 LMICs. eClinicalMedicine

[Internet]. 2021 Jul 1 [cited 2023 Dec 5];37. Available from: https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(21)00251-0/fulltext

14. CDC. 2022 Breastfeeding Report Card [Internet]. Centers for Disease Control and Prevention. 2023 [cited 2023 Dec 5]. Available from: https://www.cdc.gov/breastfeeding/data/reportcard.htm

15. Theurich MA, Davanzo R, Busck-Rasmussen M, Díaz-Gómez NM, Brennan C, Kylberg E, et al. Breastfeeding rates and programs in europe: A survey of 11 national breastfeeding committees and representatives. J Pediatr Gastroenterol Nutr. 2019 Mar 1;68(3):400–7.

16. Canada PHA of. Canada's breastfeeding dashboard - Canada.ca [Internet]. aem. 2022 [cited 2023 May 17]. Available from: https://health-infobase.canada.ca/breastfeeding/

17. Brown CRL, Dodds L, Legge A, Bryanton J, Semenic S. Factors influencing the reasons why mothers stop breastfeeding. Can J Public Health Rev Can Santé Publique. 2014;105(3):e179.

18. Social determinants of health [Internet]. [cited 2025 Feb 18]. Available from: https://www.who.int/health-topics/social-determinants-of-health

19. Thulier D, Mercer J. Variables Associated With Breastfeeding Duration. J Obstet Gynecol Neonatal Nurs. 2009 May 1;38(3):259–68.

20. Habibi M, Laamiri FZ, Aguenaou H, Doukkali L, Mrabet M, Barkat A. The impact of maternal socio-demographic characteristics on breastfeeding knowledge and practices: An experience from Casablanca, Morocco. Int J Pediatr Adolesc Med. 2018 Jun 1;5(2):39–48.

21. Magnano San Lio R, Maugeri A, La Rosa MC, Cianci A, Panella M, Giunta G, et al. The Impact of Socio-Demographic Factors on Breastfeeding: Findings from the "Mamma & Bambino" Cohort. Medicina (Mex). 2021 Feb;57(2):103.

22. Vogel A, Hutchison B, Mitchell E. Factors associated with the duration of breastfeeding. Acta Paediatr. 1999;88(12):1320–6.

23. Factors Associated With Breastfeeding Duration [Internet]. [cited 2024 Oct 26]. Available from: https://www.mdpi.com/1648-9144/49/9/65

24. Perinatal Services and Outcomes in Manitoba [Internet]. [cited 2023 Sep 25]. Available from: http://mchp-appserv.cpe.umanitoba.ca/deliverable.php?referencePaperID=76742

25. Hector D, King L, Webb K, Heywood P. Factors affecting breastfeeding practices: applying a conceptual framework. New South Wales Public Health Bull. 2005;16(3–4):52–5.

26. Risk factors for self-reported insufficient milk during the first 6 months of life: A systematic review - Segura-Pérez - 2022 - Maternal & Child Nutrition - Wiley Online Library [Internet]. [cited 2023 Jun 28]. Available from: https://onlinelibrary-wiley-com.uml.idm.oclc.org/doi/10.1111/mcn.13353

27. Pérez-Escamilla R, Tomori C, Hernández-Cordero S, Baker P, Barros AJD, Bégin F, et al. Breastfeeding: crucially important, but increasingly challenged in a market-driven world. The Lancet. 2023 Feb 11;401(10375):472–85.

28. Huang Y, Liu Y, Yu XY, Zeng TY. The rates and factors of perceived insufficient milk supply: A systematic review. Matern Child Nutr. 2022;18(1):e13255.

29. Arbour MW, Kessler JL. Mammary Hypoplasia: Not Every Breast Can Produce Sufficient Milk. J Midwifery Womens Health. 2013;58(4):457–61.

30. Insufficient glandular tissue (breast hypoplasia) | Australian Breastfeeding Association [Internet]. [cited 2023 Aug 20]. Available from: https://www.breastfeeding.asn.au/resources/insufficient-glandular-tissue-breast-hypoplasia

31. Vanky E, Isaksen H, Haase Moen M, Carlsen SM. Breastfeeding in polycystic ovary syndrome. Acta Obstet Gynecol Scand. 2008 Jan 1;87(5):531–5.

32. The impact of intrapartum and immediate post-partum complications and newborn care practices on breastfeeding initiation in Ethiopia: A prospective cohort study - Mohammed - 2023 - Maternal & Child Nutrition - Wiley Online Library [Internet]. [cited 2023 Jun 18]. Available from: https://onlinelibrary-wiley-com.uml.idm.oclc.org/doi/10.1111/mcn.13449

33. De Roza JG, Fong MK, Ang BL, Sadon RB, Koh EYL, Teo SSH. Exclusive breastfeeding, breastfeeding self-efficacy and perception of milk supply among mothers in Singapore: A longitudinal study. Midwifery. 2019 Dec;79:102532.

34. Trimeloni L, Spencer J. Diagnosis and Management of Breast Milk Oversupply. J Am Board Fam Med. 2016 Jan 1;29(1):139–42.

35. van Veldhuizen-Staas CG. Overabundant milk supply: an alternative way to intervene by full drainage and block feeding. Int Breastfeed J. 2007 Aug 29;2(1):11.

36. Schlatter SM, Schupp W, Otten JE, Harnisch S, Kunze M, Stavropoulou D, et al. The role of tongue-tie in breastfeeding problems—A prospective observational study. Acta Paediatr. 2019;108(12):2214–21.

37. The prevalence of ankyloglossia in children aged <1 year: a systematic review and meta-analysis | Pediatric Research [Internet]. [cited 2023 Jul 10]. Available from: https://www.nature.com/articles/s41390-020-01239-y

38. Hall DMB, Renfrew MJ. Tongue tie. Arch Dis Child. 2005 Dec;90(12):1211–5.

39. Filfilan RO, Almazrooa SA. Double lingual frenulum: a case report. J Med Case Reports. 2020 Jul 26;14(1):116.

40. Merritt LS. The Effect of Tongue-Tie and Lip-Tie on Breastfeeding. J Nurse Pract. 2019 May 1;15(5):356–60.

41. Kotlow LA. Diagnosing and Understanding the Maxillary Lip-tie (Superior Labial, the Maxillary Labial Frenum) as it Relates to Breastfeeding. J Hum Lact. 2013 Nov 1;29(4):458–64.

42. Allori AC, Mulliken JB, Meara JG, Shusterman S, Marcus JR. Classification of Cleft Lip/Palate: Then and Now. Cleft Palate-Craniofacial J Off Publ Am Cleft Palate-Craniofacial Assoc. 2017 Mar;54(2):175–88.

43. Boyce JO, Reilly S, Skeat J, Cahir P, Academy of Breastfeeding Medicine. ABM Clinical Protocol #17: Guidelines for Breastfeeding Infants with Cleft Lip, Cleft Palate, or Cleft Lip and Palate-Revised 2019. Breastfeed Med Off J Acad Breastfeed Med. 2019 Sep;14(7):437–44.

44. Kaye A, Thaete K, Snell A, Chesser C, Goldak C, Huff H. Initial Nutritional Assessment of Infants with Cleft Lip and/or Palate: Interventions and Return to Birth Weight. Cleft Palate Craniofacial J. 2017 Mar 1;54(2):127–36.

45. Agunbiade OM, Ogunleye OV. Constraints to exclusive breastfeeding practice among breastfeeding mothers in Southwest Nigeria: implications for scaling up. Int Breastfeed J. 2012 Apr 23;7(1):5.

46. Amir LH. ABM Clinical Protocol #4: Mastitis, Revised March 2014. Breastfeed Med. 2014 Jun 6;9(5):239.

47. Omranipour R, Vasigh M. Mastitis, Breast Abscess, and Granulomatous Mastitis. In: Alipour S, Omranipour R, editors. Diseases of the Breast during Pregnancy and Lactation [Internet]. Cham: Springer International Publishing; 2020 [cited 2023 Jun 29]. p. 53–61. (Advances in Experimental Medicine and Biology). Available from: https://doi.org/10.1007/978-3-030-41596-9_7

48. Mastitis: causes and management [Internet]. [cited 2023 Jun 29]. Available from: https://www.who.int/publications-detail-redirect/WHO-FCH-CAH-00.13

49. Pevzner M, Dahan A. Mastitis While Breastfeeding: Prevention, the Importance of Proper Treatment, and Potential Complications. J Clin Med. 2020 Aug;9(8):2328.

