EXPLORING THE POSTNATAL CARE EXPERIENCE & THE OPPORTUNITY OF mHEALTH TO IMPROVE PSYCHOSOCIAL OUTCOMES: THE DEVELOPMENT OF ESSENTIAL COACHING FOR EVERY MOTHER

by

Justine Sarah Dol

Submitted in partial fulfilment of the requirements
for the degree of Doctor of Philosophy

at

Dalhousie University
Halifax, Nova Scotia
March 2021

Dedication Page

To my husband Fadi. Thank you for your unwavering support throughout this journey. I couldn't have done any of this without you nor would I have wanted to.

Also, to my mom Chris. For instilling in me a passion for education, allowing me to skip high school to spend the day with you at Western, where my desire for a PhD was born. For your endless support of my learning and your years of editing my papers.

Table of Contents

List of Tables

List of Figures

Abstract

Introduction: After birth, some women struggle with low self-efficacy and social support and higher rates of anxiety and depression. Some women also find this a challenging time to access quality information and support. Mobile health (mHealth) interventions, particularly text messaging, holds significant promise in bridging this gap. Yet little is known about the Canadian postpartum experience. The purpose of this research is to explore (1) mothers' postpartum psychosocial adjustment in the Maritime provinces and (2) the opportunity to improve maternal psychosocial outcomes through mHealth technology.

Methods: This dissertation contains four studies. Manuscript 1 and 2 emerge from a mixed methods online survey with 561 postpartum women across the Maritime provinces. Manuscript 3 is a Joanna Briggs Institute systematic review to synthesize available information on mother-targeted mHealth interventions in the perinatal period. Manuscript 4 used an iterative design with 11 women and 18 healthcare providers to guide the development of *Essential Coaching for Every Mother*.

Results: While many women in the Maritimes experienced satisfactory postpartum care, there were areas where women reported dissatisfaction and facing challenges. Primiparous women had lower self-efficacy and higher postpartum anxiety than multiparous women. Women with older infants (4-6 months) had lower perceived social support and higher levels of postpartum anxiety and postpartum depression than women with younger infants (0-3 months). While outcomes of mHealth interventions on anxiety, social support, and self-efficacy was predominantly inconclusive, mHealth interventions that targeted postpartum depression had a significant positive impact for women who received the intervention. After three rounds of iterative interviewing, 58 messages for *Essential Coaching for Every Mother* were developed that focused on well-baby and well-mother care.

Conclusions: This dissertation addressed a critical gap in the literature that links postpartum care experience and postpartum psychosocial adjustment and the opportunity of mHealth to address these challenges. With the development of *Essential Coaching for Every Mother*, the hope is to assist women in their postpartum transition through the development of an evidence-based postpartum text message program designed to improve women's self-efficacy, social support, postpartum anxiety, and postpartum depression during the first six-weeks postpartum.

List of Abbreviations Used

App - application

eHealth – electronic health

EPDS – Edinburgh Postpartum Depression Scale

JBI – Joanna Briggs Institute

mHeath – mobile health

MSPSS – Multidimensional Scale of Perceived Social Support

NB – New Brunswick

NICU – Neonatal Intensive Care Unit

OB – Obstetrician

PEI – Prince Edward Island

PSAS – Postpartum Specific Anxiety Scale

RCT – Randomized Controlled Trial

SMS – Short Messaging Service

STAI – State-Trait Anxiety Inventory

WHO – World Health Organization

Acknowledgements

I want to thank my supervisor, Dr. Marsha Campbell-Yeo, for your support throughout my PhD. Your willingness to let me set my own course and pursue my research questions resulted in a rich and fulfilling PhD journey. Thank you for the mentorship and guidance you have provided throughout the past 5 years.

To my committee members, Dr. Gail Tomblin Murphy, Dr. Megan Aston, and Dr. Douglas McMillan. Thank you all for your unwavering support and your contribution of valuable time and feedback to my dissertation and beyond. I truly appreciate the opportunity to have had to work with each of you.

To my mentor and employer throughout my PhD journey, Dr. Christine Chambers. I am beyond thankful to have had your insight and mentorship over the past several years. Your unbiased advice and endless reference letters mean more than you will know.

To my external examiner, Dr. Patrick Leahy Warren. I am honoured to have you read my dissertation and I look forward to the opportunity to discuss this research with you.

To current and former members of the MOM-LINC lab and the Chambers' lab, I am thankful for the opportunity to share research ideas as well as life journeys with you which made my PhD experience truly outstanding. I feel blessed to have had the opportunity to be rooted in two amazing research labs throughout my PhD. In particular, I would like to acknowledge Dr. Britney Benoit for leading the way for PhD students in the MOM-LINC lab and providing an outstanding example to follow; Brianna Hughes (Richardson) for your friendship throughout this process and being my run and

systematic review buddy; and Joelle Monaghen for your laughter, friendship, and answering my random Public Health texts. In the Chambers' lab, I would like to thank Dr. Katelynn Boerner for your friendship and providing a wonderful dissertation to reference and Dr. Jennifer Parker for your never-failing listening ear, unwavering support, and true friendship.

I would like to thank the funders who have made my PhD possible: Canadian Institutes of Health Research, Dalhousie University, IWK Health, Research Nova Scotia (formerly Nova Scotia Health Research Foundation), and the Maritime SPOR Support Unit.

I would like to thank fellow PhD students who I have had the pleasure of meeting and bonding with during this journey. Dr. Phillip Joy – thanks for the ongoing conversations and regular bubble tea trips. Rachel Ollivier for your friendship and your participation in the World's Challenge Challenge with myself and Brianna. To Logan and Bonita for leading the way as the first PhD in Health cohort students and to my PhD cohort - Crystal, Jeff, Mel, Neda, Adria, and Sara - what a great bunch of scholars to be associated with! I would also like to extend thanks to the coordinators and administrators of the PhD Health program – Dr. John Kozey and Dr. Shaun Boe for your oversight of the program and Niki Power (PhD Mom) and Heather Gallent for your support throughout the program.

Finally, I would like to thank my husband Fadi for your unwavering support throughout this journey. From your initial encouragement to apply, to traveling with me to Tanzania for three months in the summer as a Queen Elizabeth Scholar, to having our son Owen and managing working from home during a pandemic, to supporting whatever

comes next, I could never thank you enough. I am truly blessed to have you as my life partner. I would also like to thank my parents, Chris and Bill, for their endless support and encouragement throughout this process.

Chapter 1: Introduction

1.1 Postnatal Adjustment

Referred to as the "fourth trimester" (Tully et al., 2017), the period after childbirth throughout the first few months of motherhood is a critical period for women. The postpartum period entails significant change, both physically in a women's body as well as emotionally and relationally as she adjusts to her new mothering role (Aber et al., 2013; Nystr & Kerstin, 2004). Despite the high monitoring and support a women receives during the antenatal period, this declines after birth, leaving women feeling less supported during this time (Tully et al., 2017). During the transition to motherhood, women experience significant disruption to their previous lives, adjusting to continuous infant care, fatigue, and loss of time for self and existing relationships (Aber et al., 2013; Nystr & Kerstin, 2004).

Kitzinger (1975) initially defined the fourth trimester as "a transition period of approximately three months after birth, particularly marked after first babies, when many women are emotionally highly vulnerable, when they experience confusion and recurrent despair, and during which anxiety is normal and states of reactive depression commonplace" (p.118). Current research supports this early definition with one in five women experiencing some mental health challenges after giving birth (Goodman et al., 2016; Heron et al., 2004; Shorey et al., 2018; Wynter et al., 2013). In Canada, the prevalence of postpartum depression and anxiety symptoms is approximately 8% during the first year postpartum while the prevalence of sustained anxiety symptoms from pregnancy to 8 weeks postpartum is 12.6% (Dennis et al., 2012, 2017b; Lanes et al., 2011), suggesting it is a particularly vulnerable time period for women's mental health.

Both postpartum depression and anxiety have been linked to maternal stress and low social support (Dennis et al., 2017b; Lanes et al., 2011).

During this critical period, women are learning the skills of motherhood, including feeding, bathing, and changing a baby, influencing how women see themselves in relation to their new infant (Kitzinger, 1975), which helps in creating their perception of their maternal self-efficacy. Mothers have reported not having enough support nor information to help in the transition to motherhood, resulting in challenges to their psychosocial adjustment and conceptualization of their self-efficacy as a mother (Deave et al., 2008; Martin et al., 2014). In the postpartum period, mothers face gaps in access to evidence-based information and support, and have been found to have low self-efficacy during this period (Aston et al., 2018), feel isolated and low perceived social support (Aston et al., 2018; Hetherington et al., 2018), and higher rates of anxiety and depression (Dennis et al., 2016; Hetherington et al., 2018).

The development of high maternal self-efficacy can be a protective factor during the postpartum period, which is the perceived ability to succeed at mother-related challenges and tasks (Leahy-Warren & McCarthy, 2011). The more capable a mother believes herself to be, the more she is likely to be able to adjust to her new situation and to address the challenges that emerge (Bandura, 1997). However, due to the changes that occur during the postpartum period, many mothers do not feel adequately prepared or ready for their role as a mother, which can create a sense of anxiety, depression, or lack of self-efficacy which can in turn impact their ability to provide care for themselves and their newborn (Mckellar et al., 2002).

A factor that had been found to influence mothers' development of self-efficacy in the postpartum period is their levels of social support (Cutrona & Troutman, 1986; Leahy-Warren et al., 2012). Mothers with social support have been found to have higher levels of self-efficacy and lower levels of postpartum depression and anxiety (Leahy-Warren et al., 2012; Leahy-Warren & McCarthy, 2011). The lack of formal support during the postpartum period is a shift from the intense monitoring that occurs near the end of pregnancy where women are meeting with healthcare providers often on a weekly basis (Tully et al., 2017). As soon as mothers gives birth, this access to care is reduced significantly to only once or twice in the first year, typically around six weeks postpartum (Spelke & Werner, 2018). During the postnatal period, mothers can often feel under-supported, unsure about their new role as a mother, and struggle to find reliable information about caring for their infant (Aston et al., 2018; Martin et al., 2014). Despite the growing evidence of the importance of self-efficacy and social support during the postpartum period and the impact that these factors have on postpartum depression and anxiety, there has been limited work exploring Canadian women psychosocial adjustment in the postpartum period.

1.2 Postnatal Education Interventions

To assist with the postpartum transition, interventions that target postpartum adjustment and health outcomes are important. The goal of health education during the postnatal period is not only to impart knowledge, but also to address the psychosocial health needs of mothers to ensure they are able to engage and act in ways to best care for themselves and their newborns (Bryanton et al., 2013; World Health Organization, 2013). Postnatal education for mothers is essential for the development of an understanding of

newborn cues, recognizing danger signs, developing breastfeeding skills, and providing sufficient care (World Health Organization, 2013). New mothers desire information from reliable sources about how to best care for their newborn during the postnatal period (Walker et al., 2015), yet challenges in delivery and uptake of this information during the postnatal period have been noted (Guerra-Reyes et al., 2017).

Women are not without knowledge and skill, rather through enhancement and access to evidence-based information, the goal is to build maternal self-efficacy and provide reassurance and feelings of normalcy (Aston et al., 2016). Furthermore, some of the topics covered during antenatal care education, such as breastfeeding, are hard for women to fully understand until they experience it for the first time, yet women are unsure about where to turn for help during the postnatal period, often turning to friends, online, or parent books (Aston et al., 2018; Tully et al., 2017). In Canada, 56.3% of women born in Canada identified that two or more learning needs went unmet in the hospital (Sword et al., 2006). As newborns are primarily cared for at home by mothers, maternal knowledge not only of promoting behaviours for newborn care (i.e., breastfeeding, skin-to-skin contact) but also being able to recognize risk factors (i.e., danger signs, infections) are essential to enhance self-efficacy (Bowman, 2005).

Deave and colleagues (2008) explored the needs of first-time parents in relation to the care, support, and information they needed for their transition to parenthood. They found that parents both antenatally and postnatally needed (1) support from friends, family, their partners, healthcare providers and antenatal/postnatal groups; (2) quality and timely information from both informal and formal sources; and (3) adequate preparation for parenthood and infant care (Deave et al., 2008). Postnatal parents also commented on

the pressures of breastfeeding, challenges of the parenting relationship, and the involvement of the partner in infant care (Deave et al., 2008). Studies have found that women's identified concerns (e.g., lifestyle adjustments, such as sleep and emotional changes) varied from healthcare provider concerns (e.g., bleeding and infection) (Martin et al., 2014; Spelke & Werner, 2018), which can lead to impacts on their psychosocial health outcomes if women are left feeling unsupported in their information needs. Thus, there is a need to focus on enhancing the postnatal care and support that women receive to ensure not only their educational needs are met but also that they can access the social support they need in their adjustment to motherhood.

Evidence shows that mothers are increasingly turning to electronic sources for information during the postpartum period (Madge & O'Connor, 2006; Plantin & Daneback, 2009). A study with American mothers found that the primary reasons for going online to seek health information during the postpartum period included "wanting to learn more about diagnosing and treating specific pediatric health conditions, and … seeking out advice and support on parenting issues and development" (Bernhardt & Felter, 2004, p. 4). A study in the United States found that 82% (n=63) of mothers sought information from websites and 36% (n=28) used social media, such as Facebook and Twitter (Guerra-Reyes et al., 2017). Furthermore, 48% (n not reported) of mothers who had a mobile phone used mobile applications for health information seeking related to newborn care (Guerra-Reyes et al., 2017).

Online health seeking is not necessarily meant to replace formal sources of information but to complement or clarify information received by more formal sources, such as doctors or nurses (Bernhardt & Felter, 2004). Information obtained online,

particularly from other mothers, can be seen as practical knowledge, that is knowledge that has been obtained through experience and action, rather than scientific or medical knowledge (Johnson, 2015; Madge & O'Connor, 2006). The Internet can also provide easy access to information and social support in a way that minimizes stigma and embarrassment that can accompany health seeking (Buultjens et al., 2012). Online communities can provide first-time mothers a link to other women who are going through a similar experience and can provide advice and normalization of their experiences (Aston et al., 2020; Johnson, 2015; Price et al., 2018).

Seeking information and community online has been found to be enhanced through mobile phones, facilitated by the convenience of easily accessible information (Guerra-Reyes et al., 2016). Given the prominence of mobile phone usage in Canada (Canadian Radio-Televsion and Telecommunications Commission, 2016), one innovative strategy that can be used to provide postnatal education directly to parents is mobile health (mHealth). mHealth, a subset of eHealth (electronic health), is defined as the use of mobile devices, such as mobile phones or smartphones, to transmit various health content and services (World Health Organization, 2011). The goal of mHealth interventions in postnatal education is not to replace the need for in-person postnatal care, as these are important for health assessments of the mother and newborn by the healthcare provider. Instead, mHealth interventions can be used to complement existing postnatal care, enhancing maternal self-efficacy and feelings of social support through standardized, time-appropriate, and evidence-based information. While there are some mobile health interventions targeting the antenatal period (SmartMom Mobile Health

Education, 2020), there are none currently available that target the postnatal period in Canada.

There has been significant growth of mHealth interventions being developed and evaluated for parents (Davis et al., 2017). When perinatal women were asked about their experience using mobile applications, the benefits included the personalized information it provides, the ability to connect with an online community, receiving reassurance, and monitoring changes in their infants development and their own bodies (Connor et al., 2018; Lupton & Pedersen, 2016). However, limitations were also identified including a feeling of disconnect from the information, lack of support in their use by healthcare providers or family, security concerns, and concerns over the quality and accuracy of the content (Connor et al., 2018; Lupton & Pedersen, 2016). A study in Turkey with pregnant women found that women who used mobile applications during pregnancy were more accepting of their pregnancy and had a better relationship with their husband than women who did not use mobile applications (Özkan Şat & Yaman Sözbir, 2018). While mobile applications were used more widely in pregnancy, studies have found that their use was reduced in the postpartum period, hypothesized due to lack of postpartum content and relevancy (Guerra-Reyes et al., 2016).

A specific aspect of mHealth that shows significant promise is text messaging. Text messages have been able to be successfully delivered across most populations as it does not require a smartphone, text messages are usually read automatically when received, they can be sent while a phone is off and retrieved later when turned back on, and they use minimal data and/or cellular service, minimizing the costs compared to voice calls or mobile applications (Crawford et al., 2014; Hall et al., 2015; Head et al.,

2013; Mayberry & Jaser, 2018). With the ability to reach more people through text message than mobile applications, as it does not require data, there is significant potential to develop a text message postnatal intervention for mothers with the objectives of enhancing self-efficacy and social support and decreasing postpartum depression and anxiety.

There is optimism in the use of mHealth interventions for positively impacting maternal and newborn health outcomes. mHealth is believed to hold potential to reach underserved people, areas, and topics that have previously been ignored. Several reviews have identified positive trends towards improving maternal and newborn health, yet there is also a call for increased reporting on intervention content, fidelity, and process outcomes (Lee et al., 2016; Poorman et al., 2015; Sondaal et al., 2016). There is potential for mHealth to empower and educate mothers directly to improve their psychosocial outcomes in the postpartum period. There is a need to develop and evaluate innovative approaches to educate and support mothers during this period to ensure maternal psychosocial health needs are met.

1.3 Research Problem, Purpose, and Significance

The purpose of this research is to address important gaps in the literature on postnatal care and psychosocial adjustment for mothers living in Canada, specifically the Maritime provinces, and explore the opportunity of addressing these gaps to improve psychosocial outcomes through using mHealth technology to provide postnatal education and support to first time mothers. There were two primary research questions: *How are mothers living in Canada experiencing their postnatal care and psychosocial adjustment*

in the postpartum period? How can an mHealth intervention be developed to address mothers' psychosocial needs in the postpartum period?

The following chapter consists of a literature review on the postpartum psychosocial outcomes, postnatal health interventions, and theoretical underpinning of this work (Chapter 2). Methods used in the studies will be discussed in Chapter 3. This dissertation contains four manuscripts. Manuscript 1 (Chapter 4) explores the postnatal care experience of women living in Nova Scotia, New Brunswick, and Prince Edward Island. Manuscript 2 (Chapter 5) identifies the influence that parity and newborn age has on psychosocial outcomes during the first six months postpartum. Manuscript 3 (Chapter 6) is a systematic review on the impact of mHealth interventions during the perinatal period on psychosocial outcomes. Manuscript 4 (Chapter 7) explains the development of *Essential Coaching for Every Mother*, a postnatal text message intervention throughout the first six weeks postpartum to improve mothers' self-efficacy and perceived social support and decrease postpartum anxiety and depression. The final chapter (Chapter 8) is an overall discussion of the results, their relation to existing literature, and implications for practical and future research.

Chapter 2: Literature Review

This chapter covers the existing literature related to women's psychosocial postpartum adjustment and postnatal interventions. This chapter is divided into four parts: (1) overview of the perinatal period and postnatal care in Canada; (2) maternal psychosocial health outcomes, specifically self-efficacy, social support, postpartum anxiety and postpartum depression; (3) overview of postnatal interventions, both in-person and eHealth interventions; and (4) the theoretical framework that was used for the underpinnings for this research.

2.1 The Perinatal Period

Prior to birth, there is a focus on providing quality antenatal care to improve maternal and newborn outcomes. Antenatal care is a time that healthcare providers can provide health promotion, screening, diagnosis, and disease prevention related to maternal and newborn mortality (Moller et al., 2013; World Health Organization, 2016). In their recently updated guidelines, the World Health Organization (WHO) recommended that the first antenatal contact occur within the first trimester of pregnancy, with a minimum of seven contacts after that until birth, with two in the second trimester and four contacts the third trimester (World Health Organization, 2016). During antenatal contacts, the focus is on nutritional interventions, maternal and fetal assessment, preventive measures, and interventions for common physiological symptoms (World Health Organization, 2016). In 2020, the Public Health Agency of Canada released their national guidelines for care during pregnancy in an effort to increase quality and standardization of care across the country (Public Health Agency of Canada, 2020a). However, antenatal care and education varies by province, including some online or web

based prenatal parent-targeted education or in-person classes through private clinic or community organizations.

While most of the intrapartum recommendations focus on care provided during labor by healthcare providers, the recommendations also outline the required care of the newborn immediately after birth. This includes providing immediate skin-to-skin contact the hour after birth, early breastfeeding when mother and newborn are ready, as well as appropriate thermal care and delayed bathing (World Health Organization, 2018). In Canada, 97.9% of births occur in hospital and most women (93.2%) have a healthcare provider present at birth (Public Health Agency of Canada, 2009). Thus, while the intrapartum period is not a focus on perinatal education for mothers, it is key in the continuum of care to ensure quality care to mothers and newborns.

While there has been significant focus on the antenatal and intrapartum periods, there has been less of a focus on the postnatal period, including the utilization of services and problems faced during this period (Fogel, 2017; Verbiest et al., 2017). Despite the critical needs of new mothers during the postnatal period, it is the most neglected aspect of the perinatal period in the provision of quality care (World Health Organization, 2013). The immediate postnatal period is typically defined as the first six weeks after a birth (World Health Organization, 2013). While there is some agreement on the educational content that should be covered during postnatal care contacts, there is less agreement on the location and frequency of when these contacts should occur (Haran et al., 2014; Warren et al., 2015).

In terms of educational content provided during postnatal contacts, the WHO (2013) outlines content that should be covered as part of the postnatal care of newborns

including: assessment of newborn for any danger signs (i.e., stopped feeding well, history of convulsions, fast breathing); provision of exclusive breastfeeding for the first six months; dry, clean cord care; and other postnatal care (i.e., delayed bathing, appropriate thermal care, mother-newborn attachment, proper immunization, and identification of preterm newborn needing additional care). Postnatal care also includes important assessments of the mother, including pre-eclampsia/eclampsia, bleeding after birth, signs of infection, and mental health (World Health Organization, 2013). For all of these recommendations, education of parents is essential to ensure they have the knowledge of the risks and benefits as well as are able to engage in the behaviour (i.e., breastfeeding, health seeking) while at home caring for themselves and their newborn.Despite the acknowledgement of postnatal education at the global level, the content, frequency, and method of delivery of perinatal contacts varies among Canadian provinces (Reproductive Care Program of Nova Scotia, 2002). While the Canadian national postpartum care guidelines were recently released in late 2020 with an increased focused on family-centered care, there was no mention of standardization of postpartum care (Public Health Agency of Canada, 2020b). The current guidelines recommend to "plan the timing and purpose of each postpartum contact in partnership with the woman and her partner/family based on their individual needs" and "provide information and support in a timely fashion, according to the needs of the woman, her partner, and family" (Public Health Agency of Canada, 2020b, p. 5). While the family-centered care approach is essential, the lack of attention to standardized care delivery leaves room for variation in the provision of postpartum care for women across the country.

2.1.1 Postnatal Care in Canada

Current WHO (2013) postnatal guidelines recommend that women and newborns receive postnatal care for the first 24 hours after birth at a health facility or within 24 hours if birth was at home, followed by a minimum of three postnatal visits occurring within 48–72 hours, between days 7–14, and six weeks post birth. In Canada, recommendations for postnatal care vary by province, with no standardization of care, education, or support across the country (Public Health Agency of Canada, 2020b; Reproductive Care Program of Nova Scotia, 2002). For example, in British Columbia, the recommendations are for mothers and newborns to be assessed within 2-4 days after being discharged from the hospital, followed by postnatal care at one week, one month, and two months post birth (Perinatal Services BC, 2016). In Nova Scotia, the recommendations are to have a postnatal contact within 1 to 2 weeks after birth, followed by a postnatal contact at six weeks (Reproductive Care Program of Nova Scotia, 2002). However, there has been limited evaluation as to whether this postnatal contact schedule occurs in practice and is sufficient for women.

Canada has a universal health care system in which access to perinatal care is free to all Canadian citizens and permanent residents who apply for public health insurance (Government of Canada, 2020). Despite the universal healthcare system, healthcare is managed provincially with each province having their own insurance plan that regulates and oversees healthcare (Government of Canada, 2020). In Nova Scotia, recommendations are for a postnatal care contact within 1-2 weeks after birth, followed by another follow-up at six weeks (Reproductive Care Program of Nova Scotia, 2002). However, both New Brunswick and PEI do not have any standardized recommendations

for postnatal visits, with timing and frequency of follow-ups varying depending on the care provider (personal communication, NB and PEI Public Health representatives).

Postnatal care services and providers also vary across other regions in Canada (The Vanier Institute of the Family, 2017), which may include contacts such as home visits or telephone-based support from a public health nurse, routine care from a midwife up to six-weeks postpartum, or visits to primary care provider, such as family doctor or nurse practitioner, who will follow the infant and mother (The Vanier Institute of the Family, 2017). Across the Canadian context, in contrast to countries with high midwifery providers, such as the United Kingdom, is a limited yet growing profession with considerable variation in access and practice approaches (Thiessen et al., 2020). There are only 16 full-time equivalent positions for registered midwives in Nova Scotia, three in New Brunswick and none in Prince Edward Island (Canadian Midwives, 2020). Additionally, given that many primary care providers, such as family doctors or nurse practitioners, do not provide antenatal care beyond 32 weeks, they are transferred to other providers (e.g., other family physicians, obstetricians, or midwives) for the rest of the pregnancy and delivery, which can interpret the continuity of care.(Canadian Institute of Health Information, 2004)

Many primary healthcare providers in Canada follow the recommendations by the Canadian Pediatric Society to see the newborn at one week of age, followed by well-baby visits at 2, 4, 6, 9, 12 and 18 months and 2-5 years (Canadian Paediatric Society, 2020), in coordination with recommended immunization schedules. The Society of Obstetricians and Gynecologists of Canada (2020) recommends that women and their newborns be followed-up at one week and 4 to 6 weeks post birth. Each type of health provider may

provide a different style of care related to routine screening and diagnostic care with the scope of practice for each provider type also varying (Canadian Institute of Health Information, 2004).

The lack of formal support during the postnatal period is a shift from the intense monitoring that occurs near the end of pregnancy where women are meeting with healthcare providers often on a weekly basis (Tully et al., 2017). As soon as women give birth, this access to care is reduced significantly to only once or twice for herself in the first year, typically at six weeks postpartum (Spelke & Werner, 2018). The amount and type of care a women receives postnatally may depend on whether they have care from doctors or midwives, whether they are considered high needs, or have identified health concerns for themselves or their infant (Reproductive Care Program of Nova Scotia, 2002). Existing guidelines in high-income countries were reviewed for recommendations on the timing and frequency of postnatal follow-up care for healthy, non-high risk women and it was found that it is typically recommended to only have one visit with a range of 3-8 weeks (Haran et al., 2014; Stumbras et al., 2016). Only two existing guidelines recommended a visit within the first week (WHO (2013) and National Institute for Health and Care Excellence (NICE, 2015a)), with a few also recommending individualized postnatal care follow-ups as needed by the woman (Stumbras et al., 2016). Overall, most formal care ends around six-weeks after birth (Reproductive Care Program of Nova Scotia, 2002).

While most women receive the recommended number of postnatal contacts in Canada, many women still struggle to adjust during this period (Chalmers et al., 2008). One of the opportunities of postnatal contacts is to receive important information about

newborn health, caring for their newborn, getting help with breastfeeding, and learning about danger signs for themselves and their newborn (World Health Organization, 2013). Parents should be aware of common newborn danger signs and be encouraged to seek health care if they recognize any of these concerns at any time (World Health Organization, 2013). Postnatal contacts also offer the ability to provide psychosocial support for women, including but not limited to screening for postpartum anxiety and postpartum depression, addressing their reproductive health needs, inquiring about the family adjustment, and providing breastfeeding support (American College of Obstetricians and Gynecologists, 2018). However, mother's psychosocial adjustment is understudied and often takes a backseat to physical maternal assessment provided by healthcare providers. While research evidence shows the importance of maternal self-efficacy and social support from the postnatal period (Fahey & Shenassa, 2013; Law et al., 2019; Leahy-Warren et al., 2012), this has not been a focus on traditional postnatal care which focuses on the physical healing of mothers or postpartum depression.

2.2 Maternal Psychosocial Health Outcomes

The recognition of the challenges and associations between maternal psychosocial health outcomes during the postnatal period has been a growing area of research. Maternal self-efficacy and perceived social support have been found to be important factors in the postpartum period in addition to mental health concerns such as postpartum depression and anxiety (Cohen, 2002; Emmanuel et al., 2011; Kingston et al., 2018; Leahy-Warren et al., 2012). A brief look will be taken at each of these psychosocial factors.

2.2.1 Self-Efficacy

Women are experiencing significant adaptation and learning during the postpartum period and developing their maternal self-efficacy which are the "beliefs or judgments a parent holds of their capabilities to organize and execute a set of tasks related to parenting a child" (de Montigny & Lacharite, 2005, p. 390). Maternal self-efficacy is thought to promote maternal role development and improve newborn outcomes where a lack of knowledge, confidence, and experience decreases maternal self-efficacy (Albanese et al., 2019; Shafaie et al., 2017). Maternal self-efficacy is relevant in the adaption and transition to motherhood as mothers develop the cognitive belief that they can perform newborn tasks (Leahy-Warren & McCarthy, 2011). Bandura (1977) suggests that the greater a person's self-efficacy related to a specific behaviour, the more likely they are to engage with that behaviour. That is, the more capable a mother believes herself to be, the more she is likely to be able to adjust to her new situation and to address the challenges that emerge (Bandura, 1997). Thus, maternal self-efficacy is a key factor in positive maternal adjustment during the postpartum period.

New mothers face demands in caring for their newborn which can be challenging, especially for first time mothers (Shorey et al., 2014). If mothers do not receive adequate postnatal education while in the hospital or during follow-up postnatal care contacts, they may fail to develop the maternal self-efficacy related to their ability to provide newborn care (Shorey et al., 2014). Maternal self-efficacy develops over time as women become more confident in their ability to parent. First time (primiparous) mothers have been found to have lower levels of maternal self-efficacy than multiparous mothers (Bryanton et al., 2008; Wiklund et al., 2018). Maternal self-efficacy has also been found to be a

factor of parenting behaviour and linked to positive newborn and child outcomes (Jones & Prinz, 2005; Shorey et al., 2014). In a study with women who had given birth two-weeks previously, maternal self-efficacy was found to be significantly correlated with newborn care, suggesting women who had higher maternal self-efficacy were able to provide better newborn care than those with lower maternal self-efficacy (Shafaie et al., 2017). As a result, the postpartum period is a critical one of maternal self-efficacy development as women transition to motherhood due to its protective nature for mothers (Albanese et al., 2019).

Parental self-efficacy has typically been measured through self-report assessments and can assess general parenting self-efficacy across the parenting role or task specific self-efficiency such as breastfeeding (Črnčec et al., 2008a; Wittkowski et al., 2017). A study with 513 Danish mothers found that 25% (n=130) of mothers had clinically low confidence when measured using the Karintine Parenting Confidence Scale (KPCS) and that confidence increased between two and six months postpartum, with confidence at two months the greatest predictor of low confidence, mood, and stress at six months postpartum (Kristensen et al., 2018).