50. Risk factors for mastitis in breastfeeding women: results of a prospective cohort study - Kinlay - 2001 - Australian and New Zealand Journal of Public Health - Wiley Online Library [Internet]. [cited 2023 May 30]. Available from: https://onlinelibrary-wiley-com.uml.idm.oclc.org/doi/abs/10.1111/j.1753-6405.2001.tb01831.x

51. Kataria K, Srivastava A, Dhar A. Management of Lactational Mastitis and Breast Abscesses: Review of Current Knowledge and Practice. Indian J Surg. 2013 Dec 1;75(6):430–5.

52. Barbosa-Cesnik C, Schwartz K, Foxman B. Lactation mastitis. JAMA. 2003 Apr 2;289(13):1609–12.

53. Benson EA. Management of breast abscesses. World J Surg. 1989 Nov 1;13(6):753–6.

54. Mitchell KB, Eglash A, Bamberger ET. Mammary Dysbiosis and Nipple Blebs Treated With Intravenous Daptomycin and Dalbavancin. J Hum Lact. 2020 May 1;36(2):365–8.

55. Deniz S, Kural B. Nipple Vasospasm of Nursing Mothers. Breastfeed Med. 2023 Jun;18(6):494–8.

56. Shiva M, Frotan M, Arabipoor A, Mirzaaga E. A Successful Induction of Lactation in Surrogate Pregnancy with Metoclopramide and Review of Lactation Induction. Int J Fertil Steril. 2010 Feb 1;3(4):191–4.

57. Cinar ND, Alvur TM, Kose D, Nemut T. Breastfeeding Twins: A Qualitative Study. J Health Popul Nutr. 2013 Dec;31(4):504–9.

58. Breastfeeding Twins: Factors Related to Weaning - Fernanda Cristina Ferreira Mikami, Rossana Pulcineli Vieira Francisco, Agatha Rodrigues, Wagner Rodrigues Hernandez, Marcelo Zugaib, Maria de Lourdes Brizot, 2018 [Internet]. [cited 2024 Mar 21]. Available from: https://journals.sagepub.com/doi/abs/10.1177/0890334418767382

59. Damato EG, Dowling DA, Standing TS, Schuster SD. Explanation for Cessation of Breastfeeding in Mothers of Twins. J Hum Lact. 2005 Aug 1;21(3):296–304.

60. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. Lancet Lond Engl. 2012 Jun 9;379(9832):2162–72.

61. The 2019 RHA Indicators Atlas [Internet]. [cited 2023 Sep 25]. Available from: http://mchp-appserv.cpe.umanitoba.ca/deliverable.php?referencePaperID=78006

62. Fan HSL, Wong JYH, Fong DYT, Lok KYW, Tarrant M. Association between early-term birth and breastfeeding initiation, duration, and exclusivity: A systematic review. Birth. 2019;46(1):24–34.

63. Lutsiv O, Giglia L, Pullenayegum E, Foster G, Vera C, Chapman B, et al. A Population-Based Cohort Study of Breastfeeding According to Gestational Age at Term Delivery. J Pediatr. 2013 Nov 1;163(5):1283–8.

64. Classification of prematurity - UpToDate [Internet]. [cited 2023 Aug 2]. Available from: https://www.uptodate.com/contents/image?imageKey=PEDS%2F119362

65. Global nutrition targets 2025: low birth weight policy brief [Internet]. [cited 2023 Jul 7]. Available from: https://www.who.int/publications-detail-redirect/WHO-NMH-NHD-14.5

66. Low birth weight [Internet]. [cited 2023 Jul 7]. Available from: https://www.who.int/data/nutrition/nlis/info/low-birth-weight

67. Campbell AG, Miranda PY. Breastfeeding Trends Among Very Low Birth Weight, Low Birth Weight, and Normal Birth Weight Infants. J Pediatr. 2018 Sep 1;200:71–8.

68. Lee TY, Lee TT, Kuo SC. The experiences of mothers in breastfeeding their very low birth weight infants. J Adv Nurs. 2009;65(12):2523–31.

69. Enomoto M, Sezaki H, Muranishi R, Sato Y, Kikuchi S, Katayama Y, et al. Acquired palatal groove and delayed oral feeding in preterm infants. Pediatr Int. 2017;59(2):171–5.

70. Society CP. The screening and management of newborns at risk for low blood glucose | Canadian Paediatric Society [Internet]. [cited 2023 Jul 6]. Available from: https://cps.ca/en/documents/position/newborns-at-risk-for-low-blood-glucose

71. Alemu B, Olayinka O, Baydoun H, Hoch M, Akpinar-Elci M. Neonatal Hypoglycemia in Diabetic Mothers: a Systematic Review. Curr Pediatr Res [Internet]. 2017 Jan 1;21(1). Available from: https://digitalcommons.odu.edu/commhealth_fac_pubs/25

72. Wight N, Marinelli KA, Academy of Breastfeeding Medicine. ABM clinical protocol #1: guidelines for blood glucose monitoring and treatment of hypoglycemia in term and late-preterm neonates, revised 2014. Breastfeed Med Off J Acad Breastfeed Med. 2014 May;9(4):173–9.

73. Narayan S, Aggarwal R, Deorari AK, Paul VK. Hypoglycemia in the Newborn. Indian J Pediatr. 2001 Oct 1;68(10):963–5.

74. Jain A, Aggarwal R, Jeeva Sankar M, Agarwal R, Deorari AK, Paul VK. Hypoglycemia in the Newborn. Indian J Pediatr. 2010 Oct 1;77(10):1137–42.

75. Fallah S, Chen XK, Lefebvre D, Kurji J, Hader J, Leeb K. Babies admitted to NICU/ICU: province of birth and mode of delivery matter. Healthc Q Tor Ont. 2011 Apr 26;14:16–20.

76. Gertz B, DeFranco E. Predictors of breastfeeding non-initiation in the NICU. Matern Child Nutr. 2019;15(3):e12797.

77. Exclusive breastfeeding for optimal growth, development and health of infants [Internet]. [cited 2024 Nov 15]. Available from: https://www.who.int/tools/elena/interventions/exclusive-breastfeeding

78. Krugman SD, Dubowitz H. Failure to Thrive. Am Fam Physician. 2003 Sep 1;68(5):879–84.

79. Nangia S, Tiwari S. Failure to Thrive. Indian J Pediatr. 2013 Jul 1;80(7):585–9.

80. Prevalence of Gastroesophageal Reflux Disease Symptoms in Infants and Children - Singendonk - 2019 - Journal of Pediatric Gastroenterology and Nutrition - Wiley Online Library [Internet]. [cited 2024 Oct 27]. Available from: https://onlinelibrary-wiley-com.uml.idm.oclc.org/doi/full/10.1097/MPG.0000000000002280?sid=vendor%3Adatabase

81. Jung AD. Gastroesophageal Reflux in Infants and Children. Am Fam Physician. 2001 Dec 1;64(11):1853–61.

82. Sferra TJ, Heitlinger LA. GASTROINTESTINAL GAS FORMATION AND INFANTILE COLIC. Pediatr Clin North Am. 1996 Apr 1;43(2):489–510.

83. Vilar-Compte M, Pérez-Escamilla R, Orta-Aleman D, Cruz-Villalba V, Segura-Pérez S, Nyhan K, et al. Impact of baby behaviour on caregiver's infant feeding decisions during the first 6 months of life: A systematic review. Matern Child Nutr. 2022;18(S3):e13345.

84. WESSEL MA, COBB JC, JACKSON EB, HARRIS GS JR, DETWILER AC. PAROXYSMAL FUSSING IN INFANCY, SOMETIMES CALLED "COLIC." Pediatrics. 1954 Nov 1;14(5):421–35.

85. Knappe S, Pfarr AL, Petzoldt J, Härtling S, Martini J. Parental Cognitions About Sleep Problems in Infants: A Systematic Review. Front Psychiatry [Internet]. 2020 Dec 21 [cited 2024 Oct 27];11. Available from: https://www.frontiersin.org/journals/psychiatry/articles/10.3389/fpsyt.2020.554221/full

86. Sadeh A, Mindell JA, Luedtke K, Wiegand B. Sleep and sleep ecology in the first 3 years: a web-based study. J Sleep Res. 2009;18(1):60–73.

87. Mindell JA, Leichman ES, Composto J, Lee C, Bhullar B, Walters RM. Development of infant and toddler sleep patterns: real-world data from a mobile application. J Sleep Res. 2016;25(5):508–16.

88. Field T. Infant sleep problems and interventions: A review. Infant Behav Dev. 2017 May 1;47:40–53.

89. Sinkiewicz-Darol E, Bernatowicz-Łojko U, Łubiech K, Adamczyk I, Twarużek M, Baranowska B, et al. Tandem Breastfeeding: A Descriptive Analysis of the Nutritional Value of Milk When Feeding a Younger and Older Child. Nutrients. 2021 Jan;13(1):277.

90. Morns MA, Steel AE, McIntyre E, Burns E. Breastfeeding Aversion Response (BAR): A Descriptive Study. J Midwifery Womens Health. 2023;68(4):430–41.

91. Hill DJ, Firer MA, Shelton MJ, Hosking CS. Manifestations of milk allergy in infancy: clinical and immunologic findings. J Pediatr. 1986 Aug;109(2):270–6.

92. De Greef E, Hauser B, Devreker T, Veereman-Wauters G, Vandenplas Y. Diagnosis and management of cow's milk protein allergy in infants. World J Pediatr. 2012 Feb 1;8(1):19–24.

93. Saarinen KM, Juntunen-Backman K, Järvenpää AL, Klemetti P, Kuitunen P, Lope L, et al. Breast-Feeding and the Development of Cows' Milk Protein Allergy. In: Koletzko B, Michaelsen KF, Hernell O, editors. Short and Long Term Effects of Breast Feeding on Child Health [Internet]. Boston, MA: Springer US; 2002 [cited 2024 Nov 16]. p. 121–30. Available from: https://doi.org/10.1007/0-306-46830-1_10

94. Hill DJ, Heine RG, Cameron DJ, Catto-Smith AG, Chow CW, Francis DE, et al. Role of food protein intolerance in infants with persistent distress attributed to reflux esophagitis. J Pediatr. 2000 May;136(5):641–7.

95. Hays T, Wood RA. A Systematic Review of the Role of Hydrolyzed Infant Formulas in Allergy Prevention. Arch Pediatr Adolesc Med. 2005 Sep 1;159(9):810–6.

96. Urashima M, Mezawa H, Okuyama M, Urashima T, Hirano D, Gocho N, et al. Primary Prevention of Cow's Milk Sensitization and Food Allergy by Avoiding Supplementation With Cow's Milk Formula at Birth: A Randomized Clinical Trial. JAMA Pediatr. 2019 Dec 1;173(12):1137–45.

97. Klinginsmith M, Winters R, Goldman J. Laryngomalacia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2024 Oct 27]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK544266/

98. Jaffal H, Isaac A, Johannsen W, Campbell S, El-Hakim HG. The prevalence of swallowing dysfunction in children with laryngomalacia: a systematic review. Int J Pediatr Otorhinolaryngol. 2020 Dec 1;139:110464.

99. Cooper T, Benoit M, Erickson B, El-Hakim H. Primary Presentations of Laryngomalacia. JAMA Otolaryngol Neck Surg. 2014 Jun 1;140(6):521–6.

100. Simons JP, Greenberg LL, Mehta DK, Fabio A, Maguire RC, Mandell DL. Laryngomalacia and swallowing function in children. The Laryngoscope. 2016;126(2):478–84.

101. Mills N, Keesing M, Geddes D, Mirjalili SA. Flexible Endoscopic Evaluation of Swallowing in Breastfeeding Infants With Laryngomalacia: Observed Clinical and Endoscopic Changes With Alteration of Infant Positioning at the Breast. Ann Otol Rhinol Laryngol. 2021 Jul 1;130(7):653–65.

102. Pavlovic Markovic A, Stojkovic Lalosevic M, Mijac DD, Milovanovic T, Dragasevic S, Sokic Milutinovic A, et al. Jaundice as a Diagnostic and Therapeutic Problem: A General Practitioner's Approach. Dig Dis. 2021 May 20;40(3):362–9.

103. PROVISIONAL COMMITTEE ON QUALITY IMPROVEMENT, SUBCOMMITTEE ON HYPERBILIRUBINEMIA. Practice Parameter: Management of Hyperbilirubinemia in the Healthy Term Newborn. Pediatrics. 1994 Oct 1;94(4):558–65.

104. Wang X, Chowdhury JR, Chowdhury NR. Bilirubin metabolism: Applied physiology. Curr Paediatr. 2006 Feb 1;16(1):70–4.

105. Neonatal jaundice: aetiology, diagnosis and treatment | British Journal of Hospital Medicine [Internet]. [cited 2023 Jun 8]. Available from: https://www.magonlinelibrary.com/doi/abs/10.12968/hmed.2017.78.12.699

106. Preer GL, Philipp BL. Understanding and managing breast milk jaundice. Arch Dis Child - Fetal Neonatal Ed. 2011 Nov 1;96(6):F461–6.

107. Ketsuwan S, Baiya N, Maelhacharoenporn K, Puapornpong P. The Association of Breastfeeding Practices with Neonatal Jaundice. J Med Assoc Thai. 2017 Mar 1;100:255–61.

108. Lavagno C, Camozzi P, Renzi S, Lava SAG, Simonetti GD, Bianchetti MG, et al. Breastfeeding-Associated Hypernatremia: A Systematic Review of the Literature. J Hum Lact. 2016 Feb 1;32(1):67–74.

109. Finberg L. Dehydration in Infancy and Childhood. Pediatr Rev. 2002 Aug 1;23(8):277–82.

110. Maxwell C, Fleming KM, Fleming V, Porcellato L. UK mothers' experiences of bottle refusal by their breastfed baby. Matern Child Nutr [Internet]. 2020;16(4). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-

85090925146&doi=10.1111%2fmcn.13047&partnerID=40&md5=865fa237574831c01324c499d1a403e3

111. Batista CLC, Rodrigues VP, Ribeiro VS, Nascimento MDSB. Nutritive and non-nutritive sucking patterns associated with pacifier use and bottle-feeding in full-term infants. Early Hum Dev. 2019 May 1;132:18–23.

112. Maxwell C, Fleming V, Porcellato L. Why have a bottle when you can have draught? Exploring bottle refusal by breastfed babies. Matern Child Nutr. 2023;19(2):e13481.

113. Buckley KM, Charles GE. Benefits and challenges of transitioning preterm infants to at-breast feedings. Int Breastfeed J. 2006 Aug 31;1(1):13.

114. Maternal mental health [Internet]. [cited 2023 Jul 16]. Available from: https://www.who.int/teams/mental-health-and-substance-use/promotion-prevention/maternal-mental-health

115. Dias CC, Figueiredo B. Breastfeeding and depression: A systematic review of the literature. J Affect Disord. 2015 Jan 15;171:142–54.

116. Henderson JJ, Evans SF, Straton JAY, Priest SR, Hagan R. Impact of postnatal depression on breastfeeding duration. Birth Berkeley Calif. 2003 Sep;30(3):175–80.

117. Beck CT. The effects of postpartum depression on maternal-infant interaction: a meta-analysis. Nurs Res. 1995;44(5):298–304.

118. Fallon V, Groves R, Halford JCG, Bennett KM, Harrold JA. Postpartum Anxiety and Infant-Feeding Outcomes: A Systematic Review. J Hum Lact. 2016 Nov 1;32(4):740–58.

119. Hoff CE, Movva N, Rosen Vollmar AK, Pérez-Escamilla R. Impact of Maternal Anxiety on Breastfeeding Outcomes: A Systematic Review. Adv Nutr. 2019 Sep 1;10(5):816–26.

120. Botha E, Joronen K, Kaunonen M. The consequences of having an excessively crying infant in the family: an integrative literature review. Scand J Caring Sci. 2019;33(4):779–90.