2.2.2 Social Support

Social support is essential for the physical and emotional wellbeing of women during the postpartum period and has been linked to positive maternal outcomes (Gjerdingen et al., 1991; Mcleish & Redshaw, 2017; Negron et al., 2013; Smith & Howard, 2008; Wiklund et al., 2018) and infant development outcomes (Racine et al., 2018). While poorly defined throughout the existing literature, Shumaker and Brownell (Shumaker & Brownell, 1984) defined social support as “an exchange of resources

between two individuals perceived by the provider or the recipient to be intended to enhance the well-being of the recipient" (p.11). There are two primary types of support can be conceptualized as linked that mothers seek during the postpartum period: *functional*, which can either be informational, instrumental, emotional or appraisal, and *structural*, which can be informal or formal sources, such as a confidant or a social network (Leahy-Warren, 2005; Leahy-Warren et al., 2012; Smith & Howard, 2008). In the transition to motherhood, the need for both types of support is prevalent, as mothers face emotional changes and physical challenges that they are unaware of how to address, seeking advice from other mothers, friends, family, or healthcare providers (Kitzinger, 1975). Having support available from family and healthcare providers has also been found to be linked to feelings of security during the postpartum period (Wiklund et al., 2018).

Women have access to many sources of information, including formal sources such as doctors, nurses, friends and family as well as informal sources, such as social media, blogs, and mobile applications (Guerra-Reyes et al., 2017), which can provide both functional and structural support. Yet, much of this information focuses on the antenatal and intrapartum period, with a deficit existing related to postnatal care and the postpartum experience (Guerra-Reyes et al., 2017). Studies have found that women tend to seek both formal and informal sources of support during the transition to motherhood. A study in the United States found that during the 2 weeks following birth, informal sources of support included fathers (35%), the mothers' parents (22%) and friends (17%) whereas formal sources included healthcare providers, including doctors (39%) and nurses (19%) [n not reported] (Sink, 2009). This study found that while questions related

to breastfeeding were asked to both informal and formal sources, specific questions around medications and eating foods were only asked to healthcare providers (Sink, 2009). Having healthcare providers offer reassurance to women can enhance the transition in their new role to mothers (Aston et al., 2018).

However, a key to a successful transition to motherhood is the availability of informal social support (Aber et al., 2013). A qualitative study with 33 American women found that a lack of support in achieving basic needs were associated with depressive symptoms, with partners, family members, and friends being key sources of emotional and instrumental support (Negron et al., 2013). For instance, contributions from the husband in terms of infant care and household chores has been found to be an important source of support for mothers (Gjerdingen et al., 1991; Leahy-Warren, 2005). Another study found similar links between lower social support and more anxious and depressive symptoms during the postpartum year (Hetherington et al., 2018). In a systematic review, social support was found to be positively correlated with breastfeeding rates, infant care, maternal adaptation, and maternal self-efficacy and be negatively correlated with stress and postpartum depression (Ni & Siew Lin, 2011).

Women who have support and learn that other mothers are struggling in similar ways develop an understanding that being a mother is learnt, not innate, which can result in normalization, feelings of encouragement, and validation (Price et al., 2018). A risk identified for new mothers is feeling like they are doing it wrong or they are a bad mother if they seek help, which can result in a women feeling ‘less than’ or inadequate in their role as a mother, leading to low confidence and maternal self-efficacy (Price et al., 2018). Social support from peers has been found to have a positive impact on the emotional

well-being of mothers by providing social connection, building confidence, and feeling valued (Mcleish & Redshaw, 2017).

Canadian mothers have acknowledged that "having their own mental health, self-confidence and well-being acknowledged by healthcare professionals was identified as an important aspect of postpartum care" (Aston et al., 2018, p. 645). Yet, some mothers have acknowledged feeling "silly" or "paranoid" if they approach healthcare providers with their worries during the postpartum period (Aston et al., 2018), which can lead to avoiding formal sources of information to minimize this feeling of being an inadequate parent. However, informal sources of support also have their own challenges, such as online blogs or google searches leading to paranoia or lack of consistent information (Price et al., 2018). Thus, social support is an important aspect during the postpartum period, offering protective factors and buffering the transition for women.

2.2.3 Postpartum Anxiety

A growing area of research in the postpartum period is on postpartum anxiety, which can manifest itself as several symptoms, including "excessive and persistent fear, worry, and tension and regularly includes physical symptoms such as sleeping difficulties and inability to concentrate. Severe symptoms include panic and recurrent intrusive thoughts or images, often related to the harm of their child" (Dennis et al., 2016, p. 486). While often comorbid with postpartum depression (discussed below), postpartum anxiety is a separate mental health concern, shaped by fear and worry, rather than depressive thoughts, and can emerge as generalized anxiety, panic disorders, obsessive compulsive disorder, or post-traumatic stress disorder (Ali, 2018). Even at sub-clinical levels, postpartum anxiety is a common experience for mothers after birth and can have long-

term outcomes on the mother and infant (Ali, 2018). Postpartum anxiety has been associated with negative maternal outcomes, such as higher levels of fatigue (Taylor & Johnson, 2013) and postpartum depression (Skouteris et al., 2009) as well as negative infant outcomes, such as poor cognitive outcomes (Keim et al., 2011) and excessive crying (Petzoldt et al., 2014). Women with postpartum anxiety, particularly primiparous women, have been found to have increased health care use and reduced breastfeeding duration up to six months postpartum (Paul et al., 2013). While anxiety may be pre-existing or may emerge in the antenatal period, studies have shown that it is important to re-assess for possible anxiety in the postpartum period due to the changes that occur after birth and variation in anxiety symptoms across the perinatal period (Andersson et al., 2006; Bayrampour et al., 2016).

A recent systematic review on the prevalence of anxiety symptoms during the postpartum period found that 15% of mothers experienced some anxiety symptoms between 1-24 weeks postpartum, ranging from 17.8% at 1-4 weeks postpartum to 14.8% after 24 weeks postpartum up to one year (Dennis et al., 2017a). Prevalence of having a clinically diagnosed anxiety disorder was found to range from 8.5% to 9.9% (Dennis et al., 2017a; Goodman et al., 2016). In Canada, a study conducted in Vancouver found that the prevalence of postpartum anxiety symptoms ranged from 22.6% at 1 week postpartum, 17.2% at 4 weeks, and 14.8% at 8 weeks (Dennis et al., 2016). Risk factors for having anxiety symptoms at 8 weeks postpartum was more likely among multiparous women who had previous mental health concerns and those who had high levels of stress when measured 1 week postpartum (Dennis et al., 2016). Additional risk factors for postpartum anxiety include history of abuse or violence, denial and acceptance coping

styles, low self-esteem, low social support, and adverse life events (Bayrampour et al., 2016, 2018). Anxiety remains an understudied aspect of mothers postpartum psychosocial health, especially compared to postpartum depression, yet it is acknowledged as a key element in maternal postpartum adjustment (Goodman et al., 2016).

Anxiety can impact a multitude of postpartum behaviours and health outcomes. In a qualitative study with women who had given birth within the past year, mothers reported that although they went online to search for health information, they also reported high anxiety after searching online, due to being overwhelmed with the amount of information or becoming fearful of what information they found (Barkin & Jani, 2016). A study with 235 primiparous Swiss mothers found that the more women received support from their partners, the fewer depressive symptoms and lower anxiety they had at six weeks postpartum, even when they were stressed (Razurel et al., 2017). Identifying ways to minimize the risk of postpartum anxiety is essential to improve the postpartum experience for mothers.

2.2.4 Postpartum Depression

One of the most prominent maternal outcomes focused on in the postpartum period is postpartum depression, which refers to a non-psychotic depressive episode that begins in or extends from pregnancy into the postpartum period, ranging from depressive symptoms of the "baby blues" to a clinical diagnosis (Lanes et al., 2011). Symptoms can include anxiety, guilt, negative maternal attitudes and attachment, poor parenting self-efficacy and coping skills, lasting up to 14 months postpartum (Lanes et al., 2011, p. 1). Postpartum depression is a concern as it has been linked to several negative child

outcomes, including child hyperactivity/inattention, physical aggression, and separation anxiety (Kingston et al., 2018; Letourneau et al., 2012). Depression can emerge in the antenatal period, with 14.5% women reporting a new episode of major or minor depression, and 14.5% reporting a new episode during the first 3 months postpartum (Baynes et al., 2005), suggesting that ongoing assessment is important across the perinatal period.

Results from systematic reviews reported that the global prevalence of postpartum depression among healthy mothers was on average 12%, ranging from 26% in the Middle East, 16% in North America, and 8% in Europe (Shorey et al., 2018; Woody et al., 2017). Across Canada, the prevalence rates for postpartum depressive symptoms ranged from 7.48% to 8.6% (Dennis et al., 2012; Lanes et al., 2011). There is also regional variation: as high as 14% in the Territories to as low as 4.3% in Prince Edward Island (Lanes et al., 2011). Similar prevalence of clinical postpartum depression was found at 8.7%, ranging from 15.9% in the Territories to 5% in New Brunswick (Lanes et al., 2011). The combined prevalence of both depressive symptoms and clinical diagnoses was 17.2% in Canada (Lanes et al., 2011). In Nova Scotia, the prevalence of postpartum depressive symptoms was 8.4% whereas the prevalence of postpartum depression was 7.1%, with a combined prevalence of 15.5% (Lanes et al., 2011). Interestingly, Dennis et al. (2012) found that women in the Atlantic provinces has the lowest prevalence of postpartum depressive symptoms in combination with more social support.

Maternal postpartum depression has been found to be related to higher levels of child emotional negativity measured at 24 months as was the trait portion of maternal postpartum depression on maternal reported child behavior problems (Prenoveau et al.,

2017). Another study noted that mothers with a high level of symptoms had a higher proportion of children with behaviour symptoms (i.e., hyperactivity/inattention and separation anxiety), followed by those with moderate symptoms, and least among those with minimal symptoms (Kingston et al., 2018). Given the gravity and risk of postpartum depression, identifying ways to minimize this risk is essential to improve the postpartum experience for mothers.

2.3 Postnatal Education Interventions

Care and education during the postnatal period is very important, particularly around maternal psychosocial health outcomes, as antenatal care primarily focuses its maternal education on care required by women during pregnancy, such as receiving important nutrition interventions such as iron and calcium, as well as assessing maternal health and newborn health during pregnancy (World Health Organization, 2016). Furthermore, care provided during the intrapartum period, while an essential component of the continuity of care, the goal is reducing mortality during labour and delivery, not on later newborn care by mothers. Due to the short length of stay after birth in hospitals, the opportunity for healthcare providers to offer information and support to address postnatal psychosocial outcomes is a challenge, both in terms of limited time to address maternal health outcomes and the sheer volume of information needed to be disseminated (Mckellar et al., 2002). Thus, it is essential to examine postnatal care in the context of providing women with information and support to enhance maternal psychosocial outcomes during this vulnerable yet understudied period. For the purpose of this dissertation, postnatal education prefers to information shared with new parents, often provided by nurses, midwives, and physicians, but can also be individualized or group-

based and can be provided face- to-face, by phone, through print media, or virtual (Bryanton et al., 2013).

2.3.1 In-Person Postnatal Education

Traditionally, postnatal care has occurred in-person through public health nurses, midwives, or primary healthcare providers, with growing use of structured educational programs during the postpartum period. For instance, a systematic review by Bryanton and colleagues (2013) identified 27 studies that reported on structured, in-person educational interventions within the first two months postpartum on general health or care of an infant or parent-infant relationships, provided by an educator (e.g., nurse, nurse practitioner, midwife, physician). While the benefits of in-person educational programs remained unclear in their review, primarily due to different reporting, educational interventions that targeted infant behaviour were found to improve maternal knowledge (Bryanton et al., 2013). Postpartum interventions that focus on increasing attendance at the postpartum visit have used approaches such as incentivization (e.g., gifts), home visit programs, patient education, and appointment scheduling assistance (Stumbras et al., 2016). Interventions can also be developed to be individual or group-provided and could involve home visits or be multi-component based (Gardner & Deatrick, 2006). However, a challenge in synthesizing the overall findings is that there is no consistent reporting on outcomes, outcome measurement tools, and timing of evaluation on postnatal educational interventions (Bryanton et al., 2013).

Home visits, a common in-person intervention in the postpartum period, are often offered to women after they give birth, typically conducted by public health nurses or midwives but can also be provided by lay individuals, such as postpartum doulas (Bull &

Swann, 2004). Home visits are not universal in approach, timing, or frequency, but are "diverse in their goals, target recipients, mode and timing of their delivery and their theory and content" (Bull & Swann, 2004, p. 1). However, in a review of postpartum home visits with over 11,000 women, having more frequent home visits did not impact women's physical or psychological health outcomes (Yonemoto et al., 2017). Due to differences in reporting and intervention approaches used, no recommendations for the number of home visits was able to be ascertained (Yonemoto et al., 2017). While home visits have been found to be particularly helpful for women who are high-risk (e.g., family dysfunction, postpartum depression, low income), there is no evidence to suggest that home visits improve parenting, maternal mental health, maternal quality of life, or maternal physical health outcomes in low-risk women (Shaw et al., 2006).

An essential element for postnatal intervention is to develop a woman's self-efficacy during this critical period to ensure women feel confident in their ability to parent both immediately and over the long-term, offering protective factors against other negative psychosocial health outcomes. In a systematic review on parenting interventions targeting parenting self-efficacy for first-time parents, it was found that interventions significantly and positively enhanced parenting self-efficiency when measured immediately (SMD 0.57, 95% CI 0.44 to 0.70, $p < 0.001$) and at a short-term follow up to 6 months (SMD 0.61, 95% CI 0.27 to 0.95; $z=5.73$, $p < 0.001$) for ten randomized controlled trials (Liyana Amin et al., 2018). Looking specifically at postnatal education interventions that focused on postpartum mental health, a systematic review of psychosocial and psychological interventions targeting postpartum depression in the first six weeks did not find an overall impact, however, interventions that targeted at risk

women (RR: 0.67, 95% CI 0.51 to 0.89), occurred only during the postpartum period (RR: 0.76, 95% CI 0.58 to 0.98), or were individual-based (RR: 0.76, 95% CI 0.59 to 1.00) were more effective in preventing postpartum depression (Dennis, 2005). Another study with first-time parents provided with a psycho-educational postnatal program found to significantly reduce anxiety and depression after six months compared to a control group of standard care (Fisher et al., 2010).

Similarly, telephone support interventions, either by healthcare providers or peers, provided during pregnancy to six weeks postpartum had insufficient evidence to recommend routine telephone support for postpartum women on maternal or newborn outcomes (Lavender et al., 2013). A systematic review on the impact of therapist-supported Internet-based cognitive behavior therapy for postpartum mental health found it resulted in a significant improvement in anxiety and depressive symptoms compared to a control group (Lau et al., 2017).

Overall, there is some support for in-person postnatal educational interventions to improve maternal self-efficacy and maternal mental health outcomes in the postpartum period. However, there is still uncertainty around the best implementation strategy, and synthesis on the best approach is still unable to occur due to variation in approaches, measurement, and reporting.

2.3.2 eHealth Postnatal Education

Given the emergence of eHealth and mHealth technology, as well as global issues (e.g., the coronavirus pandemic that swept the world in 2020), there is an opportunity to shift postpartum education into virtual or online settings. In a recent literature review, van den Heuvel and colleagues (2018) identified 71 articles that reporting on the use of

eHealth during prenatal, perinatal, and postnatal care which fell into six main domains: information and eHealth use, lifestyle (gestational weight gain, exercise, and smoking cessation), gestational diabetes, mental health, low- and middle-income countries, and telemonitoring/teleconsulting. In regards to information and eHealth use, they summarized that use of eHealth resources for perinatal information varies between 50% to 98%, yet concerns over reliability were identified (van den Heuvel et al., 2018). The review also identified that many of the interventions targeted lifestyle changes, as well as gestational diabetes and mental health with the goal of changing behaviour and improving outcomes (van den Heuvel et al., 2018). mHealth interventions have shown varying effects on behaviour change, with significant heterogeneity among design, implementation, and outcomes limiting clear conclusions (Daly et al., 2018; Marcolino et al., 2018).

With mobile phone availability and use, combined with the opportunity for real-time communication, mHealth has rapidly been expanding with the goal to improve access and health outcomes (Iribarren et al., 2017), including maternal, newborn and child health outcomes (Mildon & Sellen, 2019). Worldwide, seven billion people live in an area where they have mobile phone coverage which means that 95% of the world's population have access to a mobile phone network (International Telecommunication Union, 2016). This is in contrast to Internet access, with 53% of the world's population not using the Internet (International Telecommunication Union, 2016).

In terms of mobile penetration, 86.5% of Canadian households have a mobile phone subscription and 73% of Canadian adults own a smartphone (Canadian Radio-Televsion and Telecommunications Commission, 2016). Canadian households in the

lowest two income quintiles are more likely to own a mobile phone, compared to a landline (Canadian Radio-Televsion and Telecommunications Commission, 2016). In Nova Scotia specifically, 84.1% of residents have a mobile phone subscription, of which 19.2% were mobile-phone only subscribers (no landlines), as of most recent data in 2014 (Canadian Radio-Televsion and Telecommunications Commission, 2016).

The effective use of text messaging to enhance maternal and newborn outcomes during the postnatal period have been found in both high income countries and low and middle-income countries (Evans et al., 2014; Patel et al., 2018). Text messaging holds substantial potential to engage with women during the postnatal period. A study comparing the response and engagement rate between self-selected email or text message information on safe infant sleep found that while mothers opted-in slightly more to emails (55.7%, n=441), mothers who receive text messages were more likely to engage with the content and respond to queries (Moon et al., 2017).

Cormick and colleagues (2012) conducted interviews with pregnant women in Argentina and found that 96% (n=140) would like to receive text messages related to prenatal care, although timing of when they would like to receive it varied. Overall, 91% (n=133) of women expressed a desire to receive text messages postnatally (Cormick et al., 2012). Most women wanted one to three messages per week on information related to newborn skin care, diet, lactation, when to call a doctor, and appointment reminders (Cormick et al., 2012). Another literature review on the use of text message as an mHealth educational tool during pregnancy reinforces the finding that women are receptive to the use of text messaging during pregnancy as a health promotion tool to

increase maternal education and utilization of health services during the continuum of care (Lamont et al., 2016).

A prominent example of a text message intervention that has been implemented and evaluated targeting the perinatal period is text4baby. Text4baby targets "low-income women who are pregnant or have recently given birth, and need information and motivation to promote adoption and maintenance of healthy behaviors" (Evans et al., 2012, p. 2). Text4baby, based on the behavioural change models of social cognitive theory, the transtheoretical model, and the health belief model, has the objective of increasing maternal expectations of health outcomes and to promote maternal self-efficacy (Evans et al., 2012). Text4baby is a free service available in the United States that covers topics between pregnancy and the first year, including nutrition, flu prevention, mental health, breastfeeding, and immunization (Jordan et al., 2011). Mothers who sign up during pregnancy receive three messages per week based on gestational age of their infant, which continues throughout the first year (Jordan et al., 2011). Measurement of outcomes occurred through a study specific questionnaire on the attitudes, knowledge, and behaviors of the information provided through the text message intervention (Evans et al., 2012).

During the pilot, they found a significant effect for the text4baby intervention on the attitude statement "I am prepared to be a new mother" for the intervention group when measured between a prenatal baseline and 2-3 month follow-up (OR = 2.73, CI = 1.04, 7.18, p = 0.042) (Evans et al., 2012). In a sample of military women, the text4baby intervention was conducted but again, no significant differences were found on prenatal knowledge, attitudes, and beliefs measured between baseline and four weeks later,

however, in the adjusted model for significant confounders, there was an improvement in knowledge of the dangers of alcohol during pregnancy and an increase in awareness of taking prenatal vitamins (Evans et al., 2014). However, no behavioral effects of the intervention were observed, including online health seeking, smoking, alcohol consumption, or 3+ servings of fruit and vegetables (Evans et al., 2014). Additionally, when followed until their first postpartum visit, mothers who received more text4baby text messages were less likely to consume alcohol during pregnancy compared to mothers who received fewer text messages (Evans et al., 2015). In a separate study with another population of American mothers, 92% of mothers reported reading all the messages sent to them through text4baby and only 1% of participants expressed concerns around enrollment in the mHealth intervention (specific data not shown in original paper) (Gazmararian et al., 2014). Text4baby has shown promise for American mothers, but such a perinatal program does not exist in Canada, although SmartMoms is a Canada-wide antenatal text message program endorsed by The Society of Obstetricians and Gynecologists of Canada (SmartMom Mobile Health Education, 2020).

Therefore, this dissertation had the goal of not only reviewing existing mHealth interventions that targeted women's psychosocial adjustment during the perinatal period but also to develop a postnatal text message intervention called *Essential Coaching for Every Mother*. *Essential Coaching for Every Mother* was designed to send text messages to mothers during the first six-weeks postpartum with the goals of improving mothers' self-efficacy and feelings of social support and decrease postpartum depression and anxiety

2.4 Conceptual & Theoretical Framework

2.4.1 Conceptual Framework

Leahy-Warren and colleagues (2012) developed a conceptual framework describing the connection between social support, maternal self-efficacy and postpartum depression for first time mothers, underpinned by the social exchange theory (Blau, 1964) and Bandura's theory of self-efficacy (Bandura, 1977). The primary tenets of this theory is that social support can enhance maternal parental self-efficacy and positively influence mental health for first-time mothers at 6 weeks post birth (Leahy-Warren et al., 2012). Additionally, the authors state that "outcomes support two principles of Bandura's theory of self-efficacy: that social persuasion in the guise of informal support positively influences parenting self-efficacy and that psychosocial variables such as depression have inverse relationships to self- efficacy" (Leahy-Warren et al., 2012, p. 394) . The current research uses this conceptual framework as a foundation but extends their theory to include postpartum anxiety based on the growing acknowledgement of this outcome as an important postpartum mental health outcome. Additionally, this dissertation extends the theory to all mothers (regardless of parity), out to six-months postpartum (instead of six-weeks), and in a Canadian population. The goal is to build on the existing model and strengthen the findings for expansion into different postpartum populations. Figure 2.1 outlines the relationship behind these outcomes as proposed by Leahy-Warren and colleagues (2012), indicated by solid lines, with the addition of postpartum anxiety, indicated by dashed lines.

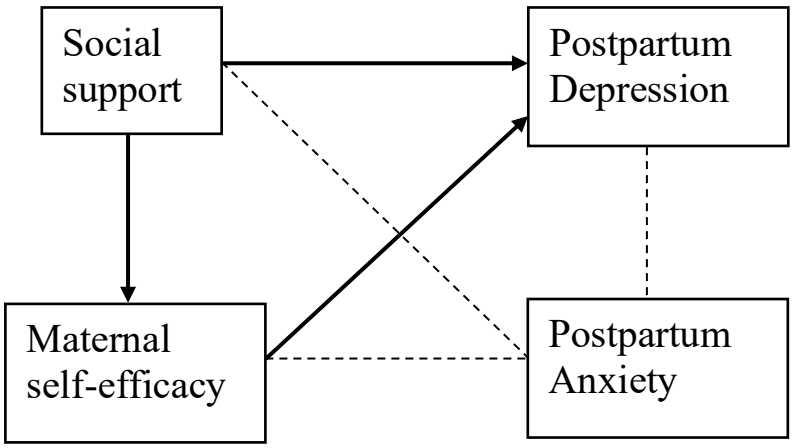


Figure 2.1. Postpartum adjustment theory developed by Leahy-Warren (2012), amendment to include postpartum anxiety (dashed lines indicate new proposed relations)

In their theory, Leahy-Warren and colleagues (2012) conceptualized social support as being "structural (sources of support) and functional components (informational, instrumental, emotional and appraisal)" (p.390), with their findings suggesting that mothers received high levels of support across all four functional aspects. They found significant relationships among their sample of first-time mothers at six weeks postpartum between informal structural social support (e.g., family, friends) and maternal parental self- efficacy ($r = 0.21$, $p < 0.001$) as well as postnatal depression ($r = -0.20$, $p < 0.001$) (Leahy-Warren et al., 2012). They also found a relationship between maternal self-efficacy and postnatal depression ($c^2 = 18.26$, $p < 0.001$) and an inverse relationship between total functional social support and postnatal depression ($r = -0.43$, $p < 0.001$) (Leahy-Warren et al., 2012).

Their findings lend support to their theory, which is further supported by additional research as well. High levels of social and family support have been found associated with higher levels of maternal self-efficacy for first time mothers

(Esmaelzadeh Saeieh et al., 2017; Mihelic et al., 2016). Cutrona and Troutman (Cutrona & Troutman, 1986) found that social support offers a protective factor against postpartum depression through enhancing maternal self-efficacy. Studies have found that postpartum depression can be reduced if women have high levels of social support, with the moderating effect of maternal self-efficacy (Haslam et al., 2006). There is clear justification of the relationship between maternal self-efficacy, social support and postpartum depression during the postpartum period.

To build on Leahy-Warren's theory, I propose that postpartum anxiety is likely influenced by social support and maternal self-efficacy in a similar way that postpartum depression is. Maternal self-efficacy has been found to have an inverse relationship with postpartum depression and anxiety, whereby women who have higher maternal self-efficacy were less likely to have postpartum depression or anxiety (Kohlhoff & Barnett, 2013; Reck et al., 2012). Low social support during pregnancy has been found to be linked to an increased risk of anxiety and depression at six weeks to four months postpartum (Bayrampour et al., 2016; Hetherington et al., 2018; Leahy-Warren et al., 2012). This was also found to be maintained over time; Hetherington and colleagues (2018) found that low social support at four months postpartum was associated with an elevated risk for anxiety at one year postpartum, but not depression. Bayrampour and colleagues (Bayrampour et al., 2016) found that perceived low social support was a significant risk factor for both anxiety and depression across pregnancy and up to one year postpartum. Postpartum depression has also been found to be associated with higher anxiety during the prenatal period and lower perceived satisfaction with paternal physical support (Sayil et al., 2007), suggesting there is a possible interaction between postpartum

anxiety and depression. Given that we know these factors are likely related, I propose that postpartum anxiety is a key factor in postpartum adjustment. The goal of the mHealth intervention is to enhance feelings of maternal self-efficacy and social support while reducing postpartum anxiety and depression.

2.4.2 Self-Efficacy Theoretical Framework

Through the provision of daily text messages through *Essential Coaching for Every Mother*, it is hypothesized that it will increase mothers' self-efficacy and feelings of social support and decrease their feelings of postpartum anxiety and depression. Bandura (1977) suggested that the greater a person's self-efficacy related to a specific behaviour (i.e., parenting), the more likely they are to engage with that behaviour. Bandura (1977) believes that self-efficacy can be encouraged through performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. Therefore, one way to increase self-efficacy is through the provision of text messages that encourages active learning, which can promote self-efficacy (Bandura, 2004). Active learning can occur not only through direct observation of others, but also positive reinforcement through verbal persuasion and reinforcement (e.g., "you're doing a great job") as well as vicarious experiences and modeling (i.e., understanding what is normal behaviour) (Bartholomew Eldredge et al., 2016).

An example of an mHealth app-based educational program that was developed based on Bandura's self-efficacy theory for parents is *Home-but not Alone*, which was developed for use in Singapore that was provided over four weeks after discharge from the hospital with routine care to improve parenting self-efficacy (Shorey et al., 2017a). Features of this app included the ability to interact with other parents, receiving feedback

from a professional midwife, and push notifications of education, all components meant to encourage the development of parenting self-efficacy (Shorey et al., 2017a). Using a randomized controlled trial, they found that participants who received the intervention had statistically significant improvements for parental self-efficacy, social support and parenting satisfaction at four weeks postpartum compared to the control group but had no changes in postpartum depression (Shorey et al., 2017a). Therefore, using mHealth interventions may be a useful way to not only share information to build mothers' self-efficacy but also build feelings of social support through providing ongoing contact to mothers.

2.5 Summary of Literature and Proposed Gap in Research

This literature review highlighted the challenges that women face in their transition to motherhood in their psychosocial adjustment and in particular, the importance of maternal self-efficacy and social support. The potential of using mHealth technologies to develop a postnatal educational intervention was identified, with a particular focus on text messages. Situating this work within the conceptual framework developed by Leahy-Warren and colleagues (2012) and the self-efficacy theory by Bandura (1977) identified the potential relationship between the psychosocial outcomes of relevance during the postpartum transition: maternal self-efficacy, social support, postpartum anxiety, and postpartum depression.

Despite the potential of mHealth to address postnatal psychosocial concerns, this is a significant gap in the current literature with much of the previous work focused on in-person visits. While in-person visits are extremely important to the well-being of women and their newborns, women need additional support in-between visits, which can be filled

by mHealth technologies, such as text messaging. Therefore, this research aimed to explore the postnatal experience of Canadian mothers to develop a postnatal text message intervention called *Essential Coaching for Every Mother* to improve mothers' self-efficacy and feelings of social support and decrease postpartum depression and anxiety.

Chapter 3: Methods

This chapter provides an overview of the aims and methods used to address the primary research questions: *How are mothers living in Canada experiencing their postnatal care and psychosocial adjustment in the postpartum period? How can an mHealth intervention be developed to address mothers' psychosocial outcomes?* This chapter describes the aims and methods of Manuscript 1 (Chapter 4) and Manuscript 2 (Chapter 5) which arose from the same mixed method study. Following that, a brief overview of the aims and methods of Manuscript 3 (Chapter 6) as a systematic review on mHealth interventions in the perinatal period and its impact on maternal self-efficacy, social support, postpartum anxiety, and postpartum depression. Finally, Manuscript 4 (Chapter 7) as the development of *Essential Coaching for Every Mother* is included. Study specific details are provided in the original manuscript and is in addition to the information presented in this chapter to minimize repetition.

3.1 Manuscript 1 (Chapter 4)

3.1.1 Aims & Objectives

Manuscript 1 (Chapter 4) is a mixed method study on the postpartum care experience of mothers in the three Maritime provinces (Nova Scotia, New Brunswick, and Prince Edward Island) in Eastern Canada. This study had two objectives. First, to fill the gap in knowledge related to the timing and frequency of postnatal care that mothers in these provinces experienced in relation to their most recent birth. The second objective was to explore how Maritime mothers viewed their most recent postnatal experience using thematic analysis to understand aspects that mothers felt were satisfactory and those that were unsatisfactory. Given the lack of recent examination of the postpartum

experience of mothers in Canada (Chalmers et al., 2008), and in particular the Maritime provinces, this work sought to fill this gap.

3.1.2 Methods

Manuscript 1 and 2 arose from the same online survey which had the overall purpose of exploring the relationship between mothers' self-efficacy, social support, postpartum anxiety, postpartum depression, newborn pain management knowledge, and their health information seeking behaviour during the six-month period post birth of their newborn for mothers living in Nova Scotia, New Brunswick, or Prince Edward Island. An online survey was used to collected data using primarily standardized surveys but with some open-ended response options as well. Mothers were eligible to complete the survey if they met the following criteria: (1) had a newborn six months of age or less; (2) were over 18 years of age; (3) could speak, write and read English; and (4) currently lived in one of the Maritime Provinces. All participants were provided with written information about the study via online consent form and were required to provide electronic consent to participate prior to starting the survey. Mothers were excluded if they live outside the Maritime Provinces or had their most recent baby over six-months prior to the time of study.

In specific relation to Manuscript 1, participants were asked to respond to the following questions which had the corresponding response options as outlined in Table 3.1. Quantitative data were analyzed using the statistical package for social sciences (SPSS 25). Total scores and frequencies were computed for all relevant outcomes. The open-ended question was analyzed using Nvivo 12 using thematic analysis informed by a qualitative descriptive approach (Bradshaw et al., 2017; Braun & Clarke, 2006). Two

independent scholars reviewed the manuscript for themes and discussed any discrepancies. Summarized themes were reviewed by experts to ensure findings were elucidated.