121. Yuen M, Hall OJ, Masters GA, Nephew BC, Carr C, Leung K, et al. The Effects of Breastfeeding on Maternal Mental Health: A Systematic Review. J Womens Health. 2022 Jun;31(6):787–807.

122. Infertility | CDC [Internet]. 2023 [cited 2023 Jul 11]. Available from: https://www.cdc.gov/reproductivehealth/infertility/index.htm

123. 1 in 6 people globally affected by infertility: WHO [Internet]. [cited 2023 Jul 11]. Available from: https://www.who.int/news/item/04-04-2023-1-in-6-people-globally-affected-by-infertility

124. Barrera CM, Kawwass JF, Boulet SL, Nelson JM, Perrine CG. Fertility treatment use and breastfeeding outcomes. Am J Obstet Gynecol. 2019 Mar 1;220(3):261.e1-261.e7.

125. Hammarberg K, Fisher J, Wynter K, Rowe H. Breastfeeding after assisted conception: a prospective cohort study. Acta Paediatr. 2011;100(4):529–33.

126. O'Quinn: Exclusive breastfeeding and assisted reproduct... - Google Scholar [Internet]. [cited 2023 Aug 7]. Available from: https://scholar.google.com/scholar_lookup?title=Exclusive%20breastfeeding%20and%20assisted%20reproductive%20technologies%3A%20a%20Calgary%20cohort&author=C.%20O%27Quinn&publication_year=2012

127. Ladores S, Aroian K. First-time mothers with a history of infertility: their internalized pressure to breastfeed. J Hum Lact. 2015;31(3):504–10.

128. Davanzo R. Controversies in Breastfeeding. Front Pediatr [Internet]. 2018 [cited 2023 Jul 12];6. Available from: https://www.frontiersin.org/articles/10.3389/fped.2018.00278

129. Plastic Surgery Statistics [Internet]. American Society of Plastic Surgeons. [cited 2023 Aug 7]. Available from: https://www.plasticsurgery.org/news/plastic-surgery-statistics

130. Cheng F, Dai S, Wang C, Zeng S, Chen J, Cen Y. Do Breast Implants Influence Breastfeeding? A Meta-Analysis of Comparative Studies. J Hum Lact. 2018 Aug 1;34(3):424–32.

131. Roberts CL, Ampt AJ, Algert CS, Sywak MS, Chen JSC. Reduced breast milk feeding subsequent to cosmetic breast augmentation surgery. Med J Aust. 2015;202(6):324–8.

132. Cruz NI, Korchin L. Breastfeeding after augmentation mammaplasty with saline implants. Ann Plast Surg. 2010 May;64(5):530–3.

133. Souto GC, Giugliani ERJ, Giugliani C, Schneider MA. The Impact of Breast Reduction Surgery on Breastfeeding Performance. J Hum Lact. 2003 Feb 1;19(1):43–9.

134. Kraut RY, Brown E, Korownyk C, Katz LS, Vandermeer B, Babenko O, et al. The impact of breast reduction surgery on breastfeeding: Systematic review of observational studies. PLOS ONE. 2017 Oct 19;12(10):e0186591.

135. Camargo J de F, Modenesi T de SS, Brandão MAG, Cabral IE, Pontes MB de, Primo CC. Breastfeeding experience of women after mammoplasty. Rev Esc Enferm USP. 2018 Jul 23;52:e03350.

136. Polycystic ovary syndrome [Internet]. [cited 2023 Aug 7]. Available from: https://www.who.int/news-room/fact-sheets/detail/polycystic-ovary-syndrome

137. Azziz R. Polycystic Ovary Syndrome. Obstet Gynecol. 2018 Aug;132(2):321.

138. Diabetes [Internet]. [cited 2023 Jul 14]. Available from: https://www.who.int/news-room/fact-sheets/detail/diabetes

139. Taylor JS, Kacmar JE, Nothnagle M, Lawrence RA. A Systematic Review of the Literature Associating Breastfeeding with Type 2 Diabetes and Gestational Diabetes. J Am Coll Nutr. 2005 Oct 1;24(5):320–6.

140. Hummel S, Winkler C, Schoen S, Knopff A, Marienfeld S, Bonifacio E, et al. Breastfeeding habits in families with Type 1 diabetes. Diabet Med. 2007;24(6):671–6.

141. Breastfeeding in women with diabetes: lower rates despite greater rewards. A population-based study - Finkelstein - 2013 - Diabetic Medicine - Wiley Online Library [Internet]. [cited 2023 Jun 11]. Available from: https://onlinelibrary-wiley-com.uml.idm.oclc.org/doi/full/10.1111/dme.12238

142. Thyroid Disease | Thyroid Foundation Of Canada [Internet]. [cited 2023 Aug 9]. Available from: https://thyroid.ca/thyroid-disease/

143. Speller E, Brodribb W. Breastfeeding and thyroid disease: A literature review. Breastfeed Rev. 20(2):41–7.

144. Motil KJ, Thotathuchery M, Montandon CM, Hachey DL, Boutton TW, Klein PD, et al. Insulin, Cortisol and Thyroid Hormones Modulate Maternal Protein Status and Milk Production and Composition in Humans12. J Nutr. 1994 Aug 1;124(8):1248–57.

145. Anaemia [Internet]. [cited 2023 Aug 9]. Available from: https://www.who.int/health-topics/anaemia

146. Cappellini MD, Motta I. Anemia in Clinical Practice-Definition and Classification: Does Hemoglobin Change With Aging? Semin Hematol. 2015 Oct;52(4):261–9.

147. Henly SJ, Anderson CM, Avery MD, Hills-Bonuyk SG, Potter S, Duckett LJ. Anemia and Insufficient Milk in First-Time Mothers. Birth. 1995;22(2):87–92.

148. Rioux FM, Savoie N, Allard J. Is There a Link Between Postpartum Anemia And Discontinuation of Breastfeeding? Can J Diet Pract Res. 2006 Jul;67(2):72–6.

149. Marijuana Use During Pregnancy and Lactation [Internet]. [cited 2024 Dec 19]. Available from: https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2017/10/marijuana-use-during-pregnancy-and-lactation

150. Gosdin LK. Alcohol Consumption and Binge Drinking During Pregnancy Among Adults Aged 18–49 Years — United States, 2018–2020. MMWR Morb Mortal Wkly Rep [Internet]. 2022 [cited 2024 Dec 19];71. Available from: https://www.cdc.gov/mmwr/volumes/71/wr/mm7101a2.htm

151. Kipling L. Cigarette Smoking Among Pregnant Women During the Perinatal Period: Prevalence and Health Care Provider Inquiries — Pregnancy Risk Assessment Monitoring System, United States, 2021. MMWR Morb Mortal Wkly Rep [Internet]. 2024 [cited 2024 Dec 19];73. Available from: https://www.cdc.gov/mmwr/volumes/73/wr/mm7317a2.htm

152. Canada PHA of. Perinatal Health Indicators — Canada.ca [Internet]. 2024 [cited 2024 Nov 18]. Available from: https://health-infobase.canada.ca/phi/Index

153. Winiarska-Mieczan A. Cadmium, Lead, Copper and Zinc in Breast Milk in Poland. Biol Trace Elem Res. 2014 Jan 1;157(1):36–44.

154. Napierala M, Mazela J, Merritt TA, Florek E. Tobacco smoking and breastfeeding: Effect on the lactation process, breast milk composition and infant development. A critical review. Environ Res. 2016 Nov 1;151:321–38.

155. Giglia R, Binns CW, Alfonso H. Maternal cigarette smoking and breastfeeding duration. Acta Paediatr. 2006;95(11):1370–4.

156. Reijneveld SA, Lanting CI, Crone MR, Van Wouwe JP. Exposure to tobacco smoke and infant crying. Acta Paediatr Oslo Nor 1992. 2005 Feb;94(2):217–21.

157. Haastrup MB, Pottegård A, Damkier P. Alcohol and Breastfeeding. Basic Clin Pharmacol Toxicol. 2014;114(2):168–73.

158. Mennella JA, Beauchamp GK. The transfer of alcohol to human milk. Effects on flavor and the infant's behavior. N Engl J Med. 1991 Oct 3;325(14):981–5.

159. Mennella JA, Beauchamp GK. Maternal Diet Alters the Sensory Qualities of Human Milk and the Nursling's Behavior. Pediatrics. 1991 Oct 1;88(4):737–44.

160. Cobo E, Quintero CA. Milk-ejecting and antidiuretic activities under neurohypophyseal inhibition with alcohol and water overload. Am J Obstet Gynecol. 1969 Nov 15;105(6):877–87.

161. Popova S, Dozet D, Akhand Laboni S, Brower K, Temple V. Why do women consume alcohol during pregnancy or while breastfeeding? Drug Alcohol Rev. 2022;41(4):759–77.

162. CDC. Alcohol and Breastfeeding [Internet]. Centers for Disease Control and Prevention. 2023 [cited 2023 Oct 22]. Available from: https://www.cdc.gov/breastfeeding/breastfeeding-special-circumstances/vaccinations-medications-drugs/alcohol.html

163. Hypertension in Pregnancy: Executive Summary. Obstet Gynecol. 2013 Nov;122(5):1122.

164. Leeners B, Rath W, Kuse S, Neumaier-Wagner P. Breast-feeding in women with hypertensive disorders in pregnancy. J Perinat Med. 2005;33(6):553–60.

165. Huang Y, Ouyang YQ, Redding SR. Previous breastfeeding experience and its influence on breastfeeding outcomes in subsequent births: A systematic review. Women Birth. 2019 Aug 1;32(4):303–9.

166. Palmér L. Previous breastfeeding difficulties: an existential breastfeeding trauma with two intertwined pathways for future breastfeeding—fear and longing. Int J Qual Stud Health Well-Being. 2019 Jan 1;14(1).

167. Hackman NM, Schaefer EW, Beiler JS, Rose CM, Paul IM. Breastfeeding Outcome Comparison by Parity. Breastfeed Med. 2015 Apr;10(3):156–62.

168. Kronborg H, Harder I, Hall EOC. First time mothers' experiences of breastfeeding their newborn. Sex Reprod Healthc. 2015 Jun 1;6(2):82–7.

169. Andrew MS, Selvaratnam RJ, Davies-Tuck M, Howland K, Davey MA. The association between intrapartum interventions and immediate and ongoing breastfeeding outcomes: an Australian retrospective population-based cohort study. Int Breastfeed J. 2022 Jul 5;17(1):48.

170. Simpson KR. Cervical Ripening and Labor Induction and Augmentation, 5th Edition. Nurs Womens Health. 2020 Aug 1;24(4):S1–41.

171. Brindley BA, Sokol RJ. Induction and Augmentation of Labor: Basis and Methods for Current Practice. Obstet Gynecol Surv. 1988 Dec;43(12):730.

172. Zanardo V, Bertin M, Sansone L, Felice L. The adaptive psychological changes of elective induction of labor in breastfeeding women. Early Hum Dev. 2017 Jan 1;104:13–6.

173. Liu L, Rekawek P, Cadet J, Monro J, Naert M, Stone J. 870: Exogenous oxytocin for labor induction or augmentation is associated with a decrease in breastfeeding success. Am J Obstet Gynecol. 2020 Jan 1;222(1):S544.

174. Cadwell K, Brimdyr K. Intrapartum administration of synthetic oxytocin and downstream effects on breastfeeding: elucidating physiologic pathways. Ann Nurs Res Pr. 2017;2(3):1024.

175. Kujawa-Myles S, Noel-Weiss J, Dunn S, Peterson WE, Cotterman KJ. Maternal intravenous fluids and postpartum breast changes: a pilot observational study. Int Breastfeed J. 2015 Jun 2;10(1):18.

176. Miller V, Riordan J. Treating postpartum breast edema with areolar compression. J Hum Lact Off J Int Lact Consult Assoc. 2004 May;20(2):223–6.

177. Watson J, Hodnett E, Armson BA, Davies B, Watt-Watson J. A Randomized Controlled Trial of the Effect of Intrapartum Intravenous Fluid Management on Breastfed Newborn Weight Loss. J Obstet Gynecol Neonatal Nurs. 2012 Jan 1;41(1):24–32.

178. Giudicelli M, Hassler M, Blanc J, Zakarian C, Tosello B. Influence of intrapartum maternal fluids on weight loss in breastfed newborns. J Matern Fetal Neonatal Med. 2022 Feb 16;35(4):692–8.

179. Rich M, Dowling S, Bray I. Maternal intrapartum fluids and neonatal weight loss in the breastfed infant. Br J Midwifery. 2023 Jun 2;31(6):344–51.

180. Chantry CJ, Nommsen-Rivers LA, Peerson JM, Cohen RJ, Dewey KG. Excess Weight Loss in First-Born Breastfed Newborns Relates to Maternal Intrapartum Fluid Balance. Pediatrics. 2011 Jan 1;127(1):e171–9.

181. Health Indicators Interactive Tool [Internet]. [cited 2023 Oct 14]. Available from: https://yourhealthsystem.cihi.ca/epub/SearchServlet

182. Annual Statistics | Health [Internet]. Province of Manitoba - Health. [cited 2024 Sep 23]. Available from: https://www.gov.mb.ca/health/annstats/index.html

183. Leth RA, Møller JK, Thomsen RW, Uldbjerg N, Nørgaard M. Risk of selected postpartum infections after cesarean section compared with vaginal birth: a five-year cohort study of 32,468 women. Acta Obstet Gynecol Scand. 2009 Sep;88(9):976–83.

184. Ahnfeldt-Mollerup P, Petersen LK, Kragstrup J, Christensen RD, Sørensen B. Postpartum infections: occurrence, healthcare contacts and association with breastfeeding. Acta Obstet Gynecol Scand. 2012;91(12):1440–4.

185. Prior E, Santhakumaran S, Gale C, Philipps LH, Modi N, Hyde MJ. Breastfeeding after cesarean delivery: a systematic review and meta-analysis of world literature. Am J Clin Nutr. 2012 May 1;95(5):1113–35.

186. Chien LY, Tai CJ. Effect of Delivery Method and Timing of Breastfeeding Initiation on Breastfeeding Outcomes in Taiwan. Birth. 2007;34(2):123–30.

187. French CA, Cong X, Chung KS. Labor epidural analgesia and breastfeeding: a systematic review. J Hum Lact. 2016;32(3):507–20.

188. Youngstrom PC, Baker SW, Miller JL. Epidurals Redefined in Analgesia and Anesthesia: A Distinction With a Difference. J Obstet Gynecol Neonatal Nurs. 1996 May 1;25(4):350–4.

189. Orbach-Zinger S, Landau R, Davis A, Oved O, Caspi L, Fireman S, et al. The Effect of Labor Epidural Analgesia on Breastfeeding Outcomes: A Prospective Observational Cohort Study in a Mixed-Parity Cohort. Anesth Analg. 2019 Sep;129(3):784.

190. Mahomed K, Wild K, Brown C, Green A. Does fentanyl epidural analgesia affect breastfeeding: A prospective cohort study. Aust N Z J Obstet Gynaecol. 2019;59(6):819–24.

191. WHO postpartum haemorrhage (PPH) summit [Internet]. [cited 2023 Aug 13]. Available from: https://www.who.int/publications/m/item/who-postpartum-haemorrhage-(pph)-summit

192. Thompson JF, Heal LJ, Roberts CL, Ellwood DA. Women's breastfeeding experiences following a significant primary postpartum haemorrhage: A multicentre cohort study. Int Breastfeed J. 2010 May 27;5(1):5.

193. Dökmetaş HS, Kilicli F, Korkmaz S, Yonem O. Characteristic features of 20 patients with Sheehan's syndrome. Gynecol Endocrinol. 2006 Jan 1;22(5):279–83.

194. Sert M, Tetiker T, Kirim S, Kocak M. Clinical report of 28 patients with Sheehan's syndrome. Endocr J. 2003 Jun;50(3):297–301.