Table 3.1. Questions from survey used in Manuscript 1 (Chapter 4)

Question	Available response options
During your pregnancy, which type of caregiver was most directly involved in providing you care?	An obstetrician-gynecological doctor A family doctor A midwife A nurse practitioner A nurse who was not a midwife Other Not sure Prefer not to answer
During the postnatal period, which type of healthcare provider did you receive care from (check all that apply)	An obstetrician-gynecological doctor A family doctor A midwife A nurse practitioner A nurse who was not a midwife Other Not sure Prefer not to answer
After your baby was born, how many times did you see a healthcare provider within the first 6 weeks?	0 1 2 3 4+ Not applicable Prefer not to answer
When did you visit the healthcare provider? (select all that apply)	Day 1-2 Day 3-7 Day 8-14 Day 15-21 Day 22-28 Day 29-36 Day 37-42 Day 43-49 Don’t know/remember Not applicable Prefer not to answer
Were you satisfied with the care you received postnatally?	Yes No Don’t know/remember Prefer not to answer
Please describe your experiences with postnatal care interactions with healthcare providers.	Open ended

3.2 Manuscript 2 (Chapter 5)

3.2.1 Aims & Objectives

The second study (Manuscript 2) reported in Chapter 5 had the aim to explore the relationship between parity and newborn age on perceived maternal self-efficacy, social support, postpartum anxiety, and postpartum depression. Given the previous evidence of these key psychosocial outcomes, it was important to understand how parity (primiparous versus multiparous) and age of newborn (under 3 months or between 4-6 months) influence these outcomes.

3.2.2 Methods

As stated above, Manuscript 1 and 2 arose from the same online survey which had the overall purpose of exploring the relationship between mothers' self-efficacy, social support, postpartum anxiety, postpartum depression, newborn pain management knowledge, and their health information seeking behaviour during the six-month period post birth of their newborn for mothers living in Nova Scotia, New Brunswick, or Prince Edward Island. The outcomes captured in this study map onto the key concept in Leahy-Warren and colleagues (2012) conceptual model which will allow an exploration of the correlation between social support, maternal self-efficacy, postpartum depression, and postpartum depression. For postpartum depression, I used the Edinburgh Postpartum Depression Scale, consistent with the original model (Leahy-Warren et al., 2012). However, for social support and self-efficacy, different measures were selected as stated below. In specific relation to Manuscript 2, the following outcome and measurement tools were used. Outcomes not included here that were included in the primary study are related to pain management knowledge and health seeking information.

3.2.2.1 Self-efficacy

Parenting self-efficacy was measured using the Karitane Parenting Confidence Scale (KPCS) (Črnčec et al., 2008a). This 15-item tool was developed to assess perceived parenting self-efficacy of mothers of newborns between birth to twelve months of age and has acceptable internal consistent (Cronbach's alpha = 0.81) and test-retest reliability (r = 0.88) (Črnčec et al., 2008a). A cut off score of 39 or less (out of a possible 45) was determine to be a clinically low perceived parenting self-efficacy (Črnčec et al., 2008a). Although not relevant to this study, a reliable change index of 6 or more is considered a significant change in their level of perceived parenting self-efficacy, suggesting parents could be considered to have a high parenting self-efficacy if they have a score above 40 or an improvement of 6 points, although still under a 39 score when measured over time (Črnčec et al., 2008a).

A challenge with measuring maternal self-efficacy is a lack of a "gold standard" measurement tool as well as there is a need to develop minimal clinically important differences (Albanese et al., 2019; Wittkowski et al., 2017). Wittkowski and colleagues (2017) conducted a systematic review on self-report measures of parental self-efficacy with the goal of providing clarity for future measurement. They identified 34 possible measures of parental self-efficacy, none of which have been universally adopted (Wittkowski et al., 2017). For the purposes of this project, the KPCS (Črnčec et al., 2008a) was selected as the most appropriate assessment of maternal self-efficacy because it was appropriate for infants from birth to 12 months of age and was domain-specific, meaning it was related to the task of parenting, rather than global self-efficacy (Wittkowski et al., 2017). While this differs from the measurement used in Leahy-

Warren's (2012) original study, it was the highest scored assessment tools by Wittkowski and colleagues (2017), with a higher score indicating strong psychometric and administrative qualities, including assessment in content validity, interpretability, and criterion validity among others. Thus, given the focus on the appropriate age group, specific evaluation of parenting self-efficacy, and its overall strong psychometric and administrative quality, the KPCS (Črnčec et al., 2008a) was selected as the most appropriate assessment of maternal self-efficacy.

3.2.2.2 Social Support

Social support was measured through the Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al., 1990). This 12-item scale is a measure of how much support a person feels they get from family, friends and significant others from which subscales of each source can be calculated (range 1-7) as well as a total score (range 12-84). For each category, the following items correspond with family (items 3, 4, 8, 11), friends (items 6, 7, 9, 12), and significant others (items 1, 2, 5, 10). To calculate the average scores, the responses are added up and divided by the number items in the category (i.e., for the subscales, divide for four; for the total score, divide by 12). Total scores between 1 and 2.9 are considered 'low support', 3 to 4.9 are 'moderate support', and 5 to 7 is considered 'high support' (Zimet et al., 1988). The MSPSS has been determine to be valid and internally reliable with Cronbach's alpha ranging from 0.81 to 0.94 on individual subscales to 0.83 to 0.92 for the scale overall (Zimet et al., 1990).

Measuring social support is a widely studied topic and can be measured through emotional support, such as empathy or listening; tangible support, such as practical help in child care or around the house; or informational support, such as advice or information

(Dambi et al., 2018). It can also be measured from the perspective of support sources, including formal (e.g., doctors, family, friends) and informal (e.g., social media) (Dambi et al., 2018). One of the most widely used measures of social support is the MSPSS, which measures the amount of social support across three sources – friends, family, and significant other (Dambi et al., 2018). It has also be used previously in the perinatal population with good validity and internal reliability (Esmaelzadeh Saeieh et al., 2017; Razurel et al., 2013; Zimet et al., 1990). While other options for measuring social support exist, there is no consensus on the preferred measurement tool in the postpartum period. For instance, Hopkins and Campbell (2008) developed the Postpartum Social Support Questionnaire that evaluates support from partners, parents, in-laws, and extended-family and friends, however it was originally designed for assessment beginning at 2 months postpartum, which limits completion by parents with infants younger than 2 months. The Social Provision Scale has also been used in the perinatal populations, which considers social support from all possible sources (friends, family members, co-workers, community members) and their impact on feelings of guidance, reassurance of worth, social integration, attachment, nurturance, and reliable alliance (Cutrona & Russell, 1987). However, it does not differentiate on where the support is coming from but considers all social support together. When considering the purpose of this project and the role that family, friends, and significant others have during the postpartum period, the use of the MSPSS was determined to be the most appropriate measure.

3.2.2.3 Postpartum anxiety

Anxiety was measured using the Postpartum Specific Anxiety Scale (PSAS) (Fallon et al., 2016). The scale has four factors: factor one (competence and attachment

anxieties), 15 items related to maternal self-efficacy, parenting competence and the mother-infant relationship; factor two (safety and welfare anxieties), 11 items related to fears about infant illnesses, accidents and cot death; factor three (practical baby care anxieties), seven items related to infant care such as feeding, sleeping and general routine; and factor 4 (psychosocial adjustment to motherhood), 18 items related to adjustment concerns since the birth of the baby about management of personal appearance, relationships and support (Fallon et al., 2016). The PSAS is a valid and reliable measure to assess anxiety during the first six-months postpartum, with individual factor reliability having a Cronbach's alpha from 0.80 to 0.91 with an overall alpha of 0.95 (Fallon et al., 2016).

Similar to maternal self-efficacy and social support, there is no consensus on the measurement of postpartum anxiety. In 2011, Meades and Ayers conducted a systematic review on anxiety measurement tools used in the perinatal period and found that the most commonly used measures were the General Health Questionnaire, the State–Trait Anxiety Inventory (STAI), and the Hospital Anxiety and Depression Scales, although there was significant heterogeneity across studies. Most recently, Dennis and colleagues (2017a) in their systematic review on postpartum anxiety prevalence found that majority of studies used the STAI to assess postpartum anxiety. Meades and Ayers (2011) commented that none of the measures were designed specifically for use in the postpartum period, which is a significant limitation in comparison to postpartum depression. Since the review by Meades and Ayers (2011), the publications on postpartum anxiety has increased, including Fallon and colleagues (2016) who developed a measurement tool specifically for postpartum anxiety. While the STAI has been

increasingly used and can provide both general anxiety and situation-specific anxiety, there is insufficient evidence to suggest that it is a superior measure to the PSAS. As such, given the comparable reliability of the tools to measure anxiety in this population and the lack of fee associated with the use of the PSAS, the PSAS was determined to be the most appropriate to measure postpartum anxiety for this study.

3.2.2.4 Postpartum Depression

Depression was measured using the Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987). The EPDS is a self-report screening scale with 10 items that can indicate if a respondent has symptoms related to postnatal depression (Cox et al., 1987, 2014). Each question has a possible score of 0, 1, 2, or 3 and responses are summed to calculate the total score. Total scores less than 8 indicate 'depression not likely', scores between 9-11 indicate 'depression possible', scores between 12-13 indicate 'fairly high possibility of depression', and a score of 14 or greater indicates 'probable depression'. The EPDS is a valid and reliable measure to screen depressive symptoms during pregnancy and up to the first year after birth (Boyd et al., 2005; Cox et al., 1987, 2014), with a standardized coefficient of 0.87. (Cox et al., 2014).

While numerous tools have been developed and validated for measuring postpartum depression, the EPDS is the most widely used postpartum depression screening tool in both research and clinical settings (Smith et al., 2016). It can be administered within five minutes, and has been validated in 57 languages (Smith et al., 2016). There is no cost for administration and can be repeated over time (Smith et al., 2016). In order to be consistent and relevant to future systematic reviews as well as the

previously mentioned strengths, the EPDS was selected as the most appropriate assessment tool for postpartum depression.

3.2.2.5 Demographics

Demographics were collected on the participants who complete the survey, including gender, age, income, marital status, geographic location, education level, and parity. The independent variables were parity (dichotomized into primiparous and multiparous) and age of newborn (dichotomized into 0-3 months and 4-6 months). Frequencies and descriptives were used to report demographic characteristics and correlations were run (Spearman and Pearson, as applicable) between demographic and dependent variables. Significant correlations were included as co-variates in the MANCOVA.

3.3 Manuscript 3 (Chapter 6)

3.3.1 Aims & Objectives

A systematic review (Manuscript 3), as reported in Chapter 6, was conducted to evaluate the effectiveness of mother-targeted mHealth education interventions during the perinatal period on maternal psychosocial outcomes in high-income countries. Given the potential of mHealth interventions, it was hypothesized that mHealth interventions could improve maternal self-efficacy, social support, postpartum anxiety and postpartum depression outcomes in women in high-income countries. While there have been systematic reviews on the impact of mHealth interventions on maternal and newborn health in low- and middle-income countries (Chen et al., 2018; Dol et al., 2019a; Hurt et al., 2016), the impact of mHealth interventions on maternal psychosocial health outcomes in high-income countries remains uncertain.

3.3.2 Methods

This Joanna Briggs Institute (JBI) review considered studies of mHealth education interventions targeting mothers in high-income countries during the perinatal period. All details related to the conduct of this review is reported in the published protocol (Dol et al., 2019c) and in the systematic review in Chapter 6. Briefly, interventions must have evaluated mother-targeted mHealth educational interventions during the antenatal or postnatal period and must have started sometime between the antenatal period (conception through birth) through to six weeks postpartum. This review considered studies that compared the intervention to any controls, including standard care, placebo or no treatment. All experimental study designs were included that were published after 2000 to December 16, 2018 when the search was completed. Outcomes included maternal self-efficacy, social support, postpartum anxiety and postpartum depression defined in relation to each study. Two independent reviewers screened title and abstracts and full-text, and all identified studies were critically appraised and data was extracted by two independent reviewers. Data was meta-analyzed using Review Manager 5.3 when possible and otherwise reported narratively.

3.4 Manuscript 4 (Chapter 7)

3.4.1 Aims & Objectives

The final study, chapter 7, is the development, design, and iterative testing of *Essential Coaching for Every Mother* in Halifax, Canada. First time mothers (n=11) and postpartum healthcare providers (n=18) were involved in three rounds of iterative interviewing using semi-structured interviews. This section describes the design and iterative testing that led to the creation of *Essential Coaching for Every Mother.*

3.4.2 Methods

3.4.2.1 Design

The initial messages were developed by J. Dol and reviewed by the committee to ensure accuracy of evidence-based information and content coverage. Messages were initially based on WHO (2013) guidelines for postnatal care to ensure standardized evidence-based content and in keeping with Canadian recommendations. Messages initially consisted of four types: education, reminders, social support, and interaction, all with the goal of reinforcing positive maternal self-efficacy associated with newborn care and maternal emotional health. Messages targeted newborn care and maternal emotional health as this has been identified by mothers as a high priority early need associated with new motherhood (Barnes et al., 2008; Loudon et al., 2016). If additional areas of maternal concern arose during the iterative testing, the plan was to include and pilot them. Modification of messages occurred using the Loving Care booklets which are provided to all mothers who deliver in Nova Scotia and used by all postpartum healthcare providers in the province (The Nova Scotia Department of Health and Wellness, 2015b).

Educational messages provided one-way information to encourage action, covering topics including newborn care (exclusive breastfeeding, hygiene cord care, handwashing, umbilical cord care, thermal care, and danger signs (fever, breathing, poor feeding, no movement/reduced tone, jaundice, cord infection, and convulsions)) and maternal emotional health (anxiety, depression). Reminder messages consisted of one-way messages about attending a six-week postnatal contact and seeking medical care if they recognized a danger sign or needed additional support. Social support messages include information about how other mothers had acted or responded in similar situations

to encourage mothers to provide evidence-based care or seek additional support. Finally, interactive messages included options for mothers to respond to inquiries, such as checking in to whether mothers visited a six-week postnatal contact. Both the frequency, topics, and content of the messages were to be revised based on feedback obtained from mothers and healthcare postpartum providers.

Messages were created initially with the goal of sending at least one message per day for the 42 days. To ensure equal representation of content areas, there were four messages each on: postpartum anxiety, postpartum depression, feeding, handwashing, umbilical cord care, thermal care, and each of the danger signs – fever, poor breathing, poor feeding, no movement, jaundice, cord infection, and convulsions. For each topic, there were three messages providing education and one on social support or interaction. A reminder message was provided for the postnatal care follow-up at six-weeks as well as to reminders to complete the six-week follow-up survey.

The maximum amount of characters allowed for a text message is 160 characters including spaces, as messages over that character count are split into different messages (Abroms et al., 2015b; Twilio, 2018). While this character limitation was to be the target of the finalized messages, due to the iterative process of development, the initial messages were designed to a maximum of 180 characters. Wording modifications to be within 160 characters were completed during the second round of revisions and beyond. Messages that were more than 160 characters were separated into different messages to ensure the flow of the messages was consistent. Messages were professional (e.g., no slang or informal punctuation) and the reading level was targeted at a grade eight level (Abroms et al., 2015b).

Essential Coaching for Every Mother was originally designed with the target population of first-time mothers. This target population was chosen due to the high risk for first-time mothers during the immediate postpartum period related to maternal self-efficacy, which is the primary outcome of interest. Additionally, by focusing on first time mothers, it allows for clearer delineation between confounding factors of previous experience with having a newborn or previous interaction with public health and postpartum support. While this was the focus for the original development and evaluation, there is no reason that this intervention could not also be provided to multiparous women.

3.4.2.2 Methods

To ensure that the content of *Essential Coaching for Every Mother* was appropriate and acceptable, the messages were piloted with mothers and postpartum healthcare providers simultaneously using individual interviews (see Appendix A for the original messages). At the start of the interview, participants were provided with the pre-developed messages printed on cardstock paper divided by topic area for the first two rounds of iterative testing and by timing for the third round of iterative testing. The interview was semi-structured, with the following questions starting the conversation: *How would you feel about receiving these messages during your first six-weeks after your infant was born? Does anything come to mind when you read this? Are there any words that you did not understand? Was anything in this unacceptable or offensive? Is there a different way you would say this? If so, how would you like this message to be shared with you?*

Mothers were also asked to complete a brief written survey immediately after the interview, including demographic questions as well as the Information Assessment Method (IAM)-Parent survey (Bujold et al., 2018). Mothers and healthcare providers were also asked questions how often they think mothers would like to receive such messages, when during the day the messages should be receive, and any additional information they would like to have that was not covered in the current messages (see Appendix B for the interview guide for mothers and Appendix C for the interview guide for healthcare providers).

To ensure that adequate feedback is obtained, the goal was to interview approximately five mothers and five healthcare providers in each round. If participants identified similar concerns on existing messages or the need for additional topics, it was modified by J. Dol in consultation with the committee. Once the revised messages were developed, another round of interviews with participants occurred with another five mothers and five healthcare providers. A third round of interviews was considered if additional changes were still necessary after the second round.

In practice, the first round of interviews included eight participants (3 mothers and 5 healthcare providers), the second round had thirteen participants (8 mothers, 5 healthcare providers) and the final round had 8 participants (8 healthcare providers). The first round had only three mothers as it was clear from all interviews conducted that there were significant changes required in the messages to be more well-baby focused rather than risk focused. In order to minimize the anxiety and stress on mothers who were still early postpartum (less than 2 months), recruitment for mothers was paused and modifications were made based on inclusion of only three mothers during this round. To

ensure that mothers were sufficiently engaged and consulted, additional mothers were included in the second round of feedback. During this stage, there was minimal systematic changes with much of the focus being on minor modification, rather than content or approach changes. The third round was only conducted with healthcare provider as this round was focused on the timing of the messages as appropriate to postpartum care, rather than significant changes to the content. The aim of the third round was to ensure the messages were sent to the mothers at the relevant time, and thus, it was important to include additional postpartum healthcare providers in this round to ensure representation and sufficient expertise to confirm the appropriate timing.

Chapter 4: Women's Experience of Postnatal Care in the Maritime Provinces of Canada: A Mixed Method Study

Statement of manuscript contribution: JD and MCY were the co-principal investigators on the original study in which the data were collected, along with BR, a PhD Candidate in the School of Nursing (Dalhousie University). JD analyzed the data and drafted the manuscript. JD, MCY, BR, MA, DM, and GTM contributed to revising the manuscript. All authors read and approved the final manuscript. The manuscript is currently undergoing peer-review in the *Canadian Journal of Nursing Research*.

4.1 Abstract

Objectives: To explore (1) with whom and how often women receive postnatal follow-up visits and (2) the postnatal care experiences of mothers living in the Maritimes.

Methods: Using an online mixed-method survey, women who had given birth within the past six months in Nova Scotia, New Brunswick and Prince Edward Island were recruited between October 1, 2019 - January 1, 2020. Frequencies were computed for quantitative outcomes and thematic analysis was used for qualitative responses.

Results: Five-hundred and sixty-one mothers completed the survey. Women saw on average 1.9 different postnatal healthcare providers, primarily family doctors (72.4%) and obstetricians (55.8%). The number of visits that women had with any healthcare provider within the first six weeks varied: 3.2% had no postnatal visits and 37.6% had four or more; 60.0% of women had an in-person visit between days 3-7, with 31.5% having a follow-up visit in week six or week seven. Two-thirds of women (76.1%) were satisfied with their postnatal care while 20% were unsatisfied. Women's perceived satisfactory care in the postnatal period was associated with in-person and at home follow-ups, receiving desired support, and receiving timely, appropriate care for self and newborn; unsatisfactory care was associated with challenges accessing care, experiencing gaps in follow-up visits, and having unsatisfactory assessment for themselves in their own recovery.

Conclusion: There is variation across the Maritime provinces in the timing and frequency of postnatal visits. While many women are experiencing satisfactory care, there are areas where women are reporting dissatisfaction and are facing challenges.

4.2 Introduction & Background

Despite the significant challenges and changes that occur in the period after birth for women and her newborns, the postnatal period is limited in terms of direct healthcare across the perinatal period (Isaacs, 2018; Verbiest et al., 2016). This lack of formal, standardized support during the postnatal period for women and their newborns is a shift from the intense monitoring that occurs near the end of pregnancy where women have appointments with healthcare providers often on a weekly basis (Tully et al., 2017). The quality of care a woman receives after birth varies depending on the type of care provider involved in her care, where the woman lives, whether they are considered high needs or have identified health concerns for themselves or their newborn (Langlois et al., 2015; Reproductive Care Program of Nova Scotia, 2002; Verbiest et al., 2016).

The World Health Organization recommends that postnatal care for newborns and women occur within the first 24 hours, followed by a contact between 48–72 hours, 7–14 days, and six weeks post birth (World Health Organization, 2013). In Canada, recommendations by the Canadian Pediatric Society are for the newborn to be re-assessed between 48-72 hours (Lemyre et al., 2018) and at one week (Canadian Paediatric Society, 2020). The Society of Obstetricians and Gynecologists of Canada (2020) recommends that women and their newborns be followed-up at one week and 4-6 week post birth. Under midwifery care, several home visits tend to occur in the first week, and follow-up contacts throughout the first six weeks with women having 24/7 on-call access to their midwife (Association of Nova Scotia Midwives, 2020). However, there is a lack of consistent implementation of postnatal care, education or support within Canada with recommendations for postnatal care varying by province and provider, despite detailed

protocols in public health that provide guide on terms of health nursing supports, contacts, and home visits (Reproductive Care Program of Nova Scotia, 2002).

While the Canadian national postpartum care guidelines were recently released in December 2020 with an increased focused on family-centered care, there was no mention of standardization of postpartum care (Public Health Agency of Canada, 2020b) and provincially, recommendations also vary. In Nova Scotia, the recommendations are for a postnatal care contact within one to two weeks after birth, followed by another follow-up at six weeks (Reproductive Care Program of Nova Scotia, 2002). However, both Prince Edward Island (PEI) and New Brunswick (NB) do not have any standardized recommendations for postnatal contacts, with timing and frequency of follow-ups varying depending on the care provider (personal communication, NB and PEI Public Health representatives). Additionally, women may chose not receive any postnatal visits by a public health nurse or may not screen in as high risk for a visit (Reproductive Care Program of Nova Scotia, 2002), adding additional variation in the postnatal care experience. Nevertheless, after a woman gives birth, care is usually only once or twice for herself in the first year (Spelke & Werner, 2018) and by six-weeks after birth, most planned postnatal care for the women ends (Reproductive Care Program of Nova Scotia, 2002).

In the postnatal period, women experience significant changes in the first six-weeks and beyond, both physically and mentally (Dennis et al., 2017a; Wynter et al., 2013). Postnatal care contacts are an opportunity for women to receive important information from healthcare providers about newborn health, caring for their newborn, getting help with breastfeeding, and learning about risks for themselves and their

newborn (World Health Organization, 2013). Postnatal care contacts also offer the ability to provide psychosocial support for women, including but not limited to screening for postpartum anxiety and depression, addressing their reproductive health needs, inquiring about the family adjustment, and providing breastfeeding support (American College of Obstetricians and Gynecologists, 2018; Reproductive Care Program of Nova Scotia, 2002). While mothers in Canada should have access to doctors, nurses, and midwives who can provide information about new experiences and caring for their infant, there is also a recognized paucity of information on the number and timing of postnatal care contacts, optimal provider type and whether the current models meet women's needs (Langlois et al., 2015; Tully et al., 2017; World Health Organization, 2010).

The most recent Canadian evaluation of postnatal care was part of the 2006 Maternity Experiences Survey with 6,421 women across Canada (Chalmers et al., 2008; Public Health Agency of Canada, 2009). They reported that 93.9% of women were contacted by a healthcare provider on average 6.8 days after birth, but this varied by province (Chalmers et al., 2008; Public Health Agency of Canada, 2009). They also found that two-thirds of women were very satisfied with the care that they received and three-quarters were very satisfied with the care their newborn received (Chalmers et al., 2008; Public Health Agency of Canada, 2009). However, they did not report on what resulted in a satisfactory versus unsatisfactory care experience nor did they provide detailed information on which healthcare providers were involved in postnatal care. There is an opportunity to further explore the postpartum experience of mothers living in Canada.

The objectives of the current study are to explore (1) with whom and how often women receive postnatal follow-up visits and (2) the postnatal care experiences of mothers living in the Maritimes provinces from their perspective.

4.3 Methods

4.3.1 Design

The current study used a mixed-method approach, incorporating descriptive, quantitative data and open-ended, qualitative responses from an online survey. The survey was developed using both standardized questionnaires on psychosocial health outcomes as well as non-standardized, forced choice and open-ended questions. The survey was piloted prior to recruitment for clarity, length, and ease of use. This paper is part of a larger study on the postnatal experience of mothers living in Nova Scotia, New Brunswick, and Prince Edward Island.

4.3.2 Setting

Women who had given birth within the past six months and lived in either Nova Scotia, New Brunswick, or Prince Edward Island were recruited. These three provinces cover 133,850 km^2, representing 5.1% of Canada's total population (Rawlyk, 2015; Statistics Canada, 2019a). The annual number of births in these provinces was 15,684 in 2018, representing 4.2% of Canadian births (Statistics Canada, n.d.). Canada has a universal health care system in which access to perinatal care is free to all Canadian citizens and permanent residents who apply for public health insurance (Government of Canada, 2020). Despite the universal healthcare system, healthcare is managed provincially with each province having their own insurance plan that regulates and oversees healthcare (Government of Canada, 2020). In NS, recommendations are for a

postnatal care contact within 1-2 weeks after birth, followed by another follow-up at six weeks (Reproductive Care Program of Nova Scotia, 2002). However, both NB and PEI do not have any standardized recommendations for postnatal visits, with timing and frequency of follow-ups varying depending on the care provider (personal communication, NB and PEI Public Health representatives). A focus on the Maritime province was chosen to add to the existing literature on postpartum care and outcomes across Canada (Dennis et al., 2016; Kingston et al., 2018; Sword et al., 2009).

4.3.3 Eligibility Criteria & Sample Size

To be eligible, women must have met the following criteria: (1) had a newborn six months of age or less; (2) were over 18 years of age; (3) speak, write and read English; and (4) currently lived in either Nova Scotia, New Brunswick, or Prince Edward Island. Mothers were excluded if they lived outside these provinces or had their most recent baby over six-months prior to the time of study. Given the previous and ongoing work in other areas (Dennis et al., 2016; Kingston et al., 2018; Sword et al., 2009), this project chose to focus on this understudied geographic area of Canada. Mothers were asked to self-identify as eligible by agreeing to each of the above points prior to being able to access the consent form and survey. There was no limit on the number of survey responses but a targeted sample size of 375 mothers was estimated to be sufficient with a margin of error of 5% and level of confidence of 95% using a population estimate of 15,684 women in these provinces giving birth in a 12-month period (*Sample Size Calculator*, 2014).

4.3.4 Data Collection

Women were asked to participate in an online survey via social media, including boosted posts (paid advertisement) on Facebook, as well as media releases, posters, and word of mouth. The survey was open for a three-month period (October 1, 2019 - January 1, 2020) and was hosted on a secure university survey platform. Prior to starting the survey, participants completed an online consent form and eligibility questionnaire to ensure they met all inclusion criteria outlined above. Once participants entered the survey, they completed questionnaires about their postnatal health care experience. Of note, the terms 'postnatal' and 'postpartum' are often used interchangeably in the literature, with the former referring to the newborn and the latter referring to the women, with the term postnatal typically used pertaining to the dyad (World Health Organization, 2010). For the purposes of this study, we used the terms in the same way.

If participants did not meet the eligibility criteria, they were re-directed to a page that thanked them for their interest but informed them that they were not eligible to participate. Demographics were collected to describe the sample. The survey also collected data on other postnatal outcomes using standardized measures, including psychosocial outcomes and pain management, which is not the focus of this paper and will be reported elsewhere.

The whole survey took approximately 30 minutes to complete, and women could opt into a draw for one of three $100 CAN electronic gift cards once they completed the full survey. The survey was organized to present groups of questions based on topic or standardized questionnaire. While each item was required to have a response, women were given the option to select 'prefer not to answer' for all questions to advance the

survey without response. To determine satisfaction with postnatal care, women were asked to respond with yes, no, don't know or remember, or prefer not to answer, the following question "were you satisfied with the care you received postnatally?"

4.3.5 Ethical Procedures

Ethical approval was obtained from the IWK Health Centre prior to data collection. Mothers were informed during the consent statement that they could stop the survey at any time by exiting the survey. Participants who did not complete the full survey were not included in the analysis.

4.3.6 Data Analysis

Quantitative data were analyzed using the statistical package for social sciences (SPSS 25). Total scores and frequencies were computed for all relevant outcomes. Qualitative data was analyzed using Nvivo 12 using thematic analysis informed by a qualitative descriptive approach (Bradshaw et al., 2017; Braun & Clarke, 2006), led by the first author and verified by the second author.

4.4 Results

Five-hundred and sixty-one (561) mothers completed all aspects of the survey, which was 73.7% of all respondents who self-identified as eligible and completed the consent form (n=761). There was representation across the provinces, with 46.5% of mothers from Nova Scotia, 30.5% from New Brunswick and 23.0% from Prince Edward Island. This is generally reflective of the number of births that occurred in these provinces in 2019 with Nova Scotia having 51.8% of the births, followed by New Brunswick at 40.0% and PEI at 8.2% (Statistics Canada, n.d.). The higher number of

responses from Nova Scotia and PEI may be related to media coverage of the project in those provinces.

Mothers were on average 30.66 years of age (Standard Deviation (SD) = 4.62) with a range of 1-5 (biological children (M=1.61, SD = 0.82), including their most recent baby. Over half of the women (56.5%) were primiparous and were predominantly white (98.2%). The mean age of the infant at time of survey completion was 3.2 months (SD = 1.80, range 0-6 months).

4.4.1 Postnatal Care Providers and Frequency

In terms of the healthcare provider involved in their care, most women were followed during their pregnancy by an obstetrician-gynecological doctor (56.9%) or a family doctor (26.6%, Table 4.1). In the postpartum period, women were primarily followed by a family doctor (72.4%) then an obstetrician-gynecological doctor (55.8%). For these outcomes, respondents could select more than one healthcare provider who was involved in their care. Women saw on average 1.88 healthcare providers during the postpartum period (SD = 0.90, range 0-4).

Table 4.1. All healthcare providers providing perinatal care

Healthcare provider	Pregnancy n (%)	Postnatal [a] n (%)
An obstetrician-gynecological doctor	319 (56.9)	313 (55.8)
A family doctor	149 (26.6)	407 (72.5)
A midwife	18 (3.2)	17 (3.0)
A nurse practitioner	51 (9.1)	138 (24.6)
A nurse who was not a midwife	11 (2.0)	152 (27.1)
Other	13 (2.2)	28 (5.0)

a. Does not equal 100% due to the ability to select more than one option

The number of visits that women had with any healthcare provider within the first six weeks varied: 3.2% had no postnatal visits, 15.2% had one visit, 21.6% had two or three visits each, and 37.6% had four or more. Of the 538 women who had a visit (excluding respondents who said not applicable or prefer not to answer), there was also variation in when these women visited a healthcare provider. Over half of the women had a postpartum contact between day 3-7 (60.0%) while 48.1% reported having an appointment during day 8-14 (Figure 4.1). Less than a third of women reporting having a postpartum visit at each of the following weekly time-points, with the lowest follow-up between day 37-42 (18.2%).