195. Manual removal of the placenta - a case control study - Titiz - 2001 - Australian and New Zealand Journal of Obstetrics and Gynaecology - Wiley Online Library [Internet]. [cited 2023 Jul 18]. Available from: https://obgyn-onlinelibrary-wiley-com.uml.idm.oclc.org/doi/abs/10.1111/j.1479-828X.2001.tb01292.x

196. Anderson AM. Disruption of Lactogenesis by Retained Placental Fragments. J Hum Lact. 2001 May 1;17(2):142–4.

197. Skin-to-skin contact [Internet]. Baby Friendly Initiative. [cited 2023 Jun 18]. Available from: https://www.unicef.org.uk/babyfriendly/baby-friendly-resources/implementing-standards-resources/skin-to-skin-contact/

198. Mahmood I, Jamal M, Khan N. Effect of mother-infant early skin-to-skin contact on breastfeeding status: a randomized controlled trial. J Coll Physicians Surg Pak. 2011;21(10):601–5.

199. Effect of immediate and continuous mother–infant skin-to-skin contact on breastfeeding self-efficacy of primiparous women: A randomised control trial - ScienceDirect [Internet]. [cited 2023 Jun 18]. Available from: https://www-sciencedirect-com.uml.idm.oclc.org/science/article/pii/S1871519213004010

200. Karimi FZ, Sadeghi R, Maleki-Saghooni N, Khadivzadeh T. The effect of mother-infant skin to skin contact on success and duration of first breastfeeding: A systematic review and meta-analysis. Taiwan J Obstet Gynecol. 2019 Jan 1;58(1):1–9.

201. Ten steps to successful breastfeeding [Internet]. [cited 2023 Nov 30]. Available from: https://www.who.int/teams/nutrition-and-food-safety/food-and-nutrition-actions-in-health-systems/ten-steps-to-successful-breastfeeding

202. Effectiveness of biological nurturing on early breastfeeding problems: a randomized controlled trial | International Breastfeeding Journal [Internet]. [cited 2024 Oct 27]. Available from: https://link.springer.com/article/10.1186/s13006-020-00261-4

203. Feeding Patterns of Healthy Term Newborns in the First 5 Days—The Glucose in Well Babies Study (GLOW) - Deborah L Harris, Philip J Weston, Jane E Harding, 2022 [Internet]. [cited 2024 Oct 28]. Available from: https://journals.sagepub.com/doi/abs/10.1177/08903344221087605

204. Knowledge and Use of Paced Bottle-Feeding Among Mothers of Young Infants - ScienceDirect [Internet]. [cited 2024 Oct 28]. Available from: https://www.sciencedirect.com/science/article/pii/S1499404623004724

205. Summary Safety Review - Domperidone - Assessing the Potential Risk of Psychiatric Withdrawal Events when Used for Lactation Stimulation [Internet]. [cited 2024 Dec 2]. Available from: https://dhpp.hpfb-dgpsa.ca/review-documents/resource/SSR1691692252806

206. Shen Q, Khan KS, Du MC, Du WW, Ouyang YQ. Efficacy and Safety of Domperidone and Metoclopramide in Breastfeeding: A Systematic Review and Meta-Analysis. Breastfeed Med. 2021 Jul;16(7):516–29.

207. Paul C, Zénut M, Dorut A, Coudoré MA, Vein J, Cardot JM, et al. Use of Domperidone as a Galactagogue Drug: A Systematic Review of the Benefit-Risk Ratio. J Hum Lact. 2015 Feb 1;31(1):57–63.

208. Dennis CL, Schottle N, Hodnett E, McQueen K. An All-Purpose Nipple Ointment Versus Lanolin in Treating Painful Damaged Nipples in Breastfeeding Women: A Randomized Controlled Trial. Breastfeed Med. 2012 Dec;7(6):473–9.

209. Chow S, Chow R, Popovic M, Lam H, Merrick J, Ventegodt S, et al. The Use of Nipple Shields: A Review. Front Public Health [Internet]. 2016 Nov 1 [cited 2024 Oct 27];3. Available from: https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2015.00236/full

210. Flyconazole V, Over APNOA. What is thrush? [cited 2024 Oct 27]; Available from: http://thebcs.ca/documents/factsheets/2015/THRUSH.pdf

211. Dodd V, Chalmers C. Comparing the Use of Hydrogel Dressings to Lanolin Ointment With Lactating Mothers. J Obstet Gynecol Neonatal Nurs. 2003;32(4):486–94.

212. International BreastFeeding Centre – Home of the world-renowned Newman Breastfeeding Clinic [Internet]. [cited 2024 Dec 3]. Available from: https://ibconline.ca/

213. Well Fed Clinic | Breastfeeding & Postpartum support Calgary, AB [Internet]. [cited 2024 Nov 17]. Available from: https://wellfedclinic.com/

214. Clinic OB. Ontario Breastfeeding Clinic [Internet]. Ontario Breastfeeding Clinic. [cited 2024 Dec 3]. Available from: https://ontariobreastfeedingclinic.ca/home-1

215. Lamontagne C, Hamelin AM, St-Pierre M. The breastfeeding experience of women with major difficulties who use the services of a breastfeeding clinic: A descriptive study. Int Breastfeed J. 2008 Aug 5;3(1):1–13.

216. Grolemund G, Wickham H. Dates and Times Made Easy with lubridate. J Stat Softw. 2011;40(3):1–25.

217. Grosser M. snakecase: Convert Strings into any Case [Internet]. 2023. Available from: https://CRAN.R-project.org/package=snakecase

218. Robinson D, Hayes A, Couch S. broom: Convert Statistical Objects into Tidy Tibbles [Internet]. 2024. Available from: https://CRAN.R-project.org/package=broom

219. Wickham H, Vaughan D, Girlich M. tidyr: Tidy Messy Data [Internet]. 2024. Available from: https://CRAN.R-project.org/package=tidyr

220. Wickham H. ggplot2: Elegant Graphics for Data Analysis [Internet]. Springer-Verlag New York; 2016. Available from: https://ggplot2.tidyverse.org

221. Pebesma E, Bivand R, Racine E, Sumner M, Cook I, Keitt T, et al. sf: Simple Features for R [Internet]. 2024 [cited 2024 Nov 5]. Available from: https://cran.r-project.org/web/packages/sf/index.html

222. Wickham H, François R, Henry L, Müller K, Vaughan D. dplyr: A Grammar of Data Manipulation [Internet]. 2023. Available from: https://CRAN.R-project.org/package=dplyr

223. Wickham H, Averick M, Bryan J, Chang W, McGowan LD, François R, et al. Welcome to the tidyverse. J Open Source Softw. 2019;4(43):1686.

224. Wickham H. stringr: Simple, Consistent Wrappers for Common String Operations [Internet]. 2023. Available from: https://CRAN.R-project.org/package=stringr

225. Silge J, Robinson D. tidytext: Text Mining and Analysis Using Tidy Data Principles in R. JOSS [Internet]. 2016;1(3). Available from: http://dx.doi.org/10.21105/joss.00037

226. Müller K. here: A Simpler Way to Find Your Files [Internet]. 2020. Available from: https://CRAN.R-project.org/package=here

227. Wilke CO, Wiernik BM. ggtext: Improved Text Rendering Support for “ggplot2” [Internet]. 2022. Available from: https://CRAN.R-project.org/package=ggtext

228. Sjoberg DD, Whiting K, Curry M, Lavery JA, Larmarange J. Reproducible Summary Tables with the gtsummary Package. R J. 2021;13(1):570–80.

229. Schauberger P, Walker A. openxlsx: Read, Write and Edit xlsx Files [Internet]. 2024. Available from: https://CRAN.R-project.org/package=openxlsx

230. Wickham H. Reshaping Data with the reshape Package. J Stat Softw. 2007;21(12):1–20.

231. Ooms J. writexl: Export Data Frames to Excel “xlsx” Format [Internet]. 2024. Available from: https://CRAN.R-project.org/package=writexl

232. Allaire JJ, Xie Y, Dervieux C, McPherson J, Luraschi J, Ushey K, et al. rmarkdown: Dynamic Documents for R [Internet]. 2024. Available from: https://github.com/rstudio/rmarkdown

233. Slowikowski K. ggrepel: Automatically Position Non-Overlapping Text Labels with “ggplot2” [Internet]. 2024. Available from: https://CRAN.R-project.org/package=ggrepel

234. Wickham H, Bryan J. readxl: Read Excel Files [Internet]. 2023. Available from: https://CRAN.R-project.org/package=readxl

235. Xie Y. knitr: A General-Purpose Package for Dynamic Report Generation in R [Internet]. 2024. Available from: https://yihui.org/knitr/

236. Milinco M, Travan L, Cattaneo A, Knowles A, Sola MV, Causin E, et al. Effectiveness of biological nurturing on early breastfeeding problems: a randomized controlled trial. Int Breastfeed J. 2020 Apr 5;15(1):21.