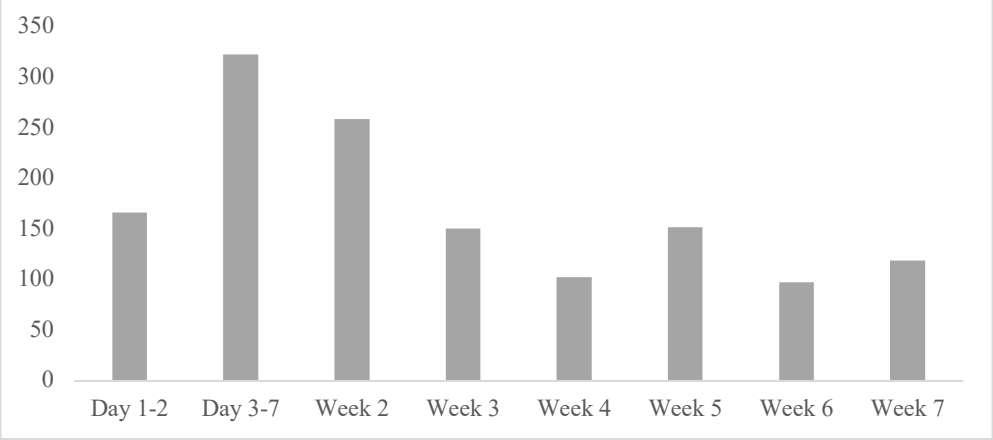


Figure 4.1. Number of women who had a postnatal visit with a healthcare provider

Over two-thirds of respondents who had a follow-up contact (n=522), had their first postnatal visit with a health care provider within the first week – 32.0% (n=167) in the first two days and 39.5% (n=206) between day three and seven (Figure 4.2). In terms of the six-week follow-up, just under a third (n=177, 31.5%) had a follow-up visit in

either week six or week seven. Two-thirds of respondents did not have a visit during these two weeks (n=364, 64.9%).

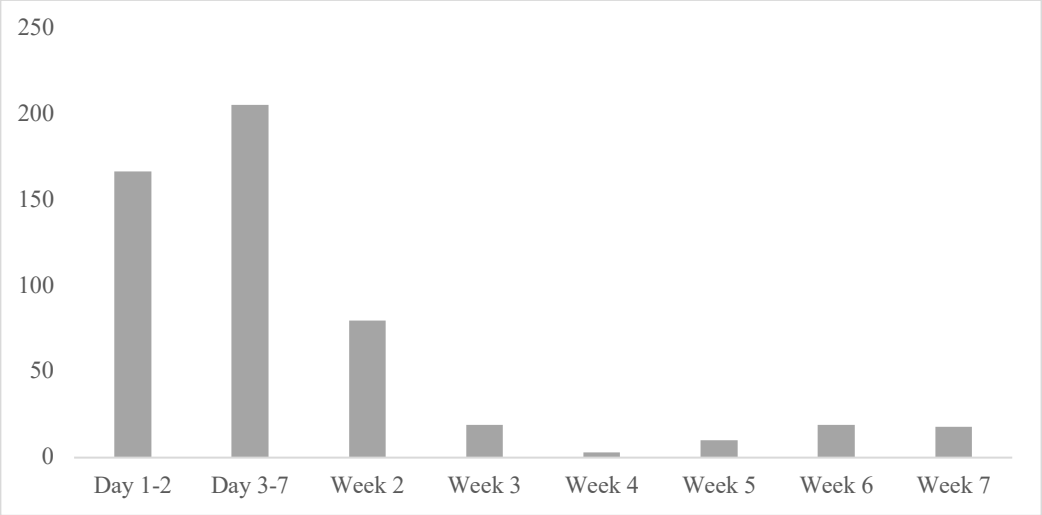


Figure 4.2. Timing of when women had their first postnatal visit with a healthcare provider

4.4.2 Postnatal Care Experiences

When asked if they were satisfied with the care they received during their postnatal follow-ups, 76.1% of women responded that they were satisfied. Twenty percent were unsatisfied and 3.9% preferred not to answer. Almost two-thirds (n= 357, 63.6%) of women provided some details about her postnatal experience when provided an opportunity to respond to an open-ended question. From these responses, six themes were identified – three themes related to satisfactory care and three themes related to unsatisfactory care. For satisfactory care, women (1) valued in-person follow-up from public health nurses and midwives; (2) desired support from their healthcare providers; and (3) perceived receiving timely, appropriate care. For unsatisfactory care, women (1)

had challenges accessing postnatal care; (2) experienced gaps in postnatal follow-ups; and (3) had unsatisfactory postpartum checks for themselves in their physical recovery.

4.4.2.1 Satisfactory Care

The first theme that was identified by women who were satisfied with their care was that the in-person follow-up that was provided by public health nurses and midwives was valued. Women acknowledged that having the public health nurses come to their homes was an invaluable part of their postnatal experience: "Thank goodness for the public health nurses who would visit and help us within the first few weeks of weight gain trouble and anxiety". Women appreciated their visits over the first six weeks and the help they provided with breastfeeding and weighing their baby. Women who were under the care of the midwives, although a small percentage of our sample, also acknowledged the benefit of having them check in on them as well as the ability to contact them directly with any questions they have. One woman said:

> Midwifery care provides excellent postpartum care. I was reassured to know that I could page them at any time with concerns. I think the immediate postpartum period would have been a lot more difficult without midwifery care. This support is needed in such a crucial moment in the mother-baby dyad.

The second theme related to satisfactory care was when women received desired support from their healthcare providers. Women felt that healthcare providers were generally helpful: "my physician and nurse [were] beyond kind and helpful" and "very thorough, took time to update me on new best-practice procedures since my last baby". In particular, women commented that healthcare providers were helpful in answering their breastfeeding questions and providing support for breastfeeding issues: "the nurses were wonderful at helping me to breastfeed and building my confidence feeding my baby." Another woman said: "[I] found the public health nurse extremely helpful, she came to

my house multiple times to help with breastfeeding and pumping. I saw a lactation consultant who I also found very helpful." Women felt that their healthcare provider was able to answer any questions they had and provide resources and more information. One woman said her healthcare provider was "helpful in providing information and answering questions without judgement or attitude". Women also felt supported and reassured by their healthcare provider, both in terms of anxiety and uncertainty around infant care but also physical changes they were experiencing. Women who were satisfied felt the knowledge of their healthcare provider was sufficient and they were able to provide advice and care to themselves and their newborn.

The final theme for women who were satisfied with their care was that they received timely, appropriate follow-ups. Women commented on their ability to receive postnatal appointments during an appropriate time frame: "My family doctor was excellent, got me right into an appointment within five days after my daughter was born". Another woman said: "Our family doctor was also fantastic, providing a check-up of the baby and myself at two weeks postnatal and four weeks postnatal." Women also appreciated that their healthcare provider asked about their mental and physical health: "Extremely attentive and professional and again, asked appropriate questions regarding mental and physical health" and "always asked about both my physical and mental states and checked on baby as well. Felt very taken care of". Women also mentioned that the six-week appointment was often a time where contraception and family planning was discussed and offered.

4.4.2.2 Unsatisfactory Care

While many women had positive experiences, women also had challenges accessing postnatal care, resulting in an unsatisfactory care experience. In particular, women commented on their difficulty in getting follow-up appointments, despite reaching out for support. Some examples of challenges in getting appointments for newborn care are as follows:

> I did try to receive [hospital] breastfeeding support once we learned baby was not gaining weight sufficiently. I left three messages and called multiple times and was unable to reach anyone for support.
>
> … due to long wait times to see my doctor, my newborn did not get in for the two-week check that was suggested when I left the hospital. He was nearly six weeks old when he was first seen.

Women also experienced challenges getting their own personal follow-up appointments as well:

> I did have to wait 12 weeks for my 6-week follow up with my obstetrician [OB] because of shortage of OBs at a near hospital.
>
> [I] have been having issues with a lot of pain in my tailbone. Went to the ER one night because I could not get an appointment with a doctor about it.

Women also discussed the long wait times for appointments or delays in appointments once booked. One woman explained: “She has some feeding problems with spitting up and [I have] been waiting 2 months for a call from the pediatrician which I feel is a long time to wait when it comes to the feeding and health of a newborn baby.” Another woman said: “After having to wait over an hour in a room full of sick people with a newborn, I then had to wait another 45 minutes in a room waiting for the doctor.”

The second theme that emerged related to unsatisfied care during the postnatal period was that women experienced gaps in care during follow-ups: “[My follow-up was]

brief, [I] would have preferred a checkup 2 weeks postpartum as well as 6 weeks. Rather than googling everything for 6 weeks." Women felt that they wanted more information than was often provided, with some mothers also mentioning that healthcare providers offered conflicting information.

> The public health nurse visited our home twice. Her information often differed from what the nurses said in the hospital. There was an inconsistency in the information provided.

Another challenge noted was that some women felt pressured by their healthcare provider to engage in certain behaviors without listening to their needs, particularly around breastfeeding.

> The attitude and anxiety from medical professionals that I felt and received about supplementing with formula when I had supply issues and he was losing weight really caused significant mental distress for me.

Women reported disappointment in the care received, both in the hospital in the immediate postpartum period as well as in their follow-up care: "It was very vague, and I felt that she did not seem to care." Not only were some women disappointed, but also women felt they received inadequate care, both for themselves and their infant:

> Felt like my particular needs, concerns and problems were not really understood and [I] was just repeated the same advice over and over without any real help.

> Someone came to take the baby's blood and it took a long time and the baby was screaming for the entire duration. We were not given the option to comfort the baby during this procedure. My husband and I found that very stressful.

Women felt rushed or ignored in their appointments, that their healthcare provider did not have time for their concerns, that their concerns were not valid, or they did not have time for any questions.

> There should be a lot more hospital visits with your OB after you have a baby. I feel like when you're pregnant, you get an appointment every month / week. Then after baby, you are kind of forgotten about and no one cares as much.

This was also in reference to their physical healing after birth – women felt that their healthcare provider did not provide a physical check on their healing, particularly for women who had caesarean sections, and were more concerned about the baby than the mother. A mother explains: "No one asked about my psychological well-being or even checked my stitches... the focus is 100% on the new baby and 0% on mothers."

The final theme that was identified was related to unsatisfactory postpartum checks for themselves. Women mentioned not having any health checks for themselves and if they did, they were short and not much information was provided about their physical healing. Women often commented that they did not receive a physical exam and if they did, they often had to ask and advocate for it. Women who had caesarean sections also commented that they were surprised that they had to wait until 6 weeks postpartum to get checked despite having a major surgery. Some mothers also commented that their healthcare provider did not check on their mental health adjustment:

> Very focused on the baby and not myself. Given my mental health history, which was even brought up by my OB at our first appointment... I am surprised I was not asked how I was doing... or monitored more closely. I have extreme anxiety and depression at the moment, and now I'm left with no family doctor.

4.5 Discussion

The objectives of the current study were to explore (1) with whom and how often women receive postnatal follow-up visits and (2) the postnatal care experiences of Canadian mothers living in the Maritime provinces from their perspective. This study found that there is variation in healthcare providers following women during their

pregnancy and postpartum, with little consistency in timing and frequency of postpartum visits. Women were found to value in-person follow-up from public health nurses and midwives and were satisfied when they received desired support from their healthcare providers and received timely, appropriate care. However, unsatisfactory postpartum care was related to having challenges accessing postnatal care, experiencing gaps in postnatal follow-ups, and having unsatisfactory postpartum checks for themselves.

During the postnatal period, women appear to be seeing more than one type of healthcare provider, with 71.9% of women being followed by their family doctor and 56.2% being followed by an obstetrician-gynecological doctor. There is also variation in the frequency of visits, with one fifth of women having one or less appointment within the first six weeks but almost two-fifths having four or more. The most common time point when women had a postnatal follow up was between day 3-7 for just over half of respondents (57.6%). This is likely the public health visit, as all provinces have a public health nurse offer a visit once a woman is home from the hospital (personal communication). Interestingly, two-thirds did not have a follow-up appointment between six and seven weeks, which is the recommended follow-up period for women. This suggests that perhaps some women are not receiving a follow-up visit around the six-week time point, which is an important period for providing information on family planning and mental health checks (Stumbras et al., 2016; Tully et al., 2017).

There is a significant dearth of studies that explore the postnatal experience of mothers around the world, including Canada. The Canadian Maternity Survey, conducted in 2006, found similar results to our study in terms of postnatal care contacts. In their survey, most women (93.3%) received a postnatal follow-up visit from a healthcare

provider on a mean of 6.9 days (Public Health Agency of Canada, 2009). However, all Maritime provinces had longer delays in receiving their first follow-up, with a mean of 7.1 days in PEI, 8.7 days in Nova Scotia and 14.6 days in New Brunswick (Public Health Agency of Canada, 2009). In our study, two-thirds of respondents had their first follow-up visit within the first week, with the largest follow-up period between days three and seven. Our results suggest that not much change has happened in almost 14 years, with postnatal follow-ups after birth mostly occurring within the first week.

In our study, three-quarters of women were satisfied with their care, which is lower than the previous Canadian average of 90.9% and the average of 93.5% in these three provinces (Public Health Agency of Canada, 2009). Women who were satisfied with their care reported receiving valuable in-person follow-up from public health nurses and midwives, receiving sufficient support from their healthcare providers and receiving timely, appropriate care. This is a challenge as only 3% of women in our study had a midwife as a care provider in the postpartum period, yet evidence shows that the relationship and care that is provided through midwifery and public health nurses is highly valuable to women (Aston et al., 2015; Perriman et al., 2018). However, there are only 16 full-time equivalent positions for registered midwives in Nova Scotia, three in New Brunswick and none in Prince Edward Island (Canadian Midwives, 2020). As women express satisfaction at the in-person follow-up care provided during the postpartum period, greater consideration of the need to offer these services is warranted. This is especially the case as unsatisfactory postpartum care was related to challenges in accessing postnatal care, gaps in postnatal follow-ups, and having unsatisfactory postpartum checks for themselves. In a recent meta-synthesis of over 800 women from 15

countries, what women felt mattered most during the postnatal period was the ability to have a positive motherhood experience, including developing self-esteem, competence, and autonomy, as well as adapting to their new role and relationships while ensuring health for themselves and their infant (Finlayson et al., 2020). In order to achieve these ultimate outcomes, appropriate care and support during the postnatal period is essential.

Studies have shown that during the postnatal period, receiving support is key to a positive experience. In Nova Scotia, Aston and colleagues (2015) explored in-home visits by public health nurses for new mothers and found that these relationships were essential to the new mothers in that the developmental of a good, non-judgmental relationship is important for this type of support to be successful. Aston and colleagues (2018) also found that the way that information was shared was important, and that the tone in which the information was provided was imperative. This was also shown in our study as mothers identified challenges with feeling listened to and feeling ignored or rushed during appointments – these behaviors were associated with an unsatisfactory experience of postnatal care. Thus, it is important that postnatal care providers are cognizant of not just the information they are providing but also how they are delivering the care and support.

Women also have challenges accessing timely and adequate postnatal care, due to not having a healthcare provider available (Public Health Agency of Canada, 2009). This also includes challenges related to seeking care for not only themselves but also their newborn, which was shown in the current study. In Canada, 13% of mothers have been found to have had challenges accessing their care provider during a non-routine

appointment (Brandon et al., 2016). There is significant opportunity for improvements in the care provided to women during the postnatal period.

4.5.1 Limitations

While our study helps fill the gap in knowledge related to the postnatal care experience in three provinces in Canada, there are some limitations. First, using a self-report online survey asking women to reflect on their postnatal experience may result in biased or selective reporting. However, by limiting the survey to mothers who had given birth within the past six months and the fact that the average age of the infant was 3.2 months helps to ensure that their postnatal experience was relatively recent. We also did not differentiate between respondents in the three provinces which limits the specific recommendations per province; however, given the similarity of postnatal care across the provinces and representativeness of respondents across the three provinces suggests that our findings should be appliable across the provinces. Also, as our respondents are from three provinces, there is some possibility of generalization to the Canadian population, yet this should be done in consideration of the postnatal care provided in each location. The survey was also in English and issues may vary when English is not the primary method of communication, as New Brunswick is a bilingual province. Given that there is currently no standardization of care across Canada, similar postnatal experiences may exist. One of the limitations was potential generalizability to non-white individuals as our sample primarily identified as white. While this does generally reflect the race make-up of these provinces (i.e., only 6.5% in Nova Scotia identified as a racial minority, 3.4% in New Brunswick, and 4.8% in PEI (Government of Canada, 2016)), it does not negate the need for further research on these populations. Finally, we did not ask how many times

respondents saw each type of healthcare provider nor did we ask whether the visits were for the mother and newborn. This could have shed some light on the number of and types of postnatal interactions. Nevertheless, our work builds on the Maternity Experience Survey findings (Chalmers et al., 2008; Public Health Agency of Canada, 2009) and provides further insight into the postnatal experiences of Canadian women.

4.5.2 Recommendations

More work is needed to ensure that women are receiving sufficient postnatal care and follow-ups during the immediate six-week period for both themselves and their newborn. There is a significant paucity of evidence and evaluation on the timing of postnatal visits in Canada and worldwide. As there are no clear postnatal follow-up guidelines, women do not know how often they should be having postpartum care visits for themselves and healthcare providers are not scheduling follow-up appointments for the mothers the same way well-baby checks are scheduled for newborns. Previous systematic reviews have found inconsistent findings related to improved maternal outcomes for home visits and postpartum support, but there was significant variation in timing and content of these visits (Shaw et al., 2006; Yonemoto et al., 2017). Improvements in standardization of frequency of care is recommended to improve the postnatal experience of mothers in these provinces, as well as across Canada. Further research is needed to determine the best timing and frequency of postnatal visits for women and their newborns (Yonemoto et al., 2017).

4.6 Conclusion

There is variation across the Maritime provinces in relation to the provision of follow-up care during the postnatal period - in terms of healthcare providers as well as

the timing and frequency of postnatal visits. While many women are experiencing satisfactory care, there are areas where women are reporting dissatisfaction and are facing challenges. Improvements are needed to the postpartum care experience of mothers in the Maritime provinces, including but not limited to, standardization of postnatal care contacts, and the need for provision of personalized care that addresses women's health needs and provides support, and enhancing timely, appropriate care for herself and the newborn.

Chapter 5: Influence of Parity and Infant Age in Maternal Self-Efficacy, Social Support, Postpartum Anxiety, and Postpartum Depression in the First Six Months

Statement of manuscript contribution: JD and MCY were the co-principal investigators on the original study in which the data were collected, along with BR, a PhD Candidate in the School of Nursing (Dalhousie University). JD analyzed the data, with the statistical support from AG, and drafted the manuscript. JD, MCY, AG, BR, MA, DM, and GTM contributed to revising the manuscript. All authors read and approved the final manuscript. The manuscript is currently undergoing peer-review in *Birth*.

5.1 Abstract

Background: After giving birth, women experience significant changes related to maternal self-efficacy and social support and are at risk of experiencing postpartum anxiety and postpartum depression.

Problem: No studies have focused on the relationship between parity and infant age and their impact on psychosocial outcomes, particularly in a Canadian context.

Aim: To explore the relationship between parity and infant age on perceived maternal self-efficacy, social support, postpartum anxiety, and postpartum depression.

Methods: Women from three Canadian provinces within the first 6-months postpartum completed standardized online questionnaires. Multivariate analysis of co-variance was used to examine the primary aim.

Findings: A total of 561 women (56.5% primiparous, 55.1% infant 0-3 months) participated. There were significant main effects for both parity ($p<0.001$) and age of infant ($p<0.001$) but no significant interaction (p=0.482). Primiparous women had lower maternal self-efficacy ($p=0.004$) and higher postpartum anxiety ($p=0.000$) than multiparous women. Women with younger infants had more perceived social support ($p=0.002$). Women with older infants had higher levels of postpartum anxiety ($p=0.003$) and depression ($p=0.000$).

Discussion: The transition that women experience, independent of parity, within the first six months is dynamic with women of older infants experiencing more postpartum mental health concerns and less perceived social support. Our findings emphasize that postnatal support should extend beyond the typical six-week follow-up period.

Conclusion: Additional studies are warranted to determine ways to provide ongoing support throughout the first six months and beyond to improve maternal well-being and address postpartum needs.

5.1.1 Statement of Significance

Problem or Issue: After a birth, women experience significant changes in their maternal self-efficacy, social support, postpartum anxiety, and postpartum depression.

What is Already Known: Mother's parity and the age of infant individually has been found to have an influencing role on these psychosocial outcomes after birth.

What this Paper Adds: Canadian first-time mothers from the Maritimes have higher maternal self-efficacy and postpartum anxiety than multiparous women. Women with infants between 4-6 months of age experience more postpartum mental health concerns compared to women with infants 3 months and younger, combined with less social support during this period.

5.2 Introduction

The period after childbirth through the first months of motherhood is a critical period for many women who experience significant changes during this time, not only physically but also psychosocially (Tully et al., 2017). The transition to motherhood involves changes in several psychosocial areas, including maternal self-efficacy (Hudson et al., 2001; Leahy-Warren & McCarthy, 2011; Porter & Hsu, 2003), social support (Ni & Siew Lin, 2011; Walker et al., 2016), postpartum anxiety (Dennis et al., 2017a; Goodman et al., 2016), and postpartum depression (Lanes et al., 2011; Shorey et al., 2018). In the transition to motherhood women are developing the belief (self-efficacy) that they can perform new 'mothering' tasks (Leahy-Warren & McCarthy, 2011), which develops over time as women become more confident in their ability to parent. Social support is essential for the physical and emotional wellbeing of women to bolster the transition during the postpartum period (Aston et al., 2018; Negron et al., 2013; Smith & Howard, 2008). Higher levels of maternal self-efficacy and social support have been linked to positive maternal and child outcomes, including improved breastfeeding rates and improved infant care (Aston et al., 2018; Jones & Prinz, 2005; Negron et al., 2013; Shorey et al., 2014; Smith & Howard, 2008). Postpartum depression and anxiety are common experiences for women and have been linked to negative maternal outcomes, including higher levels of fatigue (Taylor & Johnson, 2013), and child outcomes, including child hyperactivity/inattention and physical aggression (Ali, 2018; Goodman et al., 2016; Kingston et al., 2018).

Leahy-Warren and colleagues (2012) conceptualized that postpartum depression was influenced directly by social support as well as through maternal self-efficacy for

first time mothers, which has been validated elsewhere (Cutrona & Troutman, 1986; Esmaelzadeh Saeieh et al., 2017; Haslam et al., 2006; Mihelic et al., 2016). However, what is missing from Leahy-Warren and colleagues' (2012) conceptualization of postpartum transition is postpartum anxiety, which has been a growing area of postpartum mental health and is closely linked, yet separate from, postpartum depression. Maternal self-efficacy has been found to have an inverse relationship with both postpartum depression and anxiety, whereby women with higher maternal self-efficacy were less likely to have postpartum depression or anxiety (Kohlhoff & Barnett, 2013; Reck et al., 2012). Low social support during pregnancy has also been linked to an increased risk of both anxiety and depression up to one year postpartum (Bayrampour et al., 2016; Hetherington et al., 2018; Leahy-Warren et al., 2012). Therefore, it is essential that postpartum anxiety is explored as a key psychosocial outcome in the postpartum period.

One area of paucity is the influence of parity on psychosocial adjustment. While much evidence is available on primiparous women, there is less on multiparous women and even less comparing the experience between primiparous and multiparous women. A systematic review on maternal self-efficacy found that multiparous women had higher maternal self-efficacy than primiparous women (Leahy-Warren & McCarthy, 2011). In fact, Canadian multiparous women were 2-5 times more likely to report high maternal self-efficacy immediately after birth and 1-7 times more likely one month after birth compared to primiparous women (Bryanton et al., 2008). There has been considerably less studies, and not many with parity as the primary focus, on the other psychosocial outcomes of postpartum anxiety, depression, and social support (Ketner et al., 2019) .

What also requires further elucidation is the relationship between infant age within the first six months. Maternal self-efficacy has been found to increase over the perinatal period, from pregnancy up to 3 months postpartum (Kristensen et al., 2018; Porter & Hsu, 2003). Postpartum depressive symptoms is relatively consistent across the first year of postpartum, ranging from 5.58% <6 months to 8.27% at 9+ months postpartum (Dennis et al., 2012). Similarly, prevalence of postpartum anxiety symptoms ranges from 17.8% during the first month to 14.8% at six months postpartum (Dennis et al., 2017a). These findings suggest that the age of the infant might also influence women' psychosocial outcomes.

Despite a number of studies, there are no studies that focus on the relation of these psychosocial outcomes in a Canadian context, particularly when considering parity and age of infant within the first six-months. Given the variation in postpartum care and support not only around the world (Eberhard-Gran et al., 2010), but also within Canada (The Vanier Institute of the Family, 2017), it was important to explore these psychosocial outcomes within the Canadian context. This paper focuses on the Maritime provinces as there is a paucity of standardized data on the postpartum experience in Nova Scotia, New Brunswick, and Prince Edward Island. Much of the currently work has been qualitive (Aston et al., 2018; Price et al., 2018) or are quality assessment reports (Reproductive Care Program of Nova Scotia, 2016).

Therefore, the objective of this study was to explore the relationship between parity and infant age on maternal self-efficacy, social support, postpartum anxiety, postpartum depression in Maritime women during the first six months postpartum. It is hypothesized that maternal self-efficacy and social support will be inversely correlated to

postpartum depression and anxiety, while social support and maternal self-efficacy as well as postpartum anxiety and depression will be positive correlated. It is further hypothesized that parity and infant age will have a significant interaction on each of the psychosocial outcomes.

5.3 Participants, Ethics and Methods

5.3.1 Participants & Setting

This online survey study recruited women who had given birth within the past six months from the Maritime Provinces in Eastern Canada – Nova Scotia, New Brunswick, and Prince Edward Island (PEI). As of July 1, 2019, Nova Scotia had a population of 971,395, New Brunswick 776,827 and PEI 156,947, which together make up 5.1% of Canada's population (Statistics Canada, 2019a). In 2018, there were 372,329 births in Canada and 15,684 in the Maritime provinces, which is 4.2% of all Canadian births (Statistics Canada, n.d.). There is an almost even split between rural/urban living in the Maritime provinces, ranging from 42.6% rural in Nova Scotia to 54.9% rural in PEI (Statistics Canada, 2011).

A sample size of 375 women was estimated to be sufficient for representation, allowing for a margin of error of 5% and level of confidence of 95% using a population estimate of 15,684 Maritime women giving birth in a 12-month period (*Sample Size Calculator*, 2014), slightly overestimated based on multiples (e.g., twins, triplets). Data was collected over a 3-month period (October 1, 2019 - January 1, 2020). No upper limit of survey responses was set.

Women were eligible to complete the survey if they: (1) had an infant six months of age or less; (2) were over 18 years of age; (3) were able to speak, write and read

English; and (4) currently live in a Maritime Province. Women were excluded if they lived outside the Maritime Provinces or had their most recent baby more than six-months prior to the date the survey was completed.

5.3.2 Ethics

Institutional ethical approval was obtained.

5.3.3 Methods

The study design was a prospective descriptive study. Convenience sampling was used to recruit women through online advertisements on Facebook, Twitter, and Instagram, with paid advertisements on Facebook. Additional sources of recruitment included posting in online classifieds (e.g., Kijiji), email to stakeholders to share with their followers (e.g., Canada Public Health), and media outreach. Study posters were also printed and posted in stakeholder organizations or public areas (e.g., coffee shops). Women had the opportunity to opt into a draw for one of three $100 CAN electronic gift cards.

Upon clicking the link to participate, women were directed to a page that outlined the study details, length of time expected to complete (30 minutes), and the informed consent form. A single check box was provided where women clicked “I consent to participate”. Upon agreeing to participate, they were directed to an eligibility questionnaire. If they met the eligibility criteria, they were directed to start the survey. If they did not meet the eligible criteria, they were re-directed to a page that informed them that they were not eligible.

Once participants entered the survey, they completed questionnaires on the psychosocial concepts as described below and demographics were collected. Women

were informed during the consent statement that they could stop the survey at any time by exiting the survey. At the end of the survey, and if a participant screened to be at risk on the postpartum depression scale, information was provided about where to seek help in each province.

5.3.4 Outcome measures

Maternal self-efficacy was measured using the Karitane Parenting Confidence Scale (KPCS) with 39 or less (out of a possible 45) considered a clinically low perceived parenting self-efficacy, meaning that parents who score 39 or below may be experiencing low levels of parenting confidence (Črnčec et al., 2008a). Within the clinical range, distinctions are made between the mild clinical range (36-39), moderate clinical range (31-35), and severe clinical range (below 30) (Črnčec et al., 2008b).

Social support was measured using the Multidimensional Scale of Perceived Social Support, a 12-item scale on the perceived adequacy of support from family, friends, and significant others (Zimet et al., 1990). Each item is measured on a 7-point Likert scale, with scores ranging from 12 to 84 (Zimet et al., 1990). There are no established population norms or cut-offs.

Postpartum anxiety was measured using the postpartum Specific Anxiety Scale (PSAS). The PSAS examines the frequency, not severity, of anxieties specific to the postpartum period (Fallon et al., 2016). A cut-off score of 112 out of 204 is considered to be associated with clinical levels of anxiety, with higher scores indicating greater anxiety (Fallon et al., 2016).

Postpartum depression was measured using the Edinburgh Postpartum Depression Score (EPDS). The 10-item EPDS is an established tool for screening

postpartum depression, with higher scores indicative of greater likelihood of having or developing postpartum depression (Cox et al., 1987). Scores range from 0 to 30, with total scores less than 8 indicating 'depression not likely' while a score of 14 or greater indicates 'probable depression' (Cox et al., 1987).

5.3.5 Data Analysis

Data from the standardized questionnaires were analyzed using the statistical package for social sciences (SPSS 25) (IBM Corp, 2017). Total scores were computed for all questionnaires. Infant age was collapsed into two dichotomous groups – women with infants 0-3 months and women with infants 4-6 months. This is consistent with developmental ages with three- and six-months routinely used to differentiate milestone tracking (HealthyChildren.Org, 2020; The Nova Scotia Department of Health and Wellness, 2015b). Parity was determined based on the number of live biological children the women reported having, creating a dichotomous variable between primiparous and multiparous.

To compare groups on the dependent variables (maternal self-efficacy, social support, postpartum anxiety, and postpartum depression), multivariate analysis of co-variance (MANCOVA) was conducted. The independent variables were parity (primiparous and multiparous) and age of infant (0-3 months and 4-6 months). Frequencies and descriptives were used to report demographic characteristics and correlations were run (Spearman and Pearson, as applicable) between demographic and dependent variables. Significant correlations were included as co-variates in the MANCOVA. Chi-square tests were used to determine differences between groups.

Of the 932 participants who started the survey, 55 were not eligible: 31 did not have an infant within the past 6 months, two did not reside in the Maritime provinces, and 22 did not submit the page. Of the 877 remaining participants, 146 did not complete any aspect of the survey aside from the eligibility screening page, 116 did not complete the full set of questionnaires, and 30 did not complete the demographics, leaving a total of 584. However, 6 participants completed it twice, so the second response (indicated by later date) were removed. One participant did not respond to the parity question, ten did not provide the age of their infant, and four had infants over six months, so these participants were removed, leaving 561 complete, eligible responses.

5.4 Results

5.4.1 Participants

A total of 561 women completed the survey from Nova Scotia (n=261, 46.5%), New Brunswick (n=171, 30.5%) and PEI (n=129, 23.0%). Women were a mean age of 30.66 years (Standard Deviation (SD) = 4.62) and had a range of 1-5 children (Mean (M)=1.61, SD=0.82) biological children. 56.5% of women were primiparous and 55.1% had infants 3 months or younger. Women were predominantly white (98.2%) and had most recently given birth to a single child (95%). There were some noticeable differences in demographic characteristics based on parity and infant age, as shown in Table 1.

For maternal self-efficacy, 60.8% of women reported low parenting self-efficacy with 29.5% in the mild low clinical range, 18.8% in the moderate low clinical range, and 12.5% in the severe low clinical range. For postpartum anxiety, 30.8% had a score of 112 or more out of 204, indicating high levels of anxiety symptoms. For postpartum depression, 51.7% of women had positive depressive symptoms, 20.6% fell within the

'depression possible' range, 10.9% had 'fairly high possibility of depression', and 20.2% had 'probable depression'.

Table 5.1. Demographics characteristics of study participants

Demographics	n (%)
Parity	
Primiparous	329 (57.0)
Multiparous	248 (43.0)
Newborn Age	
0-3 months	311 (55.2)
4-6 months	252 (44.8)
Marital Status	
Single	12 (2.1)
In a relationship	74 (12.8)
Married or common law	448 (88.4)
Household Income (CAN)	
Less than $44,000	105 (18.5)
$45,000-$139,000	328 (56.7)
Over $140,000-$199,000	111 (19.3)
Baby birth weight	
Under 3,000 grams [a]	84 (14.5)
3,000-4,000 grams	315 (54.7)
Over 4,000 grams	88 (17.0)
Birth Method	
Vaginal birth	417 (72.4)
Unplanned caesarean	106 (18.4)
Planned caesarean	53 (9.2)

[a] Does not sum to 100% due to 'prefer not to answer' responses

5.4.2 Correlation of Psychosocial Outcomes

There were significant correlations between maternal age, marital status and household income on at least one of the dependent variables but not for birth weight or birth method (Table 5.2). As hypothesized, maternal self-efficacy was negatively correlated with postpartum depressive symptoms ($r(448)= - 0.477$, $p=0.000$) and anxiety symptoms ($r(551)= - 0.594$, $p=0.000$). Social support was also negative correlated with postpartum depressive symptoms ($r(548)= - 0.372$, $p=0.000$) and anxiety symptoms

(r(551)= - 0.337, p=0.000). As hypothesized, postpartum anxiety and depressive symptoms were positively correlated (r(556)= 0.720, p=0.000) and maternal self-efficacy was positively correlated with social support (r(544)= 0.378, p=0.000).

Table 5.2. Correlations of key demographic variables and primary outcomes

	Maternal Self-Efficacy		**Social Support**		**Postpartum Depression**		**Postpartum Anxiety**	
	Correlation	**p**	**Correlation**	**p**	**Correlation**	**p**	**Correlation**	**p**
Maternal Self-Efficacy*	-	-	-	-	-	-	-	-
Social Support*	**0.378**	**0.000**	-	-	-	-	-	-
Postpartum Depression*	**-0.477**	**0.000**	**-0.372**	**0.000**	-	-	-	-
Postpartum Anxiety*	**-0.594**	**0.000**	**-0.337**	**0.000**	**0.720**	**0.000**	-	-
Parity	**0.129**	**0.002**	-0.060	0.159	-0.021	0.623	**-0.215**	**0.000**
Infant Age	0.074	0.083	**-0.115**	**0.007**	**0.163**	**0.000**	**0.143**	**0.001**
Maternal Age*	-0.017	0.695	0.078	0.078	**-0.131**	**0.002**	-0.069	0.101
Marital Status	0.060	.159	**0.113**	**0.08**	**-0.132**	**0.002**	**-0.121**	**0.004**
Household income	0.039	0.375	**0.139**	**0.001**	**-0.176**	**0.000**	-0.058	0.186
Baby birth weight	-0.012	0.853	0.006	0.893	-0.017	0.710	-0.008	0.865
Birth method	-0.004	0.834	0.015	0.730	-0.017	0.689	0.000	0.995

***** Conducting using Pearson correlation

5.4.3 Influence of Parity and Infant Age

Significant main effects were found for both parity (Pillai's trace=0.094, F=12.804, p=0.000) and age of infant (Pillai's trace=0.082, F=11.077, p=0.000). The interaction between age of infant and parity was not significant (Pillai's trace=0.007, F=0.870, p=0.482). See Figure 5.1.

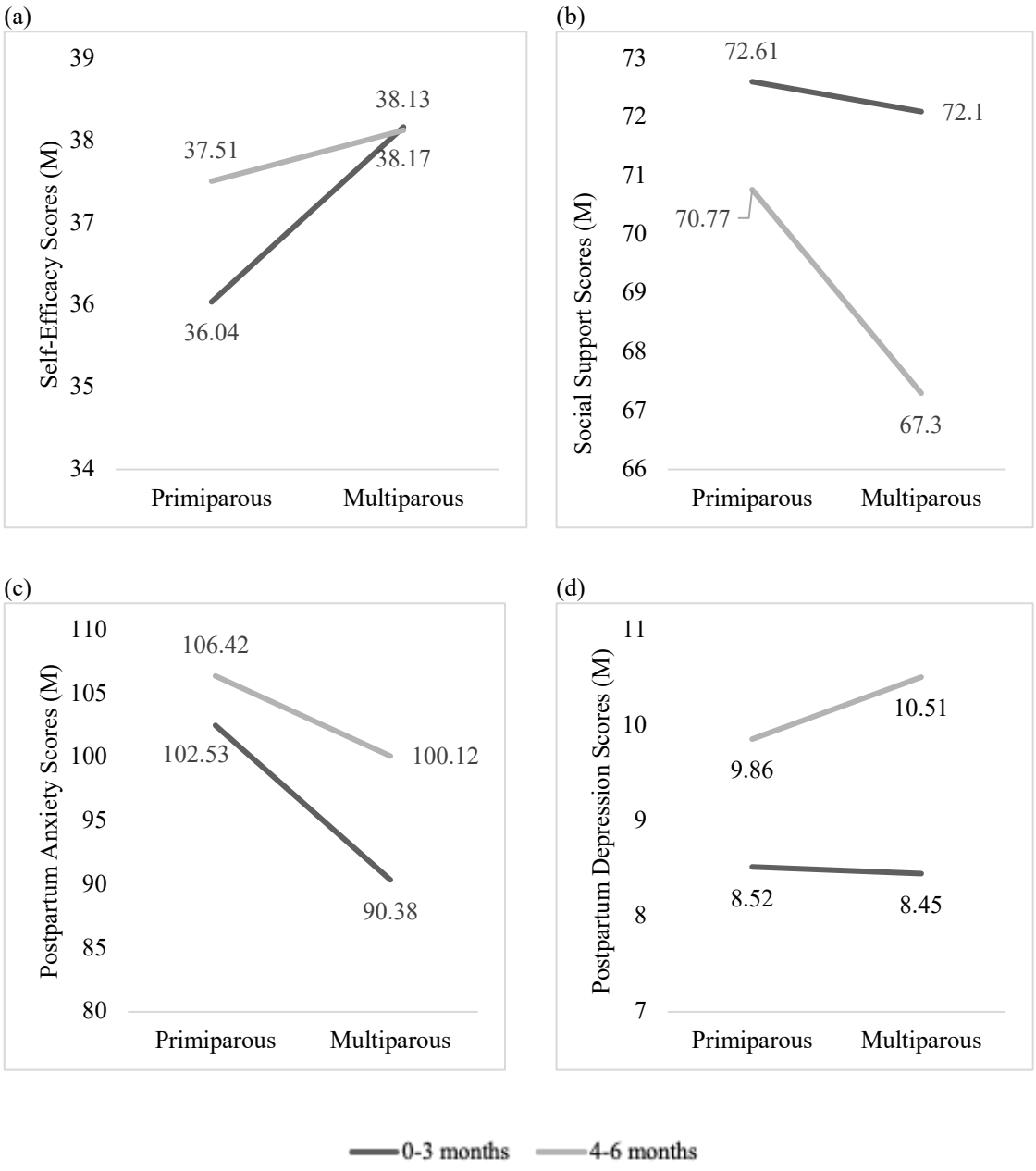


Figure 5.1. Means of MANOVA Analysis on Outcome - Parity by Newborn Age on (a) Maternal Self-Efficacy, (b) Social Support, (c) Postpartum Anxiety, and (d) Postpartum Depression

Looking at the main effects of parity, significant differences were found on maternal self-efficacy (p=0.004) and postpartum anxiety (p=0.000; Table 5.3). Primiparous women had lower maternal self-efficacy (M=36.78) than multiparous

women (M=38.15), although both means fell within the mild clinical range. Primiparous women also had higher postpartum anxiety symptoms (M=104.64) than multiparous women (M=95.24). No significant differences were found on social support and postpartum depressive symptoms based on parity, but the means for postpartum depression for both groups were in the 'probable depression' range.

Table 5.3. Outcomes based on parity

Outcome	Primiparous (n=329) Mean (95% CI)	Multiparous (n=248) Mean (95% CI)	p value
Maternal Self-efficacy	36.78 (36.18 - 37.37)	38.15 (37.47 - 38.83)	0.004
Social Support	71.69 (70.29 – 73.09)	69.70 (68.10 – 71.30)	0.071
Postpartum anxiety	104.64 (101.60 – 107.68)	95.24 (91.77 – 98.70)	0.000
Postpartum depression	9.19 (8.59 – 9.79)	9.48 (8.79 – 10.17)	0.543

For main effects of age of infant, significant differences were found for social support (p=0.002), postpartum anxiety symptoms (p=0.003), and postpartum depressive symptoms (p=0.000, Table 5.4). No significant differences were found for maternal self-efficacy (p=0.117). Women with younger infants had higher levels of social support (M=72.36) than women with older infants, (M=69.03). Women with older infants had higher levels of postpartum anxiety symptoms (M=103.42) and postpartum depressive symptoms (M=10.19) than women with younger infants (M=96.46, M=8.49, respectively). Both groups fell within the mild clinical range of low maternal self-efficacy and women with older infants were in the 'depression possible' range for postpartum depression.

Table 5.4. Outcomes based on age of newborn

Outcome	0-3 months (n=311) Mean (95% CI)	4-6 months (n=253) Mean (95% CI)	p value
Maternal Self-efficacy	37.11 (36.01 – 37.71)	37.82 (37.16 – 38.48)	0.117
Social Support	72.35 (70.92 – 73.77)	69.03 (67.49 – 70.57)	0.002
Postpartum anxiety	96.46 (93.39 – 99.53)	103.42 (100.07 – 106.76)	0.003
Postpartum depression	8.49 (7.88 – 9.09)	10.19 (9.52 – 10.85)	0.000

5.5 Discussion

This study sought to explore the relationship between parity and infant age on maternal self-efficacy, social support, postpartum anxiety, and postpartum depression in Canadian Maritime women within their most recent six-months postpartum. In terms of prevalence, almost two-thirds of women had low maternal self-efficacy, with most in the mild clinical range. Additionally, almost a third of women had high postpartum anxiety symptoms and over half of women had some depressive symptoms, with 20% scoring within the 'probable depression' range. While no significant interaction between age of infant and parity were found, there were significant effects of both parity and age of infant. This suggests that the combined effect of parity and age of infant was not different than each effect individually. Rather, parity and age of infant themselves are highly related to maternal psychosocial outcomes during the postpartum period.

In relation to maternal self-efficacy, primiparous women infants had lower maternal self-efficacy than multiparous women but no difference was found based on the age of the infant. All women fell within the mild clinical range, suggesting that while women are showing some evidence of low maternal self-efficacy, scores did not reach the moderate or severe levels that might require immediate clinical intervention. Our findings

are consistent with the existing literature which suggests that first time mothers (Bryanton et al., 2008; Leahy-Warren & McCarthy, 2011) and women with younger infants (Kristensen et al., 2018; Porter & Hsu, 2003) experience lower maternal self-efficacy than their counterparts. Having an infant for the first time seems to be associated with lower maternal self-efficacy that seems to improve with additional children.

While there were no differences in social support based on parity, women with younger infants had more perceived social support than women with older infants. Previous research has found that the social support first-time mothers receive tends to be consistent over the postpartum period, with Saeieh and colleagues (Esmaelzadeh Saeieh et al., 2017) finding that similar amounts of social support were received during pregnancy, six weeks postpartum and four months postpartum. Aston and colleagues found that peer support, sought both in-person and online, was especially critical to first time mothers in Nova Scotia (Aston et al., 2018). Our findings are unique in that this is the first study that has examined differences between women with younger infants and older infants within the first six months postpartum. Given our findings, it seems that women with younger infants have more social support in the immediate postpartum transition period, where many family members and friends visit in person to provide support. However, over time, visiting and support may occur less often. Further research is needed to understand the transition in social support that is sought, provided, and received over the first six months postpartum.

Primiparous women had higher postpartum anxiety symptoms than multiparous women and, interestingly, women with older infants had higher levels of postpartum anxiety symptoms than women with younger infants. While no group reached a clinical

score, 30.8% of women did have a high score on the postpartum anxiety measure, suggesting that some women are experiencing significant anxiety during the postpartum period but not consistently across any group. A previous review found that prevalence rate of self-reported postpartum anxiety symptoms was higher (i.e., 14.9% within month 2-3 postpartum) while clinical anxiety diagnosis were lower (i.e., 9.6% at 2-3 months postpartum) (Dennis et al., 2017a). This suggests that women are experiencing symptoms of anxiety more frequently than those who are likely to receive a clinical diagnosis. In this review, most studies used the State-Trait Anxiety Inventory (STAI) to measure state anxiety symptoms (Dennis et al., 2017a); thus differences could also be related to the use of different measurement tools. Regardless, our findings suggest that first-time mothers and women with older infants experienced more postpartum anxiety symptoms than multiparous women and women with younger infants. Further research is needed to explore the reasons behind these trends.

Finally, while there was no difference in postpartum depression symptoms by parity, women with older infants had higher levels of postpartum depressive symptoms than women with younger infants. It is interesting that women with older infants had higher levels of postpartum depression symptoms, perhaps related to settling into a routine with more fatigue and less support. Women with younger infants were the only group where the mean did not reach the ‘probable depression ‘cut-off. Another review found that only 12% of women had a consistent clinical score of depression across the first year postpartum, with two thirds reaching a clinical cut-off at only one time point (Woolhouse et al., 2014), suggesting that women may experience postpartum depression symptoms at various times during the postpartum year but not necessarily consistently. In

a Canadian study, Dennis and colleagues found that women in the Atlantic provinces had the lowest prevalence of postpartum depression across Canada (Dennis et al., 2012), which could explain why our sample did not reach clinical diagnostic score for postpartum depression. Nevertheless, there is a need for in-depth exploration as to the reasons why women with older infants may experience more postpartum depression symptoms than women with younger infants, due to the known impact on maternal and infant outcomes. Given that over half of the participants had some depressive symptoms with 20% scoring within the 'depression probable' range, women are struggling with postpartum depressive symptoms during the first six months and additional support should be offered during this critical period.

5.5.1 Strengths & Limitations

Despite the strengths of this study, it does have limitations. Use of an online cross-sectional study is limited in its ability to determine cause-and-effect. We did not follow women over time to explore how their psychosocial outcomes changed. It is also possible that through online recruitment some women may have self-identified as eligible inaccurately. As we only collected the month that the mother gave birth to increase anonymity, we may have misclassified some women in the wrong category, however this relates to only the women in the 3-4 months range, decreasing the impact that this would have on the findings. Finally, despite having broad representation across the three provinces as well as a large sample across parity and socioeconomic status, our sample had little diversity in race. Additionally, we did not ask questions related to gender identity or previous mental health diagnosis, which again limits our analysis and interpretation of our findings.

Despite these limitations, our study provides the first reported findings examining the effects of parity and infant age on multiple psychological outcomes in a Canadian context. We also had a high number of responses and good representation across the provinces. Approximately 7,842 births occur each year in a 6 month period in the Maritime provinces (Statistics Canada, n.d.), equating to a 7.3% survey completion rate of women eligible to participate. Given that there is little evidence available on the psychosocial adjustment experience of Maritime women, our findings raise numerous questions regarding the needs of new mothers over the first 6 months of giving birth and how to best support women during this life transition.

5.6 Conclusion

Overall, these findings suggest that the transitions women experience after giving birth for the first time influences their maternal self-efficacy and postpartum anxiety symptoms. Additionally, the transition that women experience within the first six months is dynamic as women with older infants' report experiencing more postpartum mental health concerns combined with less social support during this period. While most women are not necessarily reaching clinical, diagnosable levels of low maternal self-efficacy, postpartum anxiety, and postpartum depression, there needs to be awareness of the struggles in their psychosocial adjustment throughout the first six-month period, especially given that not reaching diagnosable levels does not indicate an absence of stress or impact on quality of life.

While current recommendations are for a mental health check at the six-week postpartum visit for the mother, our findings suggest that postpartum depression actually increases during the latter half of the first year. Additional mental health check-ins for the

mother should be considered and could occur during the baby's vaccination and well-baby visit at 4 and 6-months postpartum.

Chapter 6: Impact of mHealth Interventions During the Perinatal Period on Maternal Psychosocial Outcomes: A Systematic Review

Statement of manuscript contribution: JD was responsible for the development of the research questions, development the search strategy in consultation with a health science librarian, conducting the database searches, developing the inclusion/exclusion criteria, overseeing the screening process, developing data extraction protocol, and leading data extraction and critical appraisal in accordance with Joanna Briggs Institute (JBI) methodology. JD and BR extracted the data and completed the critical appraisals. JD analyzed the data and drafted the manuscript. JD, MCY, BR, MA, DM, and GTM contributed to revising the manuscript. All authors read and approved the final manuscript. The manuscript underwent peer-review and was accepted for publication following one revision that was led by JD. The full reference for this manuscript is:

Dol, J., Richardson, B., Tomblin Murphy, G., Aston, M., McMillan, D., & Campbell-Yeo, M. (2020). Impact of mHealth interventions during the perinatal period on maternal psychosocial outcomes: A systematic review. *JBI Evidence Synthesis, 18*(1), 30-55. doi: 10.11124/JBISRIR-D-19-00191

6.1 Abstract

Objective: The objective of this review was to evaluate the effectiveness of mother-targeted mobile health (mHealth) education interventions during the perinatal period on maternal psychosocial outcomes in high-income countries.

Introduction: The perinatal period is an exciting yet challenging period for mothers that requires physical, emotional and social adjustment to new norms and expectations. In recent years, there has been an increase in the use of mHealth by new mothers who are seeking health information through online or mobile applications. While there have been systematic reviews on the impact of mHealth interventions on maternal and newborn health in low- and middle-income countries, the impact of these interventions on maternal psychosocial health outcomes in high-income countries remains uncertain.

Inclusion criteria: This review considered studies of mHealth education interventions targeting mothers in high-income countries (as defined by the World Bank) during the perinatal period. Interventions must have started between the antenatal period (conception through birth) through to six weeks postpartum. All experimental study designs were included. Outcomes included self-efficacy, social support, postpartum anxiety and postpartum depression.

Methods: PubMed, CINAHL, PsycINFO and Embase were searched for published studies in English on December 16, 2018. Grey literature was also searched for non-peer reviewed articles, including Google Scholar, mHealth intelligence and clinical trials databases. Critical appraisal was undertaken by two independent reviewers using standardized critical appraisal instruments from JBI. Quantitative data were extracted from included studies independently by two reviewers using the standardized data

extraction tool from JBI. All conflicts were solved through consensus with a third reviewer. Quantitative data were, where possible, pooled in statistical meta-analysis using RevMan. Where statistical pooling was not possible, findings were reported narratively.

Results: Of the 1,607 unique articles identified, 106 full-text papers were screened, and 24 articles were critically appraised, with 21 included in the final review. Eleven were quasi-experimental and 10 were randomized controlled trials. The mHealth intervention approach varied with text message and mobile applications being the most common. Length of intervention ranged from four weeks to six months. The topics of the mHealth intervention varied widely, with the most common topic being postpartum depression. Mothers who received an mHealth intervention targeting postpartum depression show a decreased score when measured post-intervention (odds ratio = –6.01, 95% confidence interval = –8.34 to –3.67, $p < 0.00001$). The outcomes related to self-efficacy, social support and anxiety showed mixed findings of effectiveness (beneficial and no change) across the studies identified.

Conclusions: This review provides insight into the effectiveness of mHealth interventions targeting mothers living in high-income countries in the antenatal and postnatal period to enhance four psychosocial outcomes: self-efficacy, social support, anxiety and depression. Despite a wide variety of outcome measurements used, the predominant findings suggest that there are insufficient data to conclude that mHealth interventions can improve self-efficacy and anxiety outcomes. Potential benefits on social support were related to mHealth interventions targeting postnatal behaviors. Postpartum depression was the mostly commonly reported outcome. Findings related to the comparison of pre-post outcomes and intervention versus control demonstrated that mHealth interventions

targeting postpartum depression were associated with a reduction in postpartum depression.

6.2 Introduction

The perinatal period is an exciting yet challenging period that requires physical, emotional and social adjustment to new norms and expectations for mothers (Almalik, 2017; Aston, 2002; Javadifar et al., 2016; Nelson, 2003; Walker et al., 2015). It is also a period of significant learning (Nelson, 2003) and bodily changes (Hodgkinson et al., 2014) for the mother. As a result, it is a time of considerable information seeking for mothers, both for information on specific health concerns as well as social support and advice (Bernhardt & Felter, 2004). Data show that new and expectant mothers seek information from online sources, ranging from 44% of expectant mothers during pregnancy (Grimes et al., 2014) to greater than 90% of mothers postpartum (Slomian et al., 2017; Walker et al., 2017). This has led to increased use of mobile health (mHealth) by mothers who are seeking health information through online or mobile applications (Bernhardt & Felter, 2004; Javanmardi et al., 2018). mHealth, a subset of electronic health (eHealth), is defined as the use of mobile devices, such as mobile phones or smartphones, to transmit various health content and services (World Health Organization, 2011). Examples of mHealth can include short message service (SMS), mobile applications and telemedicine. mHealth interventions can be tailored to demographic factors, such as gestational age of the fetus or age of the mothers, and can include information, monitoring and motivational content (Daly et al., 2018).

Mothers are using a range of online sources during the perinatal period, including blogs and forums, social media and mobile applications (Lee, 2016). A review on the use of Internet sources by pregnant women found that use of these resources was associated with greater feelings of self-efficacy and social support as well as reduced anxiety

(Javanmardi et al., 2018). The primary reasons mothers searched for health information online during the postpartum period were to find out more information about newborn or infant health concerns and to get advice and support on parenting issues (Bernhardt & Felter, 2004).

Many factors contribute to the popularity of mHealth interventions, including the widespread availability and use of mobile phones. Combined with the opportunity for real-time communication, mHealth has rapidly been expanding to reach pregnant women and mothers with the goal to improve access to information and health outcomes (Iribarren et al., 2017). The use of online sources is not necessarily intended replace professional sources of information but to complement or clarify information received in person from doctors or nurses (Bernhardt & Felter, 2004). The use of mHealth interventions to provide education and support to mothers is a growing field of health innovation. mHealth interventions targeting mothers address a variety of perinatal health topics, including gestational weight gain (Knight-Agarwal et al., 2015), smoking cessation (Heminger et al., 2016; Naughton et al., 2012; Rodgers et al., 2005), breastfeeding (Gallegos et al., 2014), newborn education (Shorey et al., 2017) and mental health (Broom et al., 2015). A recent article on SMS as an mHealth educational tool during pregnancy found that women are receptive to its use to increase maternal education and utilization of health services during the perinatal period (Lamont et al., 2016). Considering the growing evidence of the use of mHealth interventions during this period, it is important to explore the impact on maternal psychosocial health outcomes, including self-efficacy, social support, anxiety and depression.

The broader goal of health education during the postnatal period is not only to impart knowledge on the topics of the intervention, but also to increase the self-efficacy of mothers to engage and act in ways that provide the best care for themselves and their newborns (Bryanton et al., 2013; World Health Organization, 2013). Self-efficacy is thought to be a factor of parenting behavior and has been linked to positive newborn outcomes (Shorey et al., 2014). At the root of perinatal heath interventions is the desire to increase mothers' self-efficacy and their belief in their ability to enhance positive parenting behaviors. Thus, targeting self-efficacy has been found to be a priority outcome for existing mHealth interventions (Dalton et al., 2018; Gallegos et al., 2014; Shorey, et al., 2017), and is an important psychosocial health outcome during the perinatal period.

Social support is essential for the physical and emotional well-being of mothers during the postpartum period and has been linked to positive maternal outcomes (Negron et al., 2013; Smith & Howard, 2008). A literature review on the effects of peer support through mobile applications found improvements in mental health and increases in feelings of support (McColl et al., 2014). Mothers who have support and have learned that other mothers are struggling in similar ways develop an understanding that being a mother is learned behavior, not innate (Price et al., 2018). This can result in normalization, feelings of encouragement and validation (Price et al., 2018). mHealth can also provide an easy access to information and social support in a way that minimizes stigma and embarrassment that can accompany the seeking of health information (Buultjens et al., 2012).

Anxiety and depression are common psychosocial health outcomes that mothers face during the perinatal period, with prevalence estimated at 20-25% for prenatal anxiety

(Field, 2017), 15% for postpartum anxiety (Dennis et al., 2017) and 12% for postpartum depression (Shorey et al., 2018; Woody et al., 2017). Although mothers may go online to search for health information, they report high anxiety after searching online due to encountering an overwhelming amount of information or becoming fearful of the information they found (Barkin & Jani, 2016). Postpartum depression is also associated with higher anxiety during the prenatal period (Sayil et al., 2007). The use of mHealth interventions offers potential means to reach and impact mothers who are struggling or at risk of anxiety and depression during the perinatal period.

There have been several systematic reviews on the impact of mHealth interventions on maternal and newborn health in low- and middle-income countries, with mixed findings on psychosocial outcomes (Amoakoh-Coleman et al., 2016; Colaci et al., 2016; Dol et al., 2019; Hurt et al., 2016; Sondaal et al., 2016). Evidence exists for mHealth interventions in low- and middle-income countries to improve healthcare use during the perinatal period, particularly increasing antenatal and postnatal contacts (Colaci et al., 2016; Dol et al., 2019; Sondaal et al., 2016) as well as facility-based delivery services (Colaci et al., 2016; Dol et al., 2019; Sondaal et al., 2016). Despite the available synthesis of evidence of mHealth interventions targeting the perinatal period in low- and middle-income countries, its impact has not been synthesized in high-income countries to the same degree. Therefore, the impact of these interventions on maternal psychosocial health outcomes in this context remains uncertain. Thus, this review will focus solely on data from high-income countries (as defined by the World Bank (2020)) to gain insight into the impact that mHealth interventions may have in these countries.

A preliminary search of PROSPERO, PubMed, the Cochrane Database of Systematic Reviews and the *JBI Database of Systematic Reviews and Implementation Reports* was conducted, and no current or underway systematic reviews on the topic were identified. Systematic reviews have been conducted on the use and prevalence of mHealth interventions for maternal health behavior, such as smoking cessation, diabetes management, weight management or breastfeeding (Chen et al., 2018; Daly et al., 2018; Poorman et al., 2015), but no reviews have focused on perinatal psychosocial outcomes. A recent systematic review was published by Daly and colleagues (Daly et al., 2018) on the impact of mHealth; however, they reported only on mobile applications, excluding interventions that use other forms of mHealth, including SMS technology, to reach parents.

Therefore, the objective of this quantitative review is to evaluate the impact of mother-targeted mHealth education interventions available during the perinatal period on maternal psychosocial outcomes in high-income countries.

6.2.1 Review Question

What is the effect of mother-targeted mHealth education interventions available during the perinatal period on maternal psychosocial outcomes? Specifically, what is the effect of mother-targeted mHealth education interventions on maternal self-efficacy, social support, postpartum anxiety and postpartum depression?

6.3 Inclusion criteria

6.3.1 Participants

This review considered studies that included mHealth interventions targeting mothers in high-income countries as defined by the World Bank (2020). Studies were

excluded if the mHealth intervention primarily targeted other caregivers (e.g., fathers, healthcare providers, community health workers) or were conducted in low- or middle-income countries. This review also excluded studies that focused on refugee populations due to the confounding factors that influence their experience during the perinatal period, despite living in high-income countries, as well as a recent systematic review already conducted on the perinatal health outcomes in this population (Heslehurst et al., 2018).

6.3.2 Intervention

This review considered studies that evaluated mother-targeted mHealth educational interventions during the antenatal or postnatal period. No limitations on education topics were set, provided the topic targeted pregnant women or postnatal mothers. mHealth interventions could include mobile phones, smartphones or tablets and could occur through phone calls, video calls, SMS or mobile applications. The mHealth intervention must have been initiated during the antenatal period or between birth and six weeks postnatally but could extend beyond this period for implementation. Interventions were excluded if they began prior to pregnancy or after six weeks postnatally. The six week postnatal period was selected to be consistent with the World Health Organization's recommendation of postnatal follow-up (World Health Organization, 2013) and with the postpartum follow-up period in many high-income countries, such as the United Kingdom (NICE, 2015b) and Canada (Society of Obstetricians and Gynaecologists of Canada, 2020). The mHealth component must have been the primary aspect of the intervention, excluding interventions that only included an mHealth component as part of a multifaceted intervention (i.e., counseling call options, text messages of upcoming

appointments or content reminder). eHealth interventions not associated with mobiles were excluded, such as websites or web cameras.

6.3.3 Comparator

This review considered studies that compared the intervention to any control, including standard care, placebo or no treatment.

6.3.4 Outcomes

This review considered studies that included the following outcomes:

- Self-efficacy, defined in relation to each study measured using standardized questionnaires (e.g. Perceived Maternal Parenting Self-Efficacy tool (Barnes & Adamson-Macedo, 2007), Infant Care Self-Efficacy (Forman & Owen, 1989)) or other measures as reported by studies
- Social support, defined in relation to each study measured using standardized questionnaires (e.g. Multidimensional Scale of Perceived Social Support (Zimet et al., 1990), Support Behaviour Inventory (Brown, 1986)) or other measures as reported by studies
- Postpartum anxiety, measured using standardized questionnaires (e.g. Postpartum Specific Anxiety Scale (Fallon et al., 2016), State Anxiety Inventory scale (Chlan et al., 2003)) or other measures as reported by studies
- Postpartum depression, measured using standardized questionnaires (e.g., Edinburgh Postnatal Depression Scale (Cox et al., 1993))

6.3.5 Types of Studies

This review considered both experimental and quasi-experimental study designs including randomized controlled trials (RCT), non-randomized controlled trials, before

and after studies, and interrupted time-series studies. In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies were considered for inclusion. Studies published in English were included. Studies published from 2000 to December 16, 2018 were included based on the emergence of mHealth interventions after this period and consistent with other reviews on a similar topic (Dol et al., 2019a; Gagnon et al., 2016; Hurt et al., 2016).

6.4 Methods

This systematic review was conducted in accordance with the JBI methodology for systematic reviews of effectiveness (The Joanna Briggs Institute, 2017). This review was conducted in accordance with an *a priori* protocol (Dol et al., 2019c).

6.4.1 Search Strategy

The search strategy aimed to locate both published and unpublished studies. A three-step search strategy was utilized in this review and was conducted in consultation with a health science librarian. First, an initial limited search of PubMed was undertaken followed by analysis of the text words contained in the title and abstract and the index terms used to describe the articles. Second, the search strategy, including all identified keywords and index terms, was adapted for each included information source and was undertaken on December 16, 2018. The full search strategies are provided in Appendix D. Finally, the reference lists of all studies selected for critical appraisal were screened for additional studies.

6.4.2 Information Sources

The databases searched included PubMed, CINAHL, PsycINFO and Embase. Sources of unpublished studies and gray literature included Google Scholar and mHealth

intelligence. Clinical trial databases (https://clinicaltrials.gov, ClinicalTrials.gov, Cochrane Central Register of Controlled Trials) were also searched for relevant studies.