237. Health Inequities in Manitoba: Is the Socioeconomic Gap in Health Widening or Narrowing Over Time? | MCHP Concept Dictionary and Glossary for Population-Based Research | Max Rady College of Medicine | University of Manitoba [Internet]. [cited 2023 Sep 25]. Available from: http://mchp-appserv.cpe.umanitoba.ca/deliverable.php?referencePaperID=76460

238. Government of Canada SC. 2021 Census Boundary files [Internet]. 2021 [cited 2024 Dec 7]. Available from: https://www12.statcan.gc.ca/census-recensement/2021/geo/sip-pis/boundary-limites/index2021-eng.cfm?year=21

239. RHA Finder | Province of Manitoba [Internet]. Province of Manitoba - Health. [cited 2024 Dec 7]. Available from: //www.gov.mb.ca/health/rha/finder.html

240. Concept: Winnipeg Area Definitions [Internet]. [cited 2024 Dec 7]. Available from: http://mchp-appserv.cpe.umanitoba.ca/viewConcept.php?conceptID=1311

241. Direct Marketing Tools - prospectsinfluential.com [Internet]. [cited 2024 Dec 7]. Available from: https://www.prospectsinfluential.com/list-brokers-resources/direct-marketing-tools/

242. canada post lit of FSA - Google Search [Internet]. [cited 2025 Jan 1]. Available from: https://www.google.com/search?q=canada+post+lit+of+FSA&rlz=1C1GCEU_enCA1119CA1119&oq=canada+post+lit+of+FSA&gs_lcrp=EgZjaHJvbWUyBggAEEUYOdIBCDQ4MDVqMGo3qAIAsAIA&sourceid=chrome&ie=UTF-8

243. Census Forward Sortation Area Boundary File [Internet]. [cited 2024 Nov 9]. Available from: https://www150.statcan.gc.ca/n1/en/catalogue/92-179-X

244. Alliance (UK) NG. Weight loss in the early days of life. In: Faltering Growth – recognition and management [Internet]. National Institute for Health and Care Excellence (NICE); 2017 [cited 2024 Dec 10]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK536449/

245. Perinatal Services and Outcomes in Manitoba [Internet]. [cited 2023 Sep 26]. Available from: http://mchp-appserv.cpe.umanitoba.ca/deliverable.php?referencePaperID=76742

246. Canada PHA of. Chapter 4: Care during labour and birth [Internet]. 2018 [cited 2024 Dec 12]. Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/maternity-newborn-care-guidelines-chapter-4.html

247. Government of Canada SC. Live births, by weeks of gestation [Internet]. 2018 [cited 2024 Dec 11]. Available from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310042501

248. Canada PHA of. Maternal hypertension in Canada [Internet]. 2016 [cited 2024 Dec 10]. Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/maternal-hypertension-canada.html

249. Anaemia in women and children [Internet]. [cited 2024 Dec 10]. Available from: https://www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children

250. Canada PHA of. Snapshot of Diabetes in Canada, 2023 [Internet]. 2023 [cited 2024 Dec 10]. Available from: https://www.canada.ca/en/public-health/services/publications/diseases-conditions/snapshot-diabetes-canada-2023.html

251. Sgro M, Campbell D, Shah V. Incidence and causes of severe neonatal hyperbilirubinemia in Canada. CMAJ. 2006 Sep 12;175(6):587–90.

252. Perinatal Services and Outcomes in Manitoba [Internet]. [cited 2023 Nov 8]. Available from: http://mchp-appserv.cpe.umanitoba.ca/deliverable.php?referencePaperID=76742

253. Kitano N, Nomura K, Kido M, Murakami K, Ohkubo T, Ueno M, et al. Combined effects of maternal age and parity on successful initiation of exclusive breastfeeding. Prev Med Rep. 2016 Jun 1;3:121–6.

254. The Health of Rural Canadians: A Rural-Urban Comparison of Health Indicators - ARCHIVED [Internet]. [cited 2024 Nov 18]. Available from: https://www150.statcan.gc.ca/n1/pub/21-006-x/21-006-x2002006-eng.pdf

255. Health Care Access of Northern Residents | Rural Development Institute [Internet]. [cited 2024 Nov 18]. Available from: https://www.brandonu.ca/rdi/projects/health-care-access-of-northern-residents/

256. Seiger ER, Wasser HM, Hutchinson SA, Foster G, Sideek R, Martin SL. Barriers to Providing Lactation Services and Support to Families in Appalachia: A Mixed-Methods Study With Lactation Professionals and Supporters. Am J Public Health. 2022 Oct;112(S8):S797–806.

257. Canada H. Canadian Alcohol and Drugs Survey (CADS): summary of results for 2019 [Internet]. 2021 [cited 2024 Nov 18]. Available from: https://www.canada.ca/en/health-canada/services/canadian-alcohol-drugs-survey/2019-summary.html

258. Brown A, Jordan S. Impact of birth complications on breastfeeding duration: an internet survey. J Adv Nurs. 2013;69(4):828–39.

259. Al-Zirqi I, Vangen S, Forsen L, Stray-Pedersen B. Prevalence and risk factors of severe obstetric haemorrhage. BJOG Int J Obstet Gynaecol. 2008;115(10):1265–72.

260. Acker DS, Sachs BP, Friedman EA. Risk Factors for Shoulder Dystocia. Obstet Gynecol. 1985 Dec;66(6):762.

261. Haram K, Svendsen E, Abildgaard U. The HELLP syndrome: Clinical issues and management. A Review. BMC Pregnancy Childbirth. 2009 Feb 26;9(1):8.

262. Leung GM, Lam TH, Ho LM. Breast-feeding and its relation to smoking and mode of delivery. Obstet Gynecol. 2002 May 1;99(5, Part 1):785–94.

263. Ahluwalia IB, Li R, Morrow B. Breastfeeding Practices: Does Method of Delivery Matter? Matern Child Health J. 2012 Dec 1;16(2):231–7.

264. Tita ATN, Rouse DJ, Blackwell S, Saade GR, Spong CY, Andrews WW. Emerging Concepts in Antibiotic Prophylaxis for Cesarean Delivery: A Systematic Review. Obstet Gynecol. 2009 Mar;113(3):675.

265. Liabsuetrakul T, Choobun T, Peeyananjarassri K, Islam QM. Antibiotic prophylaxis for operative vaginal delivery - Liabsuetrakul, T - 2020 | Cochrane Library. [cited 2024 Nov 3]; Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD004455.pub5/full

266. Dalili H, Baghersalimi A, Dalili S, Pakdaman F, Hassanzadeh Rad A, Abbasi Kakroodi M, et al. Is there any relation between Duration of breastfeeding and anemia? Iran J Pediatr Hematol Oncol. 2015;5(4):218–26.

267. Marques RFSV, Taddei JAAC, Lopez FA, Braga JAP. Breastfeeding exclusively and iron deficiency anemia during the first 6 months of age. Rev Assoc Médica Bras. 2014 Feb;60:18–22.

268. Canada PHA of. Pregnancy and Women's Mental Health in Canada [Internet]. 2016 [cited 2024 Dec 12]. Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/pregnancy-women-mental-health-canada.html

269. Nicholls-Dempsey L, Badeghiesh A, Baghlaf H, Dahan MH. How does high socioeconomic status affect maternal and neonatal pregnancy outcomes? A population-based study among American women. Eur J Obstet Gynecol Reprod Biol X. 2023 Dec 1;20:100248.

270. 2025 ICD-10-CM Diagnosis Code P92.5: Neonatal difficulty in feeding at breast [Internet]. [cited 2024 Dec 11]. Available from: https://www.icd10data.com/ICD10CM/Codes/P00-P96/P90-P96/P92-/P92.5

271. Oliveira CS de, Iocca FA, Carrijo MLR, Garcia R de ATM. Breastfeeding and complications that contribute to early weaning. Rev Gaúcha Enferm. 2015;36:16–23.

272. Wagner EA, Chantry CJ, Dewey KG, Nommsen-Rivers LA. Breastfeeding concerns at 3 and 7 days postpartum and feeding status at 2 months. Pediatrics. 2013 Oct;132(4):e865-875.

273. Gianni ML, Bettinelli ME, Manfra P, Sorrentino G, Bezze E, Plevani L, et al. Breastfeeding difficulties and risk for early breastfeeding cessation. Nutrients. 2019;11(10).

274. Waterman J, Lee T, Etchegary H, Drover A, Twells L. Mothers' experiences of breastfeeding a child with tongue-tie. Matern Child Nutr. 2021;17(2):e13115.

275. Gatti L. Maternal Perceptions of Insufficient Milk Supply in Breastfeeding. J Nurs Scholarsh. 2008;40(4):355–63.

276. Karaçam Z, Sağlık M. Breastfeeding problems and interventions performed on problems: systematic review based on studies made in Turkey. Turk Arch Pediatr Pediatri Arş. 2018 Sep 1;53(3):134–48.

277. McFadden A, Siebelt L, Marshall JL, Gavine A, Girard LC, Symon A, et al. Counselling interventions to enable women to initiate and continue breastfeeding: a systematic review and meta-analysis. Int Breastfeed J. 2019 Oct 21;14(1):42.

278. Karaçam Z. Factors affecting exclusive breastfeeding of healthy babies aged zero to four months: a community-based study of Turkish women. J Clin Nurs. 2008;17(3):341–9.

279. Almqvist-Tangen G, Bergman S, Dahlgren J, Roswall J, Alm B. Factors associated with discontinuation of breastfeeding before 1 month of age. Acta Paediatr. 2012;101(1):55–60.

280. Hannula L, Kaunonen M, Tarkka MT. A systematic review of professional support interventions for breastfeeding. J Clin Nurs. 2008;17(9):1132–43.

281. Breastfeeding and the adjustment process in the family context: a qualitative approach/Aleitamento materno e o processo de adaptaÃ§Ã£o no contexto familiar: abordagem qualitativa. - Document - Gale OneFile: Health and Medicine [Internet]. [cited 2024 Nov 1]. Available from: https://go-gale-com.uml.idm.oclc.org/ps/i.do?p=HRCA&u=univmanitoba&id=GALE%7CA785992411&v=2.1&it=r

282. Winnipeg West Evening | La Leche League Canada - Breastfeeding Support and Information [Internet]. [cited 2024 Feb 20]. Available from: https://www.lllc.ca/winnipeg-west-evening

283. Breastfeeding Hotline [Internet]. Misericordia Health Centre. [cited 2024 Nov 18]. Available from: https://misericordia.mb.ca/programs/phcc/breastfeeding-hotline/

284. Breastfeeding Resources • Healthy Parenting Winnipeg [Internet]. [cited 2023 Oct 17]. Available from: https://healthyparentingwinnipeg.ca/breastfeeding-resources/

285. Name A. Healthy Baby | Child and Youth Programs | Province of Manitoba [Internet]. [cited 2024 Feb 24]. Available from: https://www.gov.mb.ca/healthychild/healthybaby/index.html

286. Name A. Healthy Baby Community Support Programs | Child and Youth Programs | Province of Manitoba [Internet]. [cited 2024 Nov 18]. Available from: https://www.gov.mb.ca/healthychild/healthybaby/csp.html

287. Getting Help with Breastfeeding - Baby Friendly Manitoba [Internet]. Province of Manitoba - Health. [cited 2023 Aug 17]. Available from: https://www.gov.mb.ca/health/bfm/help.html

288. Kleiman K, Wenzel A. Principles of Supportive Psychotherapy for Perinatal Distress. J Obstet Gynecol Neonatal Nurs. 2017 Nov 1;46(6):895–903.

289. Misch DA. Basic Strategies of Dynamic Supportive Therapy. Focus. 2006 Apr;4(2):253–68.

290. Freeman MP, Davis MF. Supportive psychotherapy for perinatal depression: preliminary data for adherence and response. Depress Anxiety. 2010;27(1):39–45.

291. Bronisch T. Adjustment reactions: a long-term prospective and retrospective follow-up of former patients in a crisis intervention ward. Acta Psychiatr Scand. 1991;84(1):86–93.

292. CMDh confirms recommendations on restricting use of domperidone-containing medicines | European Medicines Agency (EMA) [Internet]. 2014 [cited 2024 Nov 18]. Available from: https://www.ema.europa.eu/en/news/cmdh-confirms-recommendations-restricting-use-domperidone-containing-medicines

293. Indraratna P, Tardo D, Delves M, Szirt R, Ng B. Measurement and Management of QT Interval Prolongation for General Physicians. J Gen Intern Med. 2020 Mar 1;35(3):865–73.

294. McBride GM, Rumbold AR, Keir AK, Kunnel A, Buxton M, Jones S, et al. Longitudinal trends in domperidone dispensing to mothers of very preterm infants and its association with breast milk feeding at infant discharge: a retrospective study. BMJ Paediatr Open [Internet]. 2023 Nov 3 [cited 2024 Nov 18];7(1). Available from: https://bmjpaedsopen.bmj.com/content/7/1/e002195

295. Government of Canada SC. Three in five Canadians seeking care used virtual healthcare services during the COVID-19 pandemic [Internet]. 2023 [cited 2024 Nov 3]. Available from: https://www.statcan.gc.ca/o1/en/plus/4968-three-five-canadians-seeking-care-used-virtual-healthcare-services-during-covid-19

296. Registrants' Directory - The College of Physicians & Surgeons of Manitoba [Internet]. [cited 2024 Nov 19]. Available from: https://cpsm.mb.ca/physicians-directory

297. Manitoba C of RN of. 2023 Annual Report [Internet]. College of Registered Nurses of Manitoba. [cited 2024 Nov 19]. Available from: https://www.crnm.mb.ca/resource/2023-annual-report/

298. Manitoba C of RN of. Registered Nurses & Nurse Practitioners [Internet]. College of Registered Nurses of Manitoba. [cited 2024 Dec 12]. Available from: https://www.crnm.mb.ca/rns-nps/

299. Annual Reports - The College of Physicians & Surgeons of Manitoba [Internet]. [cited 2024 Dec 12]. Available from: https://www.cpsm.mb.ca/about-us/annual-reports

300. Costanian C, Macpherson AK, Tamim H. Inadequate prenatal care use and breastfeeding practices in Canada: a national survey of women. BMC Pregnancy Childbirth. 2016 May 5;16(1):100.

301. Farver MC. A model for outpatient lactation care. MOJ Womens Health. 2012;2:49–55.

302. Information bias | Catalog of Bias [Internet]. [cited 2024 Dec 12]. Available from: https://catalogofbias.org/biases/information-bias/

303. ICD-11 [Internet]. [cited 2025 Feb 11]. Available from: https://icd.who.int/en

304. Størdal K, Ma A, Beck CE. Reducing the use of proton pump inhibitors in infants with reflux symptoms. BMJ. 2024 May 30;385:e074588.

305. Anderson PO. Drug Treatment of Raynaud's Phenomenon of the Nipple. Breastfeed Med. 2020 Nov;15(11):686–8.

306. Amir LH, Crawford SB, Cullinane M, Grzeskowiak LE. General practitioners' management of mastitis in breastfeeding women: a mixed method study in Australia. BMC Prim Care. 2024 May 10;25(1):161.

307. Lv X, Feng R, Zhai J. A combination of mupirocin and acidic fibroblast growth factor for nipple fissure and nipple pain in breastfeeding women: protocol for a randomised, double-blind, controlled trial. BMJ Open. 2019 Mar 1;9(3):e025526.

308. McGuinness N, Cording V. Raynaud's Phenomenon of the Nipple Associated with Labetalol Use. J Hum Lact. 2013 Feb 1;29(1):17–9.

309. Howland RH. Managing Common Side Effects of SSRIs. J Psychosoc Nurs Ment Health Serv. 45(2):15–8.