6.4.3 Study Selection

Following the search, all identified citations were collated and uploaded into Covidence (Veritas Health Innovation, Melbourne, Australia) and duplicates removed. Titles and abstracts were screened by two independent reviewers (JD, BR) for assessment against the inclusion criteria for the review. The full text of selected citations was assessed in detail against the inclusion criteria by two independent reviewers (JD, BR) in Covidence. Full-text studies that did not meet the inclusion criteria were excluded, and reasons for their exclusion are provided in Appendix E. Any disagreements that arose between the reviewers were resolved through discussion, or with a third reviewer (MCY).

6.4.4 Assessment of Methodological Quality

Eligible studies were critically appraised by two independent reviewers (JD, BR) at the study level for methodological quality using standardized critical appraisal instruments from JBI for experimental and quasi-experimental studies (The Joanna Briggs Institute, 2017). No authors of papers were contacted to request missing or additional data for clarification. Any disagreements that arose between the reviewers were resolved through discussion, or with a third reviewer (MCY). Following critical appraisal, studies that did not meet a critical appraisal score of 50% or greater were excluded.

6.4.5 Data Extraction

Data were extracted from papers included in the review using the standardized data extraction tool available in JBI SUMARI by two independent reviewers (JD, BR)

(The Joanna Briggs Institute, 2017). The data extracted included specific details about the interventions, populations, study methods and outcomes of significance to the review question and specific objectives. Any disagreements that arose between the reviewers were resolved through discussion or with a third reviewer (MCY).

6.4.6 Data Synthesis

Based on available extracted data, studies were pooled in statistical meta-analysis using RevMan V5.3 (Copenhagen: The Nordic Cochrane Centre, Cochrane) for postpartum depression only. Effect sizes, expressed as odds ratios (ORs) and their 95% confidence intervals (CIs), were calculated for analysis. Heterogeneity was assessed statistically using the standard chi-squared and I^2 tests. The choice of random effects model was based on the guidance by Tufanaru et al (2015). For the other outcomes where statistical pooling was not possible, the findings were presented in narrative form including tables to aid in data presentation where appropriate.

No subgroup analyses were conducted due to insufficient data to investigate differences between interventions targeting the antenatal period alone, postnatal period alone or across the perinatal period, or comparing low-income and/or vulnerable populations compared to a community sample. However, studies that targeted vulnerable populations were noted narratively in the results when applicable. We chose not to generate a funnel plot to assess publication bias as there were no outcomes with 10 or more studies included in a meta-analysis.

6.4.7 Assessing Certainty in the Findings

The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach for grading the certainty of evidence was followed (The GRADE

Working Group, 2013) and a Summary of Findings (SoF) was created using GRADEpro (McMaster University, ON, Canada; see Appendix F). The SoF presents the following information: absolute risks for the treatment and control for postpartum depression, and a ranking of the quality of the evidence based on the risk of bias, directness, heterogeneity, precision and risk of publication bias of the review results. The outcomes reported in the SoF include self-efficacy, social support, postpartum anxiety and postpartum depression. For self-efficacy, social support and postpartum anxiety, descriptive information is provided in the comment section.

6.5 Results

6.5.1 Study Inclusion

The search of the literature yielded 1607 articles after 491 duplicates were removed. After a review of title and abstracts, 1501 were excluded. The full texts of the remaining 106 articles were assessed to determine if they met eligibility criteria, and 82 articles were excluded after full-text screening, leaving 24 studies included for critical appraisal. After critical appraisal, three studies were excluded, leaving 21 articles included for synthesis. Figure 6.1 outlines the search results and study selection process for this review and provides additional details on the reasons for exclusion at full-text review (see Appendix E for additional details).

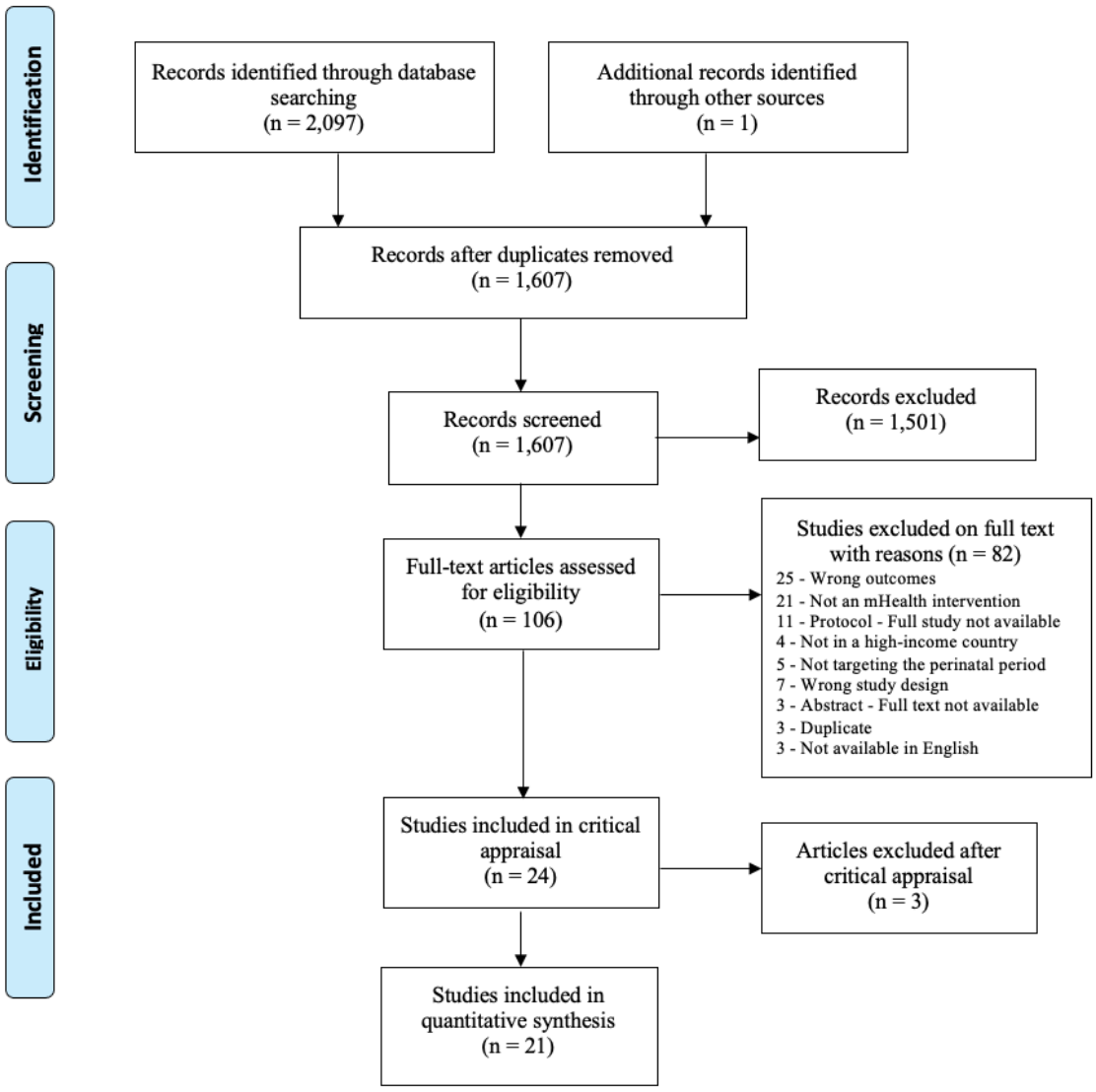


Figure 6.1. Search results and study selection and inclusion process

6.5.2 Methodological Quality

The 24 articles that met inclusion criteria were critically appraised for methodology quality using either the quasi-experimental (non-randomized) studies critical appraisal checklist or the randomized controlled trial critical appraisal checklist,

as appropriate to the study design. Thirteen studies were quasi-experimental and 11 were RCTs. Three articles were excluded for poor methodology quality with scores between 0% and 31%, which was below the 50% cut-off as per the protocol (see Table 6.1 and Table 6.2 for full methodological quality assessment). Dalton and colleagues (2018) was excluded due to scoring "no" or "unclear" on most critical appraisal outcomes, with the exception of similarity of groups and using multiple measurements pre- and post-outcomes. Song and colleagues (2013) was excluded due to scoring "no" or "unclear" on all items. Hantsoo and colleagues (2018) was excluded as an RCT due to scoring "no" or "unclear" on most items, with the exception of treatment of groups and outcome measurements.

For the 11 included quasi-experimental studies, critical appraisal scores ranged from 56% to 100%. Cause and effect, multiple measurements of outcomes pre- and post-intervention, outcome measurement and appropriate statistical analysis were appraised highly in most studies. Critical appraisal scores for the 10 included RCTs ranged from 50% to 92%, with methodological concerns primarily related to treatment blinding for participants, providers and outcome assessors, which is related to the behavior-type intervention approach. Secondary areas of concern related to allocation concealment and appropriate design.

Table 6.1 Critical Appraisal Scores of Quasi-Experimental Studies

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	%
Included										
Abroms et al. 2015.	Y	N/A	N/A	N	Y	U	Y	Y	Y	71.4%
Al Hashmi. 2017.	Y	Y	Y	Y	Y	Y	Y	Y	Y	100%
Baumel et al 2018.	Y	U	U	Y	Y	Y	Y	Y	Y	77.8%
Bhat et al. 2018.	Y	N/A	N/A	N	Y	Y	N/A	Y	U	66.7%
Brown. 2018.	Y	N/A	N/A	N	Y	Y	N/A	Y	Y	83.3%
Dalfra et al 2009.	Y	Y	Y	Y	Y	U	N	Y	Y	77.8%
Fujioka et al. 2012.	Y	U	Y	N	U	U	Y	Y	Y	55.6%
Globus et al. 2016.	Y	Y	Y	Y	Y	Y	Y	Y	Y	100%
Jallo et al. 2017.	Y	N/A	N/A	N	Y	U	N/A	Y	Y	66.7%
Letourneau et al 2015.	Y	N/A	N/A	N	Y	Y	N/A	Y	Y	88.3%
Prasad. 2018.	Y	Y	U	Y	Y	U	Y	Y	Y	77.8%
Excluded										
Dalton et al. 2018.	U	Y	U	N	Y	U	N	U	U	22.2%
Song et al. 2013.	U	N/A	N/A	N	U	U	N/A	U	U	0%
%	**84.61**	**38.46**	**30.76**	**38.46**	**84.61**	**46.15**	**46.15**	**84.61**	**76.92**	

Y = Yes, N = No, U = Unclear; JBI critical appraisal checklist for Quasi-Experimental Studies (non-randomized experimental studies): Q1 = Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?; Q2 = Were the participants included in any comparisons similar?; Q3 = Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?; Q4 = Was there a control group?; Q5 = Were there multiple measurements of the outcome both pre and post the intervention/exposure?; Q6 = Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?; Q7 = Were the outcomes of participants included in any comparisons measured in the same way?; Q8 = Were outcomes measured in a reliable way?; Q9 = Was appropriate statistical analysis used?

Table 6.2 Critical Appraisal Scores of Randomized Controlled Trials

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	%
Included														
Bhati. 2014	Y	Y	U	Y	N	N	Y	U	U	Y	Y	Y	U	53.8 %
Choi et al 2016.	Y	U	Y	N	N	U	Y	Y	Y	Y	Y	Y	Y	61.5 %
Dennis-Tiwary et al. 2017.	U	U	Y	N	Y	U	Y	U	Y	Y	Y	Y	U	53.8 %
Garfield et al. 2016.	Y	Y	Y	N	Y	U	Y	Y	Y	Y	Y	Y	U	76.9 %
Gallegos et al 2014.	N	N	U	N	N/A	N/A	Y	Y	N/A	Y	Y	Y	N	50%
Hannan et al 2016.	Y	U	Y	N	N	N	Y	Y	Y	Y	Y	U	U	53.8 %
Ngai et al. 2015.	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	76.9 %
Shorey et al. 2017.	Y	Y	Y	N	N/A	Y	Y	Y	Y	Y	Y	Y	Y	91.7 %
Takeuchi & Horiuchi 2016.	Y	Y	Y	N	U	U	Y	U	Y	Y	Y	Y	Y	69.2 %
Toohill et al. 2014.	Y	U	Y	N	N	U	Y	Y	Y	Y	Y	Y	U	61.5 %
Excluded														
Hantsoo et al. 2018.	U	U	Y	U	U	U	Y	U	N	Y	Y	U	U	30.8 %
%	**72.72**	**45.45**	**81.81**	**9.09**	**18.18**	**9.09**	**100.0**	**63.63**	**72.72**	**100.0**	**100.0**	**81.81**	**36.36**	

Y = Yes, N = No, U = Unclear; JBI critical appraisal checklist for randomized controlled trials: Q1 = Was true randomization used for assignment of participants to treatment groups?; Q2 = Was allocation to treatment groups concealed?; Q3 = Were treatment groups similar at baseline?; Q4 = Were participants blind to treatment assignment?; Q5 = Were those delivering treatment blind to treatment assignment?; Q6 = Were outcome assessors blind to treatment assignment?; Q7 = Were treatment groups treated identically other than the intervention of interest?; Q8 = Was follow-up complete, and if not, were strategies to address incomplete follow-up utilized?; Q9 = Were participants analyzed in the groups to which they were randomized?; Q10 = Were outcomes measured in the same way for treatment groups?; Q11 = Were outcomes measured in a reliable way?; Q12 = Was appropriate statistical analysis used?; Q13 = Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

6.5.3 Characteristics of Included Studies

Of the 21 included articles (Appendix G), nine targeted the antenatal period and 10 covered the postnatal period, with one covering both periods and one being unclear in terms of targeted timing. Eleven were quasi-experimental studies, including pre-post design and pilot evaluations, and 10 were RCTs, of which four were pilot RCTs. Most studies were conducted in the United States, with one each in Oman (Al hashmi, 2017), Italy (Dalfra et al., 2009), Israel (Globus et al., 2016), Canada (Letourneau et al., 2015), Hong Kong (Ngai et al., 2015) and Singapore (Shorey et al., 2017b), and two each in Australia (Gallegos et al., 2014; Toohill et al., 2014) and Japan (Fujioka et al., 2012; Takeuchi & Horiuchi, 2016).

Most participants were community-sampled pregnant or recently postpartum women, although some studies targeted vulnerable sub-populations, including women of low socioeconomic status (Bhati, 2015; Brown, 2018; Hannan et al., 2016). The topic of the mHealth intervention varied and included smoking cessation, gestational diabetes, perinatal mood (including depression, anxiety and stress), physical activity, breastfeeding, neonatal intensive care unit (NICU) and NICU transition, perinatal massage, childbirth fear, general postpartum adjustment and newborn care. The mHealth intervention approach also varied with SMS and mobile applications as the most common approaches, followed by phone calls, telemedicine and mobile phone Internet. The length of intervention ranged from four weeks to six months.

6.5.4 Review Findings

Table 6.3 provides a representation of whether a significant difference or improvement in the four outcomes was identified in each study. It was noted that studies

tended to fall into three overarching topic areas: mental health (stress, anxiety, childbirth fear, postpartum depression); healthy behavior (smoking cessation, gestational diabetes, physical activity, perinatal massage); and postnatal activities (NICU, breastfeeding, newborn care). To provide a more succinct summary, each outcome is discussed in this capacity. Differentiation between community sample and vulnerable samples is noted.

Table 6.3 Overview of outcomes

Study	**Topic**	**Was there a significant difference or improvement?**			
		Self-Efficacy	**Social Support**	**Anxiety**	**Depression**
Mental Health					
Bameal (2018)	Perinatal mood	-	-	No	Yes
Bhat (2018)	Depression	-	-	-	Yes
Bhati (Bhati, 2015) **	Depression & sleep disturbances	-	-	-	Yes
Brown (2018) **	Depression	-	-	-	Yes
Dennis-Tiwary (2017)	Perinatal threat, anxiety, and stress	-	-	No	No
Latourneau (2015)	Depression	-	Mixed	-	Yes
Jallo (2017)	Stress	No	-	-	-
Ngai (2015)	Depression	-	-	-	Yes
Prasad (2018)	Depression	-	Unknown	-	Mixed
Toohill (2014)	Childbirth fear	Yes	-	-	No
Healthy Behaviour					
Abroms (2015a)	Smoking cessation	Yes	-	-	-
Al Hashmi (2017)	Gestational diabetes	Yes	-	-	-
Choi (2016)	Physical activity	No	No	-	No
Dalfra (2009)	Gestational diabetes	-	-	-	No
Fujioka (2012)	Smoking cessation	No	-	-	-
Takeuchi (2016)	Perinatal massage	No	-	-	-
Postnatal Behaviour					
Gallegos (2014)	Breastfeeding	No	Yes	-	-
Garfield (2016)	NICU transition	No	-	-	-
Globus (2016)	NICU	-	-	No	-
Shorey (2017a)	Newborn care	Yes	Yes	-	Yes
Hannan (2016) **	Postpartum adjustment	-	Mixed	-	-

** Low-income/vulnerable population; NICU = neonatal intensive care unit

6.5.4.1 Self-efficacy

For measurement of self-efficacy, the following validated measures were used by the 10 studies: Childbirth Self-Efficacy Inventory (Takeuchi & Horiuchi, 2016; Toohill et al., 2014), Parenting Self-Efficacy Scale (Shorey et al., 2017a), Coping Self-Efficacy Scale (Jallo et al., 2017), Parenting Sense of Competence Scale (Garfield et al., 2016), Breastfeeding Self-Efficacy Scale (Gallegos et al., 2014), Self-Efficacy Scale from the Life-Span Perspective (Japanese version) (Fujioka et al., 2012), self-efficacy for physical activity (Choi et al., 2016), a revised version of the Diabetes Management Self-Efficacy Scale (Al hashmi, 2017), and a modified version of the Attitude-Social Influence-Efficacy Model (Abroms et al., 2015a). Given the heterogeneity across the scales that were used, no meta-analysis was possible, and the results were reported narratively. Of the 10 studies, two covered mental health topics (Jallo et al., 2017; Toohill et al., 2014), five covered healthy behavior (Abroms et al., 2015a; Al hashmi, 2017; Choi et al., 2016; Fujioka et al., 2012; Takeuchi & Horiuchi, 2016) and three covered postnatal behavior (Gallegos et al., 2014; Garfield et al., 2016; Shorey et al., 2017a).

Under mental health, Jallo et al. (2017) conducted a pre-post-test experimental study to determine the effect of a mobile app on reduced stress in women at risk of preterm labor. Self-efficacy was measured self-efficacy using the Coping Self-Efficacy Scale. The authors found no significant difference in self-efficacy measured between baseline (Median = 148.5, range = 32 to 245) and eight days post intervention (Median = 155, range = 110 to 241, mean change = –7.5, range = –80 to 54, p = 0.88). Of note, only five of the 15 participants who completed the baseline survey also completed the follow-up survey eight days later. Toohill et al. (2014) sought to determine the effect of

counselling phone calls from midwives on women's childbirth fears using an RCT study design measured with the Childbirth Self-Efficacy Inventory. At baseline, Toolhill et al. (2014) found no significant differences between the intervention (M = 368.5, standard deviation [SD] = 122.5) and control groups (M = 385.9, SD = 102.9) related to childbirth self-efficacy. When measured post-intervention, there was a significant mean change difference of 41.4 (95% CI: 15.48 to 67.3, p = 0.002) in childbirth self-efficacy scores between the intervention (mean change = 61.10, SD = 87.45) and control group (mean change = 19.7, SD = 92.61).

In relation to healthy behaviors, topics covered included smoking cessation, gestational diabetes, physical activity and perinatal massage with no consonance in outcome findings. Two studies reported on self-efficacy related to smoking cessation in the antenatal period. Abroms et al. (2015a) conducted a pilot evaluation of SMS on smoking cessation using a quasi-experimental study design. Of the 20 enrolled participants, 16 completed a two-week follow-up survey, and 13 completed the four-week follow-up survey, which measured self-efficacy using a modified version of the Attitude-Social Influence-Efficacy Model. According to the authors' findings, confidence in participants' ability to quit smoking was rated 3.6 (SD = 1.2) at baseline on a scale from 1 to 5, with 5 indicating high confidence. Participants' self-efficacy continued to increase, reported at 3.8 (SD = 1.3) at two weeks and 4.8 (SD = 0.5) at four weeks. However, this was only among participants who did not drop out, which was almost half in this small study. Fujioka et al. (2012) examined the effect of a mobile e-learning support program on self-efficacy related to smoking cessation using the Self-Efficacy Scale from the Life-Span Perspective (Japanese version). The authors found that self-

efficacy was higher, but not statistically significant, in the group that quit smoking compared with those who continued to smoke at one month and three months post intervention (data reported narratively).

Al Hashmi (2017) conducted a pre-post-test experimental study on the effects of SMS on women's self-efficacy for adherence to healthy behaviors to control gestational diabetes in the antenatal period as measured using a revised version of the Diabetes Management Self-Efficacy Scale. The authors found that there was no significant difference between groups at baseline ($M = 118.25$, $SD = 19.51$ in the intervention group versus $M = 122.9$, $SD = 19.92$ in the control group, $p = 0.62$). When measured post intervention at four weeks, self-efficacy was found to significantly increase in the intervention group compared with the control group (mean change = 9.89, $SD = 19.58$ versus mean change = –1.84, SD = 17. 58, $p < 0.001$). Choi et al. (2016) conducted a pilot RCT to observe the effect of a mobile app on physical activity levels in inactive pregnant women. Self-efficacy was measured using the self-efficacy for physical activity questionnaire. The authors found that there was a significant difference at baseline between groups, with the intervention group having higher self-efficacy than the control group ($M = 21.9$, $SD = 5.0$ versus $M = 18.7$, $SD = 3.4$, $p = 0.05$), but this difference disappeared when measured at 12 weeks ($M = 18.7$, $SD = 4.4$ versus $M = 17.1$, $SD = 5.2$, $p = 0.58$).

Takeuchi et al. (2016) conducted an RCT to compare a smartphone website with a leaflet on antenatal perineal massages. Childbirth self-efficacy was measured using a childbirth self-efficacy scale. The authors found no significant difference between the

intervention (M = 93.4, SD = 13.81) and control group (M = 94.1, SD = 16.79) on childbirth self-efficacy after the intervention (p = 0.59).

The remaining studies targeted the postnatal period and behaviors that occur during this period. Gallegos et al. (2014) conducted an RCT to determine the effects of SMS on breastfeeding rates and self-efficacy in the postnatal period, as measured using the Breastfeeding Self-Efficacy Scale. For the intervention group, there was a 0.15 positive change between baseline (M = 4.00, SD = 0.74) and eight weeks (M = 4.15, SD = 0.72) and a 0.07 positive change for the control group (M = 4.22, SD 0.66 versus M = 4.29, SD = 0.67) for self-efficacy, but this was not statistically significant (p = 0.25).

Garfield et al. (2016) conducted a pilot RCT to determine the effect of a mobile app on parents transitioning from the NICU to home. Self-efficacy was measured using the Parenting Sense of Competence Scale. The authors found that there was no statistically significant difference between the intervention and control group (M = 71.8, SD = 10.5 versus M = 69.8, SD = 1.0; p = 0.37) after four weeks independently, but the authors noted that self-efficacy "increased at a higher overall rate over time for the intervention group (7% increase) compared to the control group (< 1% increase)" (Garfield et al., 2016, p. 133).

Shorey et al. (2017a) conducted an RCT to determine the effect of a mobile app on newborn care to improve parenting outcomes. Self-efficacy was measured using the parenting self-efficacy scale. The authors found a significant improvement in parenting self-efficacy for parents who received the intervention from their baseline scores (mean difference = 11.8, SD = 23.7) compared to the control group, which saw a decrease in their self-efficacy scores over the same four-week time period (mean difference = –11.9,

SD 21.9). At the post-test, participants in the intervention group compared to the control group had a significant adjusted mean difference of 23.20 (95% CI 16.44 to 29.95, $p < 0.001$).

6.5.4.2 Social Support

Six studies reported on social support using varied measures, including the Social Provisions Scale (Letourneau et al., 2015), Multidimensional Scale of Perceived Social Support (Hannan et al., 2016), Social Support for Parenting Scale (Shorey et al., 2017a), Social Support and Exercise Survey—family and friends subscale (Choi et al., 2016), with the remaining two studies using study-specific questions (Gallegos et al., 2014; Prasad, 2018). Given the different scales used, no meta-analysis was possible, and the results were reported narratively. Of the six studies, two covered mental health topics (Letourneau et al., 2015; Prasad, 2018), one covered healthy behavior (Choi et al., 2016) and three covered postnatal behavior (Gallegos et al., 2014; Hannan et al., 2016; Shorey et al., 2017a).

Two studies examined social support (with evaluation of depression) but used different measures, so no analytic comparison was possible. Letourneau et al. (2015) used the Social Provisions Scale measured in a pre-post-test study. The authors found that the use of telephone-based peer support increased social support from baseline ($M = 70.73$, $SD = 8.72$), to mid-point (7.43 weeks, $M = 73.18$, $SD = 8.44$), to final end-point (13.9 weeks, $M = 76.69$, $SD = 10.85$); however, only the increase from baseline to mid-point was significant ($p = 0.017$). In Prasad et al.'s (2018) quasi-experimental study, the authors asked two questions to determine feelings of social support: i) As a mother of a newborn, do you feel supported by your family and friends? and ii) As a mother of a

newborn, do you feel a sense of connectedness with your circle of family and friends? In the intervention group (mobile application), 52% of participants (12 out of 23) answered "yes" to the two questions compared to 10% (2 out of 20) in the control group.

Only one study covered healthy behavior. Choi et al. (2016) conducted a pilot RCT to determine the effect of a mobile application on physical activity in inactive pregnant women. The authors measured social support using the Social Support and Exercise Survey—family and friends subscale. The authors found no significant difference between social support for physical activity from family (intervention baseline: M = 41.2, SD = 10.4; intervention 12 weeks: M = 42.0, SD = 11.5 versus control baseline: M = 40.8, SD = 9.9; control 12 weeks: M = 38.5, SD = 10.4, p = 0.28) or friends (intervention baseline: M = 39.3, SD = 11.3; intervention 12 weeks: M = 37.2, SD = 9.6 versus control baseline: M = 34.2, SD = 6.1; control 12 weeks: M = 32.1, SD = 8.6, p = 0.64) after the intervention. Choi et al. (2016) was the only study that reported on social support in the antenatal period, with the remainder targeting the postnatal period.

The final three studies that reported on social support as an outcome covered postnatal behavior, finding similar positive impacts on social support. Gallegos et al. (2014) conducted an RCT on the effect of SMS on breastfeeding rates and examined social support as a function of self-efficacy, which was reported as "current levels of support from family, peers, professionals, and organizations measured using a seven point Likert scale with summated score anchored by 'no support' and 'lots of support'" (p.4). For the intervention group, there was a 0.24 positive change between baseline (M = 3.64, SD = 1.05) and 12 weeks (M = 3.86, SD = 0.88), and a –0.02 difference for the control group between baseline (M = 3.91, SD 0.86) and 12 weeks (M = 3.89, SD =

0.68), which was statistically significant ($p < 0.001$). Shorey et al. (2017a) targeted improvements in newborn care through a mobile app, evaluating social support using the Social Support for Parenting Scale, which measured social support from spouses and other sources. When examining social support from spouses, the authors found a significant improvement in post-test scores in the intervention group (M difference = 0.31, SD = 23.3) but a significant decrease in the control group (M difference = –27.4, SD = 22.3). This resulted in an overall significant difference between the intervention and control group in terms of the social support mothers received from their spouses (M difference = 27.08, 95% CI = 20.94 to 34.8, $p < 0.001$). When examining social support from other sources, a similar finding emerged. There was a significant improvement in post-test scores in the intervention group (M difference = 4.3, SD = 29.3) but a significant decrease for the control group (M difference = –22.0, SD = 22.5). This resulted in an overall significant difference between the intervention and control group in terms of the social support from other sources (M difference = 27.23, 95% CI = 19.06 to 35.40, $p < 0.001$). Finally, Hannan et al. (2016) conducted an RCT to improve postpartum adjustment and follow-up in low-income, first-time mothers using mHealth technology (SMS and phone calls). Using the Multidimensional Scale of Perceived Social Support, the authors found that the social support scores for the mothers in the intervention group were significantly higher when measured at one month (M = 72.6, SD = 12.9), four months (M = 74.0, SD = 13.2), five months (M = 75.2, SD = 11.1) and six months (M = 74.5, SD = 12.6) compared to the scores of mothers in the control group (one month: M = 65.5, SD = 15.7; four months: M = 68.3, SD = 13.1; five months: M = 67.7, SD = 15.3 and six months: M = 67.3, SD = 17.1; $p < 0.05$). There was no

significant difference in the intervention versus control groups when measured at day three (M = 71.0, SD = 14.9 compared to M = 68.9, SD = 15.6), month two (M = 70.6, SD = 13.9 compared to M = 69.0, SD = 13.4) or month three (M = 73.0, SD = 12.4 compared to M = 70.1, SD = 12.8).

6.5.4.3 Postpartum Anxiety

Three studies reported on postpartum anxiety using the Beck Anxiety Inventory (Baumel et al., 2018), Hamilton Anxiety Score (HAM-A), Depression, Anxiety, and Stress Scale (DASS)–Anxiety subscale (Dennis-Tiwary et al., 2017) and a study-specific questionnaire (Globus et al., 2016). Given the different scales that were used, no meta-analysis was possible, and the results were reported narratively. Of the three studies, two covered mental health topics (Baumel et al., 2018; Dennis-Tiwary et al., 2017) and one covered postnatal experiences, specifically in the NICU (Globus et al., 2016). No studies were able to find a significant positive impact on postpartum anxiety.

Related to mental health, Baumel et al. (2018) conducted a quasi-experimental pilot evaluation of the 7Cups mobile app to improve perinatal mood and measured anxiety using the Beck Anxiety Inventory. The authors did not find a significant change in anxiety when measured at baseline (M = 20.47, SD = 13.15) or after the intervention was provided for one month (M = 16.65, SD = 7.52; p = 0.11). Similarly, Dennis-Tiwary et al. (2017) conducted a pilot RCT to determine the impact of a mobile app on perinatal threat, anxiety and stress. The authors measured anxiety using the HAM-A and the DASS-A. They also found no significant difference after the intervention was provided for one month on either the HAM-A for the intervention (M = 9.2, SD = 6.71) compared

to control (M = 6.93, SD = 9.1) or on the DASS-A (M = 3.2, SD = 3.0 versus M = 2.07, SD = 3.6), p not reported.

Globus et al. (2016) conducted a quasi-experimental study to provide NICU parents with information via daily SMS about their infant's NICU stay. The authors asked parents to respond to two statements to determine their anxiety on a scale from 0 to 10, with lower scores reflecting lower anxiety: i) How anxious I feel now; and ii) How anxious I feel when I think about taking my infant home? They found no significant difference between parents who received the text messages (statement 1: M = 2.7, SD = 2.6; statement 2: M = 3.1, SD = 2.8) compared to those who did not receive the text messages (statement 1: M = 3.1, SD = 2.8, p = 0.3; statement 2: M = 2.5, SD = 2.5; p = 0.15).

6.5.4.4 Postpartum Depression

Twelve studies reported on postpartum depression using the following measures: Beck Depression Inventory II (BDI-II) (Baumel et al., 2018), Edinburgh Postnatal Depression Scale (EPDS) (Baumel et al., 2018; Bhati, 2015; Brown, 2018; Letourneau et al., 2015; Ngai et al., 2015; Prasad, 2018; Shorey et al., 2017a; Toohill et al., 2014), Depression, Anxiety, and Stress Scale (DASS-21)–Depression subscale (Dennis-Tiwary et al., 2017), Center for Epidemiological Studies Depression Scale (Choi et al., 2016; Dalfra et al., 2009), and Patient Health Questionnaire-9 (PHQ-9) (Bhat et al., 2018). Because a number of studies used the EPDS, meta-analysis was possible. The remainder of the studies that used other measures were reported narratively. Of the 12 studies, nine covered mental health topics (Baumel et al., 2018; Bhat et al., 2018; Bhati, 2015; Brown, 2018; Dennis-Tiwary et al., 2017; Letourneau et al., 2015; Ngai et al., 2015; Prasad,

2018; Toohill et al., 2014), two covered healthy behavior (Choi et al., 2016; Dalfra et al., 2009) and one covered postnatal behavior (Shorey et al., 2017a).

Looking specifically at the mHealth interventions that targeted mental health and the studies that used the EPDS, meta-analysis was possible comparing baseline and post-intervention scores among five studies. As illustrated in Figure 6.2, subgroup analysis was applied based on intervention length, with an overall significant effect independent of length of intervention or period of follow-up (OR = –6.01, 95% CI = –8.34 to –3.67, $p < 0.00001$). There were also significant improvements in depression scores when interventions measured depression outcomes between four and seven weeks postpartum (Baumel et al., 2018; Bhat et al., 2018; Brown, 2018; Letourneau et al., 2015; Prasad, 2018) (OR = –4.47, 95% CI = –6.46 to –2.49, $p < 0.0001$), and those that measured between eight and 14 weeks postpartum (Baumel et al., 2018; Letourneau et al., 2015) (OR = –9.46, 95% CI = –10.89 to –8.03, $p < 0.00001$).

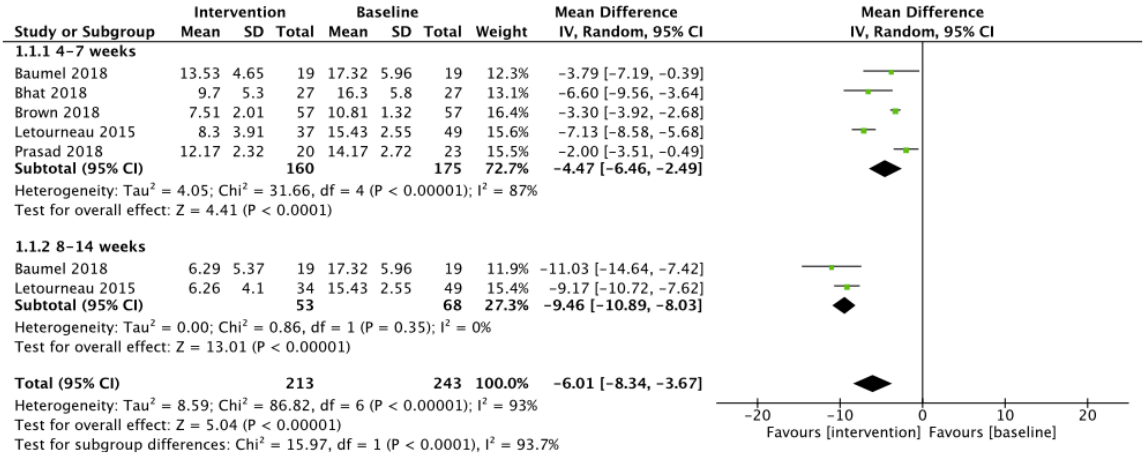


Figure 6.2. Depression when reported using the Edinburgh Postnatal Depression Scale comparing baseline and post-intervention scores

A second subgroup meta-analysis was conducted on depression scores comparing intervention and control groups, with interventions spanning a period of three to six weeks (see Figure 6.3). There were no significant differences related to reduced depression scores for mothers who received the intervention compared to the control group (Bhati, 2015; Prasad, 2018) (OR = –2.12, 95% CI = –4.82 to 0.58, p = 0.12).

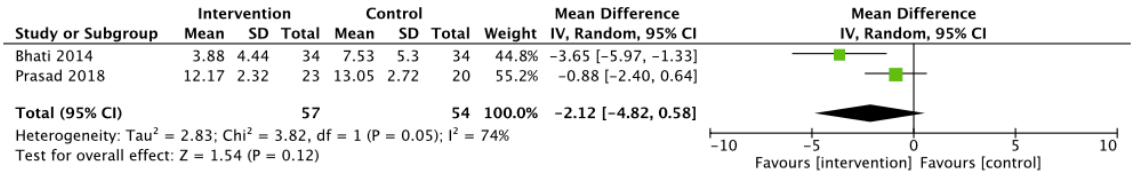


Figure 6.3. Depression when reported using the Edinburgh Postnatal Depression Scale comparing control versus intervention groups

The following studies were not included in the meta-analysis but reported on mHealth interventions targeting mental health. Ngai et al. (2015) reported separately on women who had minor depression (EPDS scores between 10 and 12) and those who had major depression (scoring 13 or more on the EPDS). At six weeks postpartum, women in the intervention group (telephone-based cognitive behavioral therapy) had lower scores for both minor (mean difference in EPDS score = 1.90, 95% CI: 0.72 to 3.08, p = 0.002) and major depression (mean difference in EPDS score = 5.00, 95% CI: 3.12 to 6.88; p < 0.001) than the control group. While this remained consistent in the minor depression subgroup at six months (mean difference in EPDS score = 1.20, 95% CI: 0.09 to 2.32; p = 0.034), it was no longer significant for the major depression subgroup at six months

(mean difference in EPDS score = 1.69, 95% CI: 0.10–3.47; p = 0.064). Toohill et al. (2014) similarly reported on mean difference and change in scores on the EPDS based on an telephone counseling intervention by midwives provided antenatally related to childbirth fear. The authors found no significant difference between the EPDS scores pre- and post-intervention for the intervention group (mean change = 1.26, SD = 4.98) compared to the control group (mean change = 0.61, SD = 5.3; mean change difference = 0.65, 95% CI = –0.79 to 2.09, p = 0.38). Dennis-Tiwary et al. (2017) found no significant difference after the mHealth intervention was provided in the antenatal period for one month on the DASS-21–Depression subscale (intervention: M = 2.07, SD = 2.63 versus control: M = 2.29, SD = 3.2), p not reported. On the other hand, while Baumel et al. (2018) did not clearly state when the mobile app intervention was provided in the perinatal period, the authors reported depression outcomes using the BDI-II and found that there was a significant reduction in symptoms between baseline (M = 26.11, SD = 13.34) and 30 days later (M = 19.18, SD = 9.23, p = 0.01). Bhat et al. (2018) reported on depression outcomes using the PHQ-9 when the intervention was provided anytime during the perinatal period. They also found that PHQ-9 scores significantly declined between baseline (M = 15.3, SD = 4.0) and approximately 14 weeks later (M = 6.2, SD = 4.4, $p < 0.001$).

Two studies focused on healthy behavior during pregnancy and used the Center for Epidemiological Studies Depression Scale to measure postpartum depression. Dalfrà et al. (Dalfra et al., 2009) conducted a quasi-experimental study on the effect of telemedicine in women with gestational diabetes. While there was significant improvement in depression scores from enrollment to after birth in both the intervention

group (enrollment: M = 17.1, SD = 8.9; after delivery: M = 24.1, SD = 11.2, $p < 0.0001$) and the control group (enrollment: M = 17.5, SD = 8.7; after delivery: M = 22.6, SD = 10.9, $p < 0.0001$), there was no significant difference between the two groups' changes ($p = 0.13$). Choi et al. (2016) conducted a pilot RCT to determine the effect of a mobile app on physical activity in inactive pregnant women and found no significant change between the intervention group (baseline: M = 9.8, SD = 6.7; 12 weeks: M = 8.8, SD = 2.7) and the control group (baseline M = 10.7, SD = 6.5; 12 weeks: M = 11.1, SD = 6.9, $p = 0.56$).

Only one study reported postnatal behavior and its relation to postpartum depression. Shorey et al. (2017a) reported on the mean difference and change scores in the EPDS between the groups that were provided an intervention using a mobile app compared to a control group. The authors found that there was no significant difference in the absolute change scores between the intervention (mean difference = 7.0, SD = 81.5) and control group (mean difference = 7.6, SD = 76.1), between baseline and four weeks later (mean difference = –0.33, 95% CI: –1.21 to 0.53, $p = 0.450$).

6.6 Discussion

This review aimed to provide insight into the effectiveness of mHealth interventions targeting mothers in high-income countries in the antenatal and postnatal period to enhance four psychosocial outcomes: self-efficacy, social support, anxiety and depression. Despite a wide variety of outcome measures used, the predominant findings suggest that there are insufficient data to conclude that mHealth interventions are associated with improved self-efficacy and anxiety outcomes in this population. In contrast, findings related to the effectiveness of mHealth on perceived social support showed some benefit across studies. While there were mixed findings for mental health

topics and only one study reported on social support in relation to healthy behavior, there appeared to be evidence that mHealth can be used to increase feelings of social support targeting postnatal behaviors. Depression outcomes were most commonly reported, and due to similar reporting, meta-analyses comparing pre-post outcomes and intervention versus control group outcomes suggested that mHealth interventions targeting postpartum depression reduced postpartum depression for mothers in high-income countries. Other mHealth interventions that did not specifically target perinatal mood as a primary focus, such as healthy behavior or postnatal behavior, were unable to provide sufficient data to determine a similar finding.

Despite insufficient evidence in the current review, self-efficacy during the postnatal period remains an important outcome that should be targeted by educational interventions during this period. In a systematic review including 10 RCTs, it was found that education interventions positively enhanced parenting self-efficacy in first-time parents when measured immediately (SMD 0.57, 95% CI 0.44 to 0.70, $p < 0.001$) and at short-term follow-up (SMD 0.61, 95% CI 0.27 to 0.95; $z=5.73$, $p < 0.001$) (Liyana Amin et al., 2018). The authors of that review focused on universal parent education intervention for first-time parents (Liyana Amin et al., 2018), whereas the current review focused only on mHealth interventions and did not exclude interventions that included multiparous parents, which could have resulted in the difference in findings. However, the authors also acknowledged challenges in analysis due to the lack of standardization in measuring parenting self-efficacy (Liyana Amin et al., 2018); greater standardization is needed to better compare findings between studies. Additionally, future research comparing the effectiveness of postpartum education interventions provided in person or

through mHealth is recommended to determine whether there are any significant differences between the approach these interventions take and the impact on self-efficacy.

Social support is essential for the physical and emotional well-being of mothers during the postpartum period and has been linked to positive maternal outcomes (Negron et al., 2013; Smith & Howard, 2008). In the transition to motherhood, the need for social support is prevalent, as mothers face emotional changes and physical challenges that they are unaware how to address, seeking advice from other mothers, friends, family or healthcare providers (Kitzinger, 1975). In this review, six studies reported on social support and two-thirds found some aspect of positive effectiveness of having a mHealth intervention during the perinatal period. This was evident when considering the topic areas of postnatal behaviors, where all studies found a positive impact on social support. This suggests that although mHealth interventions are not being provided face-to-face, there may be some benefit related to feeling supported during the postpartum period as mothers are adjusting to their new role. Mothers who have support and learn that other mothers are struggling in similar ways may develop an understanding that being a mother is learned, not innate, which can result in normalization, feelings of encouragement and validation (Price et al., 2018).

The least commonly reported outcome in the current review was postpartum anxiety, with only three studies reporting on this outcome, none of which found a significant positive change after the provision of an mHealth intervention. This could be related to the lack of available research on postpartum anxiety (Goodman et al., 2016). In a recent narrative review on postpartum anxiety, Ali (2018) explored the literature on women's experiences of postpartum anxiety and identified 14 articles for inclusion that

included 2,407 women. Ali (2018) acknowledged difficulty in synthesizing the findings due to the variation in reporting and limited research on the topic. Despite these challenges, the author concluded that anxiety disorders are common in the postpartum period, ranging from post-traumatic stress disorder to generalized anxiety disorder. The growing evidence that postpartum anxiety is a common concern facing many mothers, either clinically diagnosed or under the threshold, indicates a need for increased attention on anxiety during the postpartum period. It is recommended that further research and interventions that focus on the postpartum period should include components addressing postpartum anxiety.

Conversely, postpartum depression has been a widely studied and reported perinatal outcome (Dennis, 2005; Shen et al., 2015; Shorey et al., 2018). A systematic review found that the prevalence of postpartum depression was 17% among mothers without a history of depression (Shorey et al., 2018). In a systematic review of the effects of psychosocial and psychological interventions specifically targeting postpartum depression, Dennis (2005) found that individual interventions targeting the postpartum period were more effective for treating postpartum depression than group interventions that spanned the perinatal period. In this review, we found that mHealth interventions targeting mental health significantly reduced postpartum depression over time. A review of available mobile applications targeting depression identified 243 different apps, but also noted challenges with lack of scientific evidence, which could result in harm to users and raises questions of credibility of existing mHealth applications (Shen et al., 2015). Although mHealth interventions have the potential to improve outcomes, it is essential to

ensure that the information in the mHealth intervention is evidence-based and supplements, rather than replaces, in-person care.

When interpreting these findings, it should be noted that few of these mHealth interventions targeted psychosocial outcomes as their primary outcome, aside from postpartum depression. Three studies reported on self-efficacy as the primary outcome, yet the mHealth interventions focused on various topics including gestational diabetes (Al hashmi, 2017), NICU transition to home (Garfield et al., 2016) and newborn care (Shorey et al., 2017b). Similarly, two studies reported on anxiety as a primary outcome (Dennis-Tiwary et al., 2017; Globus et al., 2016), but only one targeted perinatal anxiety in the mHealth intervention (Dennis-Tiwary et al., 2017). This suggests that additional work is needed to determine the effectiveness of interventions that specifically target these psychosocial outcomes during the perinatal period in high-income countries. Furthermore, only one study focused on newborn care (Shorey et al., 2017b) and another on the topic of postpartum adjustment as the topic of their mHealth intervention (Hannan et al., 2016). These may be areas for future research, as this can influence maternal self-efficacy and reduce anxiety and depression during the perinatal period. Specific areas that show promise based on the current review include mHealth interventions targeting the postpartum period in terms of newborn care and its impact on feelings of social support, as well mHealth interventions targeting postpartum depression.

6.7 Conclusions

This review concludes that there are insufficient data on mHealth interventions for improving self-efficacy and anxiety. Regarding social support outcomes, there is evidence that mHealth interventions targeting the postpartum period can improve feelings

of social support during this period. Additionally, mHealth interventions targeting mental health were found to reduce postpartum depression compared to not receiving an intervention.

Similar to other reviews on mHealth interventions, there was heterogeneity across the targeted topic for the intervention, length of intervention and outcome measures used. As such, findings should be interpreted with caution. The variation in mHealth interventions creates complexity when exploring why some interventions successfully improve psychosocial outcomes while others do not. Additionally, many of these studies were quasi-experimental, pilot evaluations or pilot RCTs, suggesting that they may be underpowered to demonstrate a significant difference should one exist. The sample sizes of many of the studies were relatively low, with an average of 69 participants. Finally, studies in this review were predominately from the United States, which may influence the applicability of these findings to all high-income countries. Further research using larger samples and more rigorous designs, such as full-scale RCTs in other high-income countries, is warranted.

6.7.1 Recommendations for Practice

There is strong evidence that mHealth interventions that specifically target postpartum depression or perinatal mood can improve maternal depression scores over time. Consideration of mHealth interventions to target postpartum depression is warranted. Due to mixed findings, no recommendations are possible related to mHealth interventions for self-efficacy, social support or postpartum anxiety.

6.7.2 Recommendations for Research

Future research should consider focusing on mHealth interventions for newborn care and postpartum adjustment for mothers and how these interventions can impact maternal psychosocial outcomes in the perinatal period in high-income countries. mHealth interventions that provide the information mothers are seeking may enhance the uptake and effectiveness of the interventions on self-efficacy, social support, anxiety and depression outcomes.

Chapter 7: Design, Development and Usability Testing of *Essential Coaching for Every Mother* in Canada: A Postnatal Text Message Educational Intervention

Statement of manuscript contribution: JD designed the original study, in consultation with MCY. JD was responsibility for implementing study protocol, designing the original messages, interviewing participants, analyzing the feedback, and making changes to the messages. JD drafted the manuscript. JD, MCY, MA, DM, and GTM contributed to revising the manuscript. All authors read and approved the final manuscript. The manuscript underwent peer-review and was accepted for publication following two revisions that was led by JD. The full reference for this manuscript is:

Dol, J., Tomblin Murphy, G., Aston, M., McMillan, D., & Campbell-Yeo, M. (2020). Design, development and usability testing of Essential Coaching for Every Mother: A postnatal text message educational intervention. *Women and Birth*, epub ahead of print. doi.org/10.1016/j.wombi.2020.05.004

7.1 Abstract

Background: The transition to motherhood is an exciting yet challenging period that requires physical, emotional, and social adjustment. During the postpartum period, mothers require support and information to ensure a smooth transition and adjustment to motherhood. One innovative strategy to provide mothers with this information is mobile health (mHealth), and specifically, text messaging.

Objective: To describe the design, development and usability testing of a postnatal text message intervention called *Essential Coaching for Every Mother* in Halifax, Canada.

Methods: First time mothers (n=11) and postpartum healthcare providers (n=18) were involved in iterative interviewing. Adaption of content occurred through three rounds of user testing using semi-structured interviews. The Information Assessment Method (IAM) Parents survey was also completed by mothers.

Results: Three cycles of iterative testing were conducted with eight participants (3 mothers, 5 healthcare providers), thirteen participants (8 mothers, 5 healthcare providers) and 8 participants (8 healthcare providers), respectively. Messages evolved from risk-focused to prevention and education focused. Mothers felt the messages addressed their needs and healthcare providers ensured the content was consistent with the messaging currently provided to postpartum mothers.

Conclusion: Essential Coaching for Every Mother is the first postnatal educational text message intervention developed for mothers in Halifax, Canada. We sought to involve first time mothers (end-users) and postpartum healthcare providers (experts) in the development and usability evaluation to ensure the intervention adequately met needs and was consistent with current practices related to postpartum education.

Problem or Issue: During the postpartum period, mothers face gaps in access to evidence-based information and support.

What is Already Known: Mothers are turning to online and mobile applications for sources of information during the postpartum period. The development of a standardized, evidence-based, mHealth intervention can provide mothers with information to enhance newborn care and improve mothers' psychosocial health outcomes during this critical period.

What this Paper Adds: Essential Coaching for Every Mother is the first postnatal educational text message intervention developed for mothers in Halifax, Canada. Mothers felt the messages addressed their needs and healthcare providers ensured the content was consistent with the message currently being provided.

7.2 Introduction

The transition to motherhood can be an exciting yet challenging period that requires physical, emotional, and social adjustment to new norms and expectations for women. During the postpartum period, mothers require support and information to ensure a smooth transition and adjustment to motherhood, which is reflected in both the World Health Organization (WHO) postnatal guidelines (2013) and the Public Health Agency of Canada maternity and newborn care guidelines (2000). However, the majority of Canadian mothers face gaps in access to evidence-based information and support during the postpartum period, leading to lower self-efficacy during this period (Aston et al., 2018), feelings of isolation and low perceived social support (Aston et al., 2018; Hetherington et al., 2018), and higher rates of anxiety and depression (Dennis et al., 2016; Hetherington et al., 2018). In a recent Statistics Canada survey, 67% of mothers reported feeling postpartum anxiety or depression symptoms after giving birth but these mothers often were undiagnosed and untreated (Statistics Canada, 2019b). While most mothers receive the recommended postnatal care contacts in Canada for their newborns, many mothers still struggle to adjust during the postpartum period (Chalmers et al., 2008).

The Canadian Maternity Experiences Survey, published in 2008, found that nearly all Canadian women (93.3%) were contacted by a healthcare provider at home within a week of giving birth (Chalmers et al., 2008). While three quarters (74.5%) of the mothers were very satisfied with the care their newborn received after birth, one third (34%) were not very satisfied with the care that they received for themselves during that same period (Chalmers et al., 2008). There are numerous reasons why mothers need to connect with

healthcare providers during the postpartum period. From a global perspective, many of the reasons are common; however, it is also important to attend to the context in which mothers live. The WHO details the importance of mothers receiving information about their newborn's health, caring for their newborn, getting help with breastfeeding, and learning about danger signs for themselves and their newborn (World Health Organization, 2013). Danger signs are areas of concern that warrant further care seeking by families, including "not feeding well, reduced activity, difficult breathing, fever or feels cold, fits or convulsions" (p.4) (WHO/UNICEF & World Health Organization, 2008). Postnatal care contacts are also able to provide psychosocial support for mothers, including but not limited to screening for postpartum anxiety and depression, addressing their reproductive health needs (e.g., contraception), inquiring about family adjustment, and providing breastfeeding support (American College of Obstetricians and Gynecologists, 2018; World Health Organization, 2013). To enhance the opportunity to provide information and support to mothers, innovative strategies can be utilized to improve newborn care and improve mothers' psychosocial health outcomes during this critical period.

One innovative strategy that can provide postnatal education directly to mothers is mobile health (mHealth). Evidence exists that mothers are turning to online and mobile applications for information during the perinatal period (van den Heuvel et al., 2018; Walker et al., 2017), however, this information is not always reliable or of high quality (Dol et al., 2019b; Richardson et al., 2018). Therefore, there is a need to develop a standardized, evidence-based, mHealth intervention to provide mothers with information to enhance newborn care and improve mothers' psychosocial health outcomes. The goal

of mHealth interventions in postnatal education is not to replace the need for in-person follow-up contacts, as these are important for health assessments of the mother and newborn by a skilled healthcare provider. However, mHealth interventions can be used to complement existing postnatal care contacts to fill knowledge gaps through providing timely, standardized, relevant, and evidence-based information directly to mothers.

One aspect of mHealth that shows significant promise is text messaging. Text messaging has been demonstrated to be an effective way to enhance maternal and newborn outcomes during the postnatal period worldwide (Evans et al., 2014; Patel et al., 2018). Text messages can be successfully delivered across most populations as they do not require a smartphone. They are usually read when received but can also be sent while a phone is off and retrieved later when the phone is turned back on. They use minimal data and/or cellular service, thereby minimizing the costs compared to voice calls or mobile applications (Crawford et al., 2014; Hall et al., 2015; Head et al., 2013; Mayberry & Jaser, 2018). Text messaging has the potential to engage mothers during the postnatal period. A study with 792 mothers in the United States comparing the response and engagement rate between self-selected email or text message information on safe infant sleep found that while mothers were more likely to opt for emails (55.7%), mothers who received text messages engaged more with the content and responded to queries (Moon et al., 2017). The provision of timely health education or health information can influence behavior through repeated and relevant health messages (Labrique et al., 2013). Text messages can be sent, saved, and retrieved at any time (Iribarren et al., 2017), are able to be personalized and tailored, and can be provided through one or two-way communication (Mayberry & Jaser, 2018).

In order to further enhance these opportunities, *Essential Coaching for Every Mother* was created. *Essential Coaching for Every Mother* is a postnatal educational text message intervention with the goal of improving mothers' access to essential information on caring for themselves and their newborn during the immediate six-week postnatal period. The objectives for the current study were to describe the design, development, and iterative testing process of this postnatal text message intervention for mothers in Halifax, Canada. This paper describes (1) the original design approach used; (2) the usability of the intervention considering content and approach; and (3) the acceptability of the intervention as identified by mothers using the Information Assessment Method (IAM) Parent survey (Bujold et al., 2018) and participant feedback.

7.3 Methods

7.3.1 Setting

Essential Coaching for Every Mother was developed for implementation in Halifax, Nova Scotia, Canada. In 2017, Halifax had 4,513 live births out of the total 8,027 live births in Nova Scotia (Nova Scotia, 2018). The IWK Health Centre provides care to pregnant women within the Halifax Regional Municipality and is also a referral center for all high-risk mothers throughout the Maritimes (provinces of Nova Scotia, New Brunswick and Prince Edward Island) (IWK Health Centre, 2018). Currently, there is no national standard on the provision of information or advice associated with postpartum care within or among provinces in Canada (Reproductive Care Program of Nova Scotia, 2002); each province has developed standards of practice for postnatal care within individual organizations such as public health and women's and children's hospitals. Home visits, postnatal clinics, and drop-in centers are plentiful across Canada

but not all mothers may be aware of or have access to them. Although there are numerous opportunities in Canada for mothers to access postpartum information and support, such as online and face-to-face options through hospitals, family resource centers and public health, mothers do not always feel that they are accessible - geographically, socially or culturally (Brandon et al., 2016; Khanlou et al., 2017; Sword et al., 2006). Therefore, there is a need to explore new ways to deliver information and support in the postnatal period that will enhance the postpartum experience for mothers.

7.3.2 Participants

The study population was first-time mothers and healthcare providers in Halifax who cared for women and newborns during the postpartum period at the IWK Health Centre or in a community setting (e.g., public health). Purposive sampling was used to recruit healthcare providers to ensure representation across professions and convenience sampling was used to recruit mothers through online social media advertisements. Mothers were involved in the first two rounds of iterative testing and postpartum healthcare providers were involved in all three rounds. In this context, mothers were considered end-users of the intervention and healthcare providers were considered experts. Saturation in terms of content areas was reached by the second round of testing as identified by end-users (mothers). A third round of iterative testing was conducted with experts (healthcare providers) to ensure revised content was appropriate and consistent with communication provided during routine postpartum visits. Mothers and healthcare providers were interviewed concurrently to ensure that the content in each round was appropriate, relevant, and desirable for both groups as well as was evidence-based and consistent with healthcare provider education.

7.3.3 Inclusion/Exclusion Criteria

Mothers were included if they: 1) had given birth for the first time within the past two months at the IWK Health Centre; 2) were 18 years of age or older; and 3) could speak and read English. Mothers were excluded if: 1) they had not yet given birth; 2) had an infant older than two months; or 3) it was not their first birth (multiparous).

Postpartum healthcare providers were included if they: 1) provided care for postpartum women at the IWK Health Centre or in the community for at least six months prior to the study (to ensure that they had experience providing care to this population); 2) were currently providing maternal postpartum and newborn postnatal care or support; and 3) could speak and read English.

7.4 Methods

7.4.1 Phase I – Design

The authors developed the first draft of the messages for *Essential Coaching for Every Mother* based on the WHO postnatal guidelines (World Health Organization, 2013), as these guidelines offer best practices and evidence-based content for healthcare providers caring for postnatal mothers and newborns around the world. All messages were developed using the Social Cognitive Theory of behavior change (Bandura, 1986, 2004) and consisted of four types of messages: educational, reminder, social support, and interactive. Educational messages provided one-way information about maternal mental health and newborn care. Reminder messages consisted of one-way messages about attending a six-week postnatal contact and returning to a hospital if they recognized a danger sign. Social support messages included one-way messages about how other fictional mothers acted or responded in similar situations to encourage mothers to engage

in recommended care based on WHO and local guidelines. Finally, interactive messages included options for mothers to respond to inquiries, such as checking if mothers had completed a six-week postnatal follow-up contact.

The maximum number of characters allowed for basic text messages is 160 including spaces so content over that character count were spilt into different messages (Abroms et al., 2015b; Twilio, 2018). While this character limitation was the target for the finalized messages, due to the iterative process of text message development, the initial messages were designed to a maximum of 180 characters. During subsequent rounds of iterative testing, wording modifications were made to be within 160 characters per individual message but up to three message blocks were developed. After the third round of testing, messages were again modified based on feedback and were finalized. Messages were professional (e.g., no slang or informal punctuation) and the reading level was reviewed during the third round and final iteration to be at a grade eight level according to the Flesch-Kincaid Grade Level (Abroms et al., 2015b).

7.4.2 Phase II – Iterative & Usability Testing

To ensure that the content of *Essential Coaching for Every Mother* was appropriate and acceptable, the messages were piloted through usability testing with mothers and postpartum healthcare providers simultaneously. As guided by best practice guidelines for usability testing, approximately ten participants per round were sought, which is estimated to find 95% of all problems (Faulkner, 2003). Additionally, using a qualitative research approach, the aim was to obtain in-depth, rich data from end-user and expert participants to revise the tool (Creswell & Poth, 2017; Denzin & Lincoln, 2018).

A total of 52 text messages were created for the first round on infant health and maternal mental health, targeting the period between birth to 6 weeks. There were four messages initially developed per topic: anxiety, depression, feeding, handwashing, umbilical cord care, thermal care, and each of the infant danger signs – fever, fast breathing, poor feeding, decreased movement, jaundice, cord infection, and convulsions. There were also three messages to encourage postnatal follow-ups and seven study-related messages. For each topic, three messages provided education and one provided social support or interaction. A reminder message was provided for the postnatal care follow-up for the six-week timepoint. As *Essential Coaching for Every Mother* is meant to complement existing care, mothers were encouraged to return to their care provider, public health, or a hospital if additional care was required or if mothers had additional questions. *Essential Coaching for Every Mother* was designed to be tailored to each participant in that all mothers would receive the same content, but the name of the mother and child would be used when appropriate. During each round of testing, the messages were modified based on participant feedback and new messages were piloted during the next round. No participant participated in more than one round of testing in order to obtain feedback from a broader sampling of mothers and healthcare providers.

7.4.3 Procedures

Mothers were recruited through online advertisements on Facebook and Twitter where a poster and a description of the study was provided. Interested mothers contacted the first author for more information via email. The first author called interested mothers to provide more details on the study, determine eligibility, and book appointments if

applicable. Mothers were informed the interview would take approximately an hour. Mothers were free to decide to participate or not at this point.

Healthcare providers were recruited using purposeful sampling whereby managers and administrators of different postpartum health departments were contacted and asked to share study details with their staff. Various healthcare providers were sought to ensure that all potentially relevant healthcare providers who were responsible for providing care to postpartum mothers and newborns were represented in the sample. Interested healthcare providers contacted the first author via email and eligibility was assessed via email, followed by appointment booking if applicable.

Prior to starting the interview, participants were provided with the written letter of information and a verbal explanation. Oral and written consent was obtained related to the study purpose and for the use of a voice recorder. All interviews were conducted in person in a private room and were recorded and transcribed for analysis. Interviews were conducted by the first author, either at the IWK Health Centre or at the healthcare providers practice. Upon completion of the interviews, all participants received a $20 honorarium for their involvement and $5 parking or travel reimbursement.

Interviews with mothers and healthcare providers occurred in March and April 2019. The first author, who has previous experience conducting qualitative semi-structured interviews, conducted all interviews. During the interview, participants were provided with the messages applicable to that round of testing divided by topic area for the first two rounds and by timing (order of presentation of messages) for the third round. Messages were provided on paper printed in a message bubble similar to what they would see on their phone. Participants were only shown one topic at a time for the first two

rounds and one week of content at a time for the third round. The interviews were semi-structured, with the following questions starting the conversation for each category: How would you feel about receiving/providing these messages during the first six-weeks? Was there anything you liked or didn't like or would say differently? Following the discussion of the messages, all participants were also asked open-ended questions around preferred order of messages and their perceptions of the intervention as a whole. Participants were also asked if there were any messages or topics that they felt should be included that were not currently covered. Participants also completed a brief demographic survey. As there is no ideal "dose" for text message per intervention as of yet (Abroms et al., 2015b; Head et al., 2013; Ybarra et al., 2012), feedback was sought from participants to explore their preferred frequency and timing of receiving text messages. Mothers were also asked to complete the IAM Parent survey immediately after the interview to obtain their perspective on online parenting information (Bujold et al., 2018). Ethics approval was obtained by the IWK Health Centre (#1024247).

7.5.4 Analysis

Interviews were transcribed verbatim to facilitate analysis. The first author completed manual thematic analysis after each round and modifications were made to the messages based on the consistent concerns and feedback that were obtained. Transcripts were reviewed several times and notes were made related to content that needed to be modified or added and whether messages were appropriate. The first author modified the messages which were reviewed by the last author for verification. The modified messages were then used in the following testing round to solicit feedback from participants. For

the IAM-Parent survey and demographics, frequencies were calculated using SPSS 22.0 for descriptive analysis.

7.5 Results

7.5.1 Participants

Eight participants (3 mothers, 5 healthcare providers), thirteen participants (8 mothers, 5 healthcare providers) and 8 participants (8 healthcare providers) took part in three cycles of iterative testing, respectively. During the first round of testing, it became evident that saturation was reached with only 3 mothers and 5 healthcare providers (8 participants total). To ensure mother's voices were represented, we included additional mothers in round 2. All mothers who responded to the advertisements and met eligibility criteria were invited to participate in the first two rounds of testing. Two mothers who reached out were unable to participate due to the interviews for round 1 and 2 being already completed. All healthcare providers who indicated interest and met eligibility criteria participated in the study.

First time mothers were on average 30.6 years of age (SD=3.6). Mothers were most often cared for by an obstetrician (54.4%), followed by a midwife or a family doctor (18.2% each), with one seeing a naturopath (9.1%). Mothers identified as white (81.8%) or African Nova Scotian (18.2%). All were either married (72.7%) or common-law (27.3%). Infants were on average 40.45 days old (SD=11.49, range: 23-59 days) and 63.6% male. Infants weighed on average 7 lbs. 2 oz at birth (range: 5 lbs., 7 oz to 9 lbs. 10 oz) and were primarily delivered vaginally (81.8%).

Postpartum healthcare providers included postpartum nurses (n=2), family practice nurses (n=2), public health nurses (n=5), family physicians (n=4), midwives

(n=2), postpartum physiotherapist (n=1), and Reproductive Care Program representatives (n=2). They had a mean of 14 years of experience working with postpartum mothers (SD=10, range: 9 months-32 years). They were an average of 42.7 years old (SD=8.45) and were all female.

7.5.2 Usability Testing

7.5.2.1 Usability of Content

As outlined in Table 7.1, the focus of the educational topics and frequency changed between rounds with the largest change in topic areas occurring between round 1 and 2. Based on the feedback from round 1, participants recommended a shift in messaging away from risk-focused care to well-baby and well-mother care. For example, one healthcare provider during round 1 said: "[*For] parents with a healthy newborn baby without any concerns, you will freak parents out with this [message]. Because … parents these days are so worried, that if they get a message, oh I should check their breathing, oh my God, how do I do it? And then they start to panic*." To address this concern, danger signs were collapsed into messages around infant concerns or reframed into well-baby care or normal development messages. It is important to note that mothers appreciated specific information, even around the more risk-focused topics such as fever and fast breathing. Therefore, messages containing information about specific actions that parents can do if they experience infant concerns were maintained or expanded but were tempered and modified through providing context of what is normal during the first six-weeks. This shift is illustrated in Figure 7.1, which provides the example of infant concerns related to breathing and the transition from round 1 through to the final iteration.

Table 7.1. Topics covered in each round of iteration

	Round 1 (n=56)	**Round 2 (n=52)**	**Round 3 (n=58)**	**Final Messages (n=59)**
Topics (# of messages)	Anxiety (4) Depression (4) Postnatal follow-up (4) Feeding (4) Handwashing (4) Umbilical cord care (4) Thermal care (4) Fever (4) Fast breathing (4) Poor feeding (4) Decreased movement (4) Jaundice (4) Cord infection (4) Convulsions (4)	Anxiety (3) Depression (3) Maternal self-care (4) Postnatal follow-up (3) Breastfeeding (4) Formula (1) Feeding (5) Infant concerns (3) Jaundice (2) Cord care (4) Handwashing (4) Skin-to-skin (2) Well-baby care (4) Normal development (6) Crying (3) Safe sleep (5)	Anxiety (3) Depression (3) Maternal self-care (4) Postnatal follow-up (5) Breastfeeding (4) Formula (4) Feeding (5) Infant concerns (5) Cord care (3) Handwashing (2) Well-baby care (5) Normal development (6) Crying (4) Safe sleep (4)	Anxiety (3) Depression (3) Maternal self-care (5) Postnatal follow-up (5) Breastfeeding (5) Formula (5) Feeding (4) Infant concerns (5) Cord care (3) Well-baby care (6) Normal development (6) Crying (5) Safe sleep (4)

After round 2, there were no new overarching topics that were introduced; however, additional information within some of the topic areas were enhanced and expanded. There was also a de-emphasis on certain topics, such as handwashing and cord care, as participants felt it was too repetitious or could be condensed. For example, in round 2, a mother said: "*I don't know if I'd need all of [these handwashing messages], like maybe like just two ... cause that might be a little bit repetitive, but I mean as a reminder it might like be o.k. … but maybe not all four of them.*"

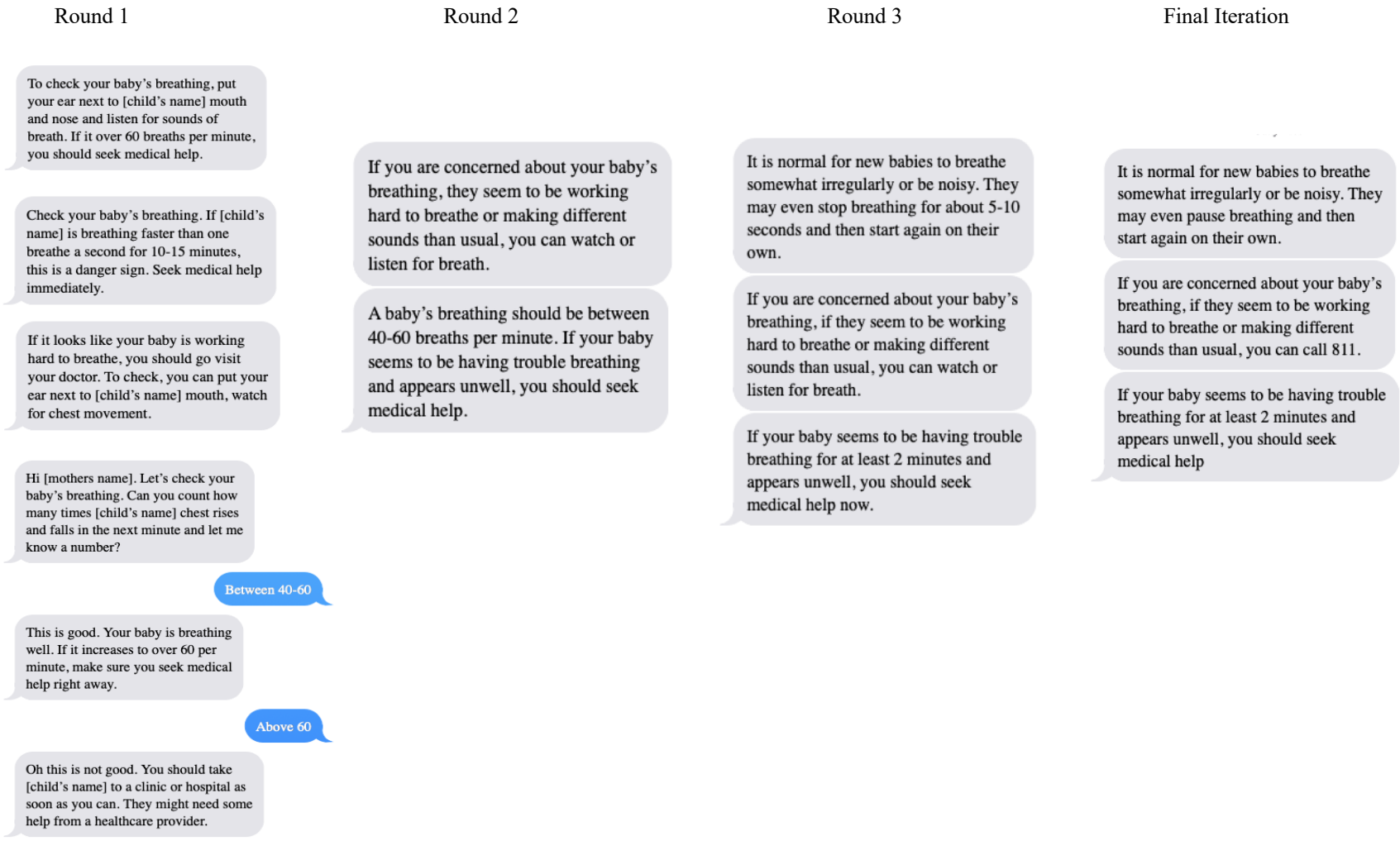


Figure 7.1. Example of iterative cycles on messages related to infant concern of breathing

Another significant change that occurred in content was the differentiation between breastfeeding and formula feeding messaging. Participants recommended creating two streams of messaging around breastfeeding and formula feeding to reduce the guilt that formula feeding mothers may feel. A mother in round 1 said: "*I would have liked to have heard somewhere that it's okay if [breastfeeding] doesn't work and as along as she is getting fed, that's what is most important*." Once the separation of messages occurred, participants acknowledged the benefit of having specific messages for formula feeding mothers, resulting in equal number of messages related to breastfeeding and formula feeding by round 3. At the same time, messages related to feeding that did not depend on whether the mother had chosen to breastfeed or formula feed were developed to ensure they would be applicable to both groups. These messages covered topics such as ready to feed cues and output.

It is important to note that while the frequency of messages (52-58 messages) throughout all 3 rounds of testing was maintained, the number of message blocks per topic increased from 1- or 2 160-character blocks sent independently to 2 to 3 160-character blocks sent together. This can be seen in the example shown in Figure 7.1, where in round 1, four separate messages were to be sent related to this topic. This was shortened to two messages to be sent together in round 2, and three messages to be sent together in round 3 and the final iteration. Revised content for messages beyond round 1 were compiled using the Nova Scotia Loving Care booklets, which are provided to all mothers who give birth in Nova Scotia. This included Breastfeeding Basics (The Nova Scotia Department of Health and Wellness, 2015a) and Birth to 6 months (The Nova Scotia Department of Health and Wellness, 2015b), as well as the Nova Scotia How to

Feed Your Baby with Infant Formula booklet (Nova Scotia Department of Health, 2015). This was done to ensure that the messaging was consistent with what healthcare providers were telling parents as well as the written information that parents received after being discharged from the hospital. The use of these booklets was also suggested by the healthcare providers interviewed during round 1. These documents build on the information provided in the WHO guidelines to ensure relevancy within the Halifax and Canadian context.

7.5.2.2 Usability of Approach

While participants generally felt that the messages were good, there were several suggestions to improve the approach that were identified throughout the iterative testing. This included revising the tone of messages, providing sufficient information about where additional care could be obtained, ensuring the language and topics were sensitive, and removing interactive messages.

Both mothers and healthcare providers recommended making the tone of messages gentler and ensuring the information provided was as clear as possible. For example, it was recommended to change one of the study messages as follows: *"[it] may be hard to hear "if your baby passes away"…it would be broader to say 'if for whatever reason, you are not able to participate…' or something like that*" (Healthcare provider, Round 1). A mother said, "*I think this would be really helpful, especially because it's a little bit general…keeping it general so parents aren't like 'oh no!' and immediately panic, is helpful*" (Round 2). As a result, messages were modified to be more general, including phases such as 'depending on your baby', or 'may', rather than specific numbers which could cause parents a high level of concern (e.g., newborn breathing must

be between 40 and 60 breaths per minute). Participants felt it was important to normalize the experience for new mothers about what to expect and emphasize that it may not be the same for every newborn.

Another suggestion was to provide specific information on where mothers can seek help. This included providing websites, links, and phone numbers for mothers to call if they were interested in finding out more information. The lack of support available was noted as a challenge throughout each round of testing as the resources available to mothers in Nova Scotia was not always clear. For example, if the most appropriate recommendation was to contact their primary healthcare provider, concerns arose around families that do not have family doctors or primary healthcare providers and those that did, having to deal with long wait lists due to the doctor shortage in Nova Scotia. As a result, messages were modified to include alternative options when available, such as contacting a public health nurse or calling 8-1-1 to receive advice from a registered nurse about recommended next steps. However, when specific resources were available, they were included (such as Le Leche League, Public Health Nurses and drops-in related to breastfeeding support).

There was concern expressed around the interactive messages. For example, a healthcare provider said: "*I don't know how it would be received to be told in that way, that oops you did the wrong thing versus being told the information on the best way to care for the umbilical cord*" (Round 1). As a result, interactive messages were removed in the round 2 iteration and beyond to focus on more knowledge sharing, rather than interaction.

In terms of frequency of messages, participants felt that two messages per day would be appropriate at the beginning, with the frequency of messages decreasing to once per day as time went on. Only two healthcare providers and three mothers felt that messages should be sent less frequent then once per day. Based on feedback from healthcare providers during round 3, when asked about the provision of messages based on frequency, rather than topic, messages provided as part of *Essential Coaching for Every Mother* was developed to be sent twice a day for the first two weeks, decreasing to one message per day for weeks 3 through 6.

Thoughts on the timing of when the messages should be sent varied across participants, ranging from early morning to middle of the night. Generally, mothers felt a late morning message would be the most appropriate, with 36.4% indicating this was a preferred time, followed by no preference (27.3%). Healthcare providers recommended sending messages in the late morning (44.4%) and early evening (38.9%), although healthcare providers tended to mention one or more preferred times. Early morning and late afternoon were also mentioned (22.2% each). Given the consistent recommendation for a late morning message, messages would ideally be sent in the late morning (10am) throughout the six-weeks, with the additional message in the first two weeks being sent in the early evening (5pm).

7.5.3 Intervention Acceptability

Mothers felt that the information provided through *Essential Coaching for Every Mother* would be very helpful during their transition home and in the first six weeks following birth. Mothers reported that the messages were well aligned with existing information provided in hospital or by primary care providers. Mothers mentioned being

overwhelmed with all the new information, so they perceived the messages as a helpful reminder. Additionally, mothers reported that while this information was available to them in book form through the Loving Care series, they did not always have the time or energy to read them right away after giving birth. As such, the messages were a welcomed way to receive brief information that mothers knew could be trusted. No mother felt that the messages would be unhelpful to them.

Acceptability of the intervention from the perspective of the mothers was also sought using the IAM-Parent survey. As Table 7.2 illustrates, most mothers (90.1%) felt that the information was relevant and understandable. The information validated what they did/do (100%); it reassured them (90.1%) and refreshed their memory (90.1%). No mothers disagreed with the information provided nor thought there was a problem with the information. Most mothers (81.2%) felt that the information would help them improve the health of their newborn and that this information would make them less worried (72.7%). As illustrated through the IAM-Parent survey, mothers had a positive perception of the potential use of information provided through *Essential Coaching for Every Mother* and its expected benefit on their newborn's health and well-being.

Healthcare providers also felt that sending the messages to mothers would be helpful in reiterating the messaging that was already being provided through the Loving Care books and in-person visits. Healthcare providers also felt that the messages would be able to reach people who may not take the time to read the Loving Care books or attend prenatal classes or postnatal contacts, thereby enhancing the number of people that have access to reliable information during the postnatal period. Healthcare providers also mentioned that since the information is text message based, they believed it would be

able to reach individuals from all socio-economic levels and that since most people have their phones on them, it may offer a source of support when new mothers are feeling isolated or unsure.

Table 7.2. IAM-Parent Survey

	N	%
Is this information relevant?		
Very relevant (this is the information I expected)	10	90.9
Relevant	1	9.1
Somewhat relevant/not very relevant	0	-
Do you understand this information?		
Very well (I completely understood)	10	90.9
Well	1	9.1
Poorly/very poorly	0	-
What do you think about this information?		
This information teaches me something new	6	54.4
This information allows me to validate what I do or I did	11	100
This information reassures me	10	90.9
This information refreshes my memory	10	90.9
This information motivates me to learn more	3	27.3
I think there is a problem with this information	0	-
I disagree with this information	0	-
This information can have negative consequences	2	18.2
Will you use this information?		
Yes	11	100
No	0	-
If yes, how will you use this information for you or your child?		
This information will help me to better understand something	6	54.4
I did not know what to do, and this information will help me to do something	5	45.5
I knew what to do, and this information convinced me to do it	6	54.4
I will use this information to do something in a different manner	4	36.4
I will use this information to speak with someone	6	54.4
Do you expect any benefit for you and/or your child from using this information?		
This information will help me to improve the health or well-being of my child	9	81.1
This information will help me to be less worried	8	72.7
This information will help me to prevent a problem or the worsening of a problem	5	45.5
This information will help me to handle a problem	8	72.7
This information will help me to be better prepared to speak with someone	6	54.5
This information will help me to be more confident to make a decision about something with someone	6	54.5
No, I expect no benefits	0	-

Both mothers and healthcare providers had positive feedback throughout all three rounds of testing on the intervention itself. A mother said: *I think this information would have been absolutely helpful to me because even if I may have been told some of it at the hospital, even if I was given pamphlet, you're just overwhelmed and there's not enough time to do anything and so I ended up actually texting my friends and asking them these very same questions. Because at least even if you're breastfeeding your phone is right there, you can text, it's a lot less mechanics and moving than needing to open a book or picking up the phone and calling someone. So getting the information passively by text, and the beauty of it is that it actually doesn't matter what time you send them because it's on the phone so you can look at them"* (Round 2). No participant indicated that this intervention should not be used; rather all feedback was focused on improving *Essential Coaching for Every Mother* to ensure it adequately covered all desired topics without overwhelming new mothers.

7.6 Discussion

The objectives for the current study were to describe the design, development, and iterative testing process of a postnatal educational text message intervention for mothers in Halifax, Canada. Overall, mothers and healthcare providers were very receptive to *Essential Coaching for Every Mother* as a postnatal text message-based intervention. Through three rounds of iterative testing, 58 messages were developed that focused on well-baby and well-mother care during the first six-weeks postpartum. Fitts Willoughby and Furberg (2015) highlight that many articles on the design of text message–based health behavior change interventions do not outline the pretesting that occurred and those articles that do publish their pre-testing, vary in approach. For example, text4Baby, an

American text message intervention that targets pregnant and postpartum women, messages were also developed through consultation with mothers and healthcare providers (Whittaker et al., 2012). A different text message intervention that targeted fathers used the approach of having experts draft the initial messages (Fletcher et al., 2016). This was followed by user testing with fathers and mothers where they rated the messages on a 3-point scale for clarity (Fletcher et al., 2016). Our iterative, user-centered designed approach has been used in other studies to develop mHealth interventions, such as preventing smoking relapse in postpartum women (Wen et al., 2014), medication adherence for type 2 diabetes mellitus (Osborn & Mulvaney, 2013), and encouraging sun protection among travelers (Rodrigues et al., 2017).

A key strength of this study was that throughout the development of appropriate messaging, from the initial design of the intervention to the final iteration, the social cognitive theory of behavior change (Bandura, 1986, 2004) was used as a guiding framework. In each iteration, the focus of the message design was to ensure that mothers felt supported by the messages in addition to being provided information. This was maintained through offering avenues where mothers could seek additional support if needed, such as Public Health or Le Leche League for breastfeeding needs. Through involving end-users (mothers) and experts (postpartum healthcare providers) in the design and development of *Essential Coaching for Every Mother*, the messages were modified to be appropriate and desirable for the Nova Scotian context, ideally resulting in more positive outcomes when measured for effectiveness and impact.

This intervention is meant to be supplemental to in-person consults and educational materials already being provided to mothers, recognizing that these topics are

be covered by other sources. The initial messages were developed based on WHO guidelines, and thus could be implemented in other countries using similar baseline messages. However, it is important to ensure that the processes used in one cultural environment are also appropriate in other environments. Our approach of interviewing mothers and healthcare providers prior to implementation ensures their voice is heard. This augmentation is important and key to implementing a strength-based healthcare approach, normalizing the messaging, and ensuring culturally appropriate messaging is used.

7.6.1 Limitations and Challenges

In general, there were some limitations that were identified related to the *Essential Coaching for Every Mother* intervention, including not being able to include all potential topics identified and challenges with timing of the messages based on need and content. While saturation of content was reached within our sample, there were some topics that were mentioned intermittently that were not able to be included such as car seat safety, differentiating between vaginal and Caesarion birth recovery, and postpartum sex. This is a recognized limitation of our intervention. However, we attempted to include topics that were mentioned by most participants. As a note, the desire to include maternal danger signs was not brought up by mothers or healthcare providers, thus the focus remained on newborn care and maternal mental health.

Another limitation was around the relevance and timing of the messages. We decided to send two messages per day in the first two weeks due to the significant amount of changes that both mothers and newborn go through during this time. It was also decided not to start the content messages until the second day after birth in the evening to

ensure that mothers were not overwhelmed with messages if they were recruited on day 2 after birth, rather than day 1. It was a challenge to balance when particular messages were sent in relation to when their content was most relevant and expected to occur versus the need to not overwhelm new parents. For example, information related to breastfeeding and feeding are especially important during the first week, as mothers are identifying feeding cues and worried about whether their newborns are getting enough to eat. However, during the first week, it is also important to receive messages about jaundice and cord care as these are topics that are prevalent during this period but not necessarily later on. Thus, a careful balance was required to ensure the parents received messages in a timely, appropriate manner without overwhelming them parents with more than two messages per day.

Our study had three additional limitations. First, no male healthcare providers provided input into the message development, which may be reflective of the high prevalence of females in the Canadian postpartum healthcare providers professions. It is possible that the female healthcare providers provided input based on their personal experience (as potentially mothers themselves) as well as professional experience. Data on prior pregnancy in healthcare providers was not collected but was mentioned in some interviews. Second, our study only included English-speaking women in our sample, which may limit the reach of the intervention. If the messages were to be translated into different languages, additional feedback would be beneficial to ensure appropriate translation of wording and content. Third, our sample of mothers primarily identified as white, which may have limited discussion around culture and tradition on parenting norms. While the recommendations for newborn care would not change based on culture

or tradition, additional topics or changes in phasing may be relevant. Future work could potentially target marginalized and/or ethnic groups to ensure content is relevant and reflective of their needs as well.

Despite the overall positive response to *Essential Coaching for Every Mother*, some concerns were raised, most notably regarding the lack of ability to ask follow-up questions, perceived brevity, or lack of personalization. Given that *Essential Coaching for Every Mother* will consist of one-way messages, a number of mothers and healthcare providers reported that some mothers may want further information following receipt of a message or that the lack of personalized information to the specific needs of the mothers and newborns may cause mothers' additional concern. Despite this limitation, only one-way messages were used to ensure that the intervention could eventually be implemented on a wider scale without need for additional human resources that a two-way messaging platform would require. To address this, attempts were made to suggest where mothers could get additional help or information, such as their care provider, public health, 8-1-1, or other avenues as appropriate. Additionally, attempts were made to normalize messages, indicating a range of behavior that may be normal and offering potential behavior that may not be, to encourage parents to review a variety of factors when making a decision, rather than focusing solely on one behavior or outcome.

7.7 Conclusion

Essential Coaching for Every Mother is the first postnatal educational text message intervention developed for mothers in Halifax, Canada. We sought to involve first-time mothers and postpartum healthcare providers in the development and usability evaluation to ensure the intervention adequately met both needs and current practices

related to postpartum education. Involving both end-users (first time mothers) and experts (postpartum healthcare providers) in the development of *Essential Coaching for Every Mother* sought to ensure that the intervention was appropriate and desirable.

Chapter 8: Conclusion

8.1. General Discussion

This dissertation provides insight into how women in living Canada are experiencing their postnatal care and psychosocial adjustment in the postpartum period and outlines the development of *Essential Coaching for Every Mother* as an mHealth program that could address women's psychosocial needs in the postpartum period. Each chapter and manuscript sheds light on these overall aims. Manuscript 1 (Chapter 4) explored the postnatal care experience of women living in Nova Scotia, New Brunswick, and Prince Edward Island. This study found that there is variation in the type of healthcare providers following women during their pregnancy and postpartum periods, with little consistency in timing and frequency of postnatal contacts. While many women are experiencing satisfactory care, there are areas where women are reporting dissatisfaction and are facing challenges. Women were found to value in-person follow-up from public health nurses and midwives and were satisfied when they received desired support from their healthcare providers and received timely, appropriate care. However, unsatisfactory care was related to having challenges accessing postnatal care, experiencing gaps in postnatal follow-ups, and having unsatisfactory postpartum checks for themselves.

Manuscript 2 (Chapter 5) identified the influence that parity and infant age had on psychosocial outcomes during the first six months postpartum. In terms of prevalence, almost two-thirds of women had evidence of low maternal self-efficacy, with most in the mild clinical range but 12% in the severe clinical range. Additionally, almost a third of women had high postpartum anxiety symptoms and over half of women had some

depression symptoms, with 20% scoring within the 'probable depression' range. While no significant interaction of age of infant by parity were found, there were significant main effects for both parity and age of infant. Specifically, primiparous women had lower maternal self-efficacy and higher postpartum anxiety symptoms than multiparous women. Women with younger newborns had more perceived social support than women with older infants. Women with older infants had higher levels of postpartum anxiety and depression symptoms than women with younger infants.

Manuscript 3 (Chapter 6) was a systematic review on the impact of mHealth interventions on psychosocial outcomes with the objective to evaluate the effectiveness of mother-targeted mHealth education interventions during the perinatal period on maternal psychosocial outcomes in high-income countries. Twenty-one studies were identified - eleven quasi-experimental and ten RCTs. The mHealth intervention approach varied and length of intervention ranged from four weeks to six months. The topics of the mHealth intervention varied widely, with the most common topic being postpartum depression. Despite a wide variety of outcome measures used, the predominant findings suggested that there were insufficient data to conclude that mHealth interventions are associated with improved maternal self-efficacy and anxiety outcomes in this population. Findings related to the effectiveness of mHealth on perceived social support showed some benefit across studies. While there were mixed findings for mental health topics and only one study reported on social support in relation to healthy behavior, there appeared to be evidence that mHealth can be used to increase feelings of social support targeting postnatal behaviors. Depression outcomes were most commonly reported, and due to similar reporting, meta-analyses comparing pre-post outcomes and intervention versus

control group outcomes suggested that mHealth interventions targeting postpartum depression reduced postpartum depression for women who received the intervention. mHealth interventions that did not specifically target perinatal mood as a primary focus, such as healthy behavior or postnatal behavior, were unable to provide sufficient data to allow conclusions to be drawn related to postpartum depression.

Finally, Manuscript 4 (Chapter 7) explained the development *of Essential Coaching for Every Mother*, a postnatal text message program designed to send messages throughout the first six weeks postpartum to first time mothers to improve mothers' self-efficacy and perceived social support and decrease postpartum anxiety and depression. Through three rounds of iterative testing, 58 messages were developed that focused on well-baby and well-mother care during the first six-weeks postpartum. Messages evolved from risk-focused to prevention and education focused. Women felt the messages addressed their needs and healthcare providers ensured the content was consistent with the messaging currently provided to postpartum mothers. *Essential Coaching for Every Mother* is a postnatal educational text message intervention with the goal of improving women's access to essential information on caring for themselves and their newborn during the immediate six-week postnatal period. Further research will be need to determine the impact of the *Essential Coaching for Every Mother* program to change behaviour and whether it improves maternal self-efficacy and social support while decreasing postpartum anxiety and depression as it was designed.

This final chapter highlights the strengths and limitations of the findings, identifies study implications, and provides recommendations for future research.

8.2 Strengths and Limitations

While study specific strengths and limitations were discussed in their respective manuscripts, there are several strengths and limitations that are important to highlight as an overall dissertation. The first strength is that these studies were able to shed light on an extremely important area of perinatal health that is often understudied in the postpartum transition and adjustment for Canadian women. As previously mentioned in this dissertation, the postpartum period is the most neglected across the perinatal period, with women often not receiving the care or support they need during this life transition. This dissertation not only provides insight into the current postpartum experience of women living in the Maritime provinces, but also involved the development of an intervention that seeks to address and improve these outcomes.

A second strength is the large sample obtained for the online survey with representation across the Maritime provinces. This allows for broad interpretation and provides strength in the analysis and interpretation.

A third strength of this dissertation is that it is rooted in theoretical and behavioural change approaches, including Leahy-Warren and colleagues (2012) postpartum theory and Bandura's (1986) social cognitive theory which was used to inform the development of *Essential Coaching for Every Mother*. The lack of postnatal parenting interventions based on theoretical models has been noted previously (Aboud & Singla, 2012; Gilmer et al., 2016), with theory-based approaches to intervention development argued to result in more effective interventions (Chandler et al., 2016).

A final strength is the uses of a patient-orientated approach to the development of *Essential Coaching for Every Mother* through the inclusion of both women identifying as

mothers (end-users) and postpartum healthcare providers (stakeholders) to ensure its accuracy, relevancy, and acceptability. This study provides novel data that adds significantly to the field on maternal psychosocial outcomes and mHealth technologies targeted at postnatal care and support. Through this, along with its theory-based, evidence-informed content, there is increased likelihood of acceptability and uptake post-development.

Despite the many strengths, there were some limitations that need to be acknowledged. First, for Manuscript 1 (Chapter 4), Manuscript 2 (Chapter 5), and Manuscript 4 (Chapter 7), recruitment primarily occurred on social media which may have resulted in biased or selective recruitment as previous work identified that overrepresentation of white ethnicity is a risk of social media recruitment (Whitaker et al., 2017). Given that these studies had little diversity in race and was conducted solely with English speaking women, it limits the generalization of the findings to non-white, non-English speaking populations. Additionally, this work targets a specific geographical area (Maritime provinces) which may limit generalization to the Canadian context and other countries. Nevertheless, given the paucity of information on postpartum women in this geographic area, the current study provides important insights which can led to future work.

A second limitation is that due to COVID-19, the originally designed RCT was not able to be conducted to determine the effectiveness of *Essential Coaching for Every Mother* as originally designed. However, as mentioned below in recommendations for future research, an evaluation of the *Essential Coaching for Every Mother* program is essential to examine the effectiveness of the intervention.

8.3 Study Implications

Overall, this dissertation highlights the challenges that Canadian women experience in the postpartum period and in particular, related to maternal self-efficacy, social support, postpartum anxiety, and postpartum depression. The results from Manuscript 2 (Chapter 6) confirm our expanded theory of postpartum transition, originally developed by Leahy-Warren and colleagues (2012), as seen in Figure 8.1. Essentially, our work supported the initial findings by Leahy-Warren and colleagues (2012) that higher social support and higher maternal self-efficacy was associated with decreased postpartum depression and social support and maternal self-efficacy were positively correlated. Additionally, our findings support the argument that postpartum anxiety should be considered in the theory of postpartum transition, as higher social support and higher maternal self-efficacy was associated with decreased postpartum anxiety. It is clear that the "fourth trimester" (Tully et al., 2017) is still a critical period for women as they adjust to the first few months of motherhood after giving birth to a child with maternal self-efficacy, social support, postpartum anxiety, and postpartum depression as important, related psychosocial outcomes. When considering the postpartum experience as a whole, it is important to consider the role that all of these factors play.

Maternal self-efficacy can be a protective factor during the postpartum period, as the more capable a mother believes herself to be, the more she is likely to be able to adjust to her new situation and to address the challenges that emerge (Bandura, 1997; Leahy-Warren & McCarthy, 2011). This dissertation provides support for the association that the higher a women's self-efficacy, the lower her postpartum anxiety and depression.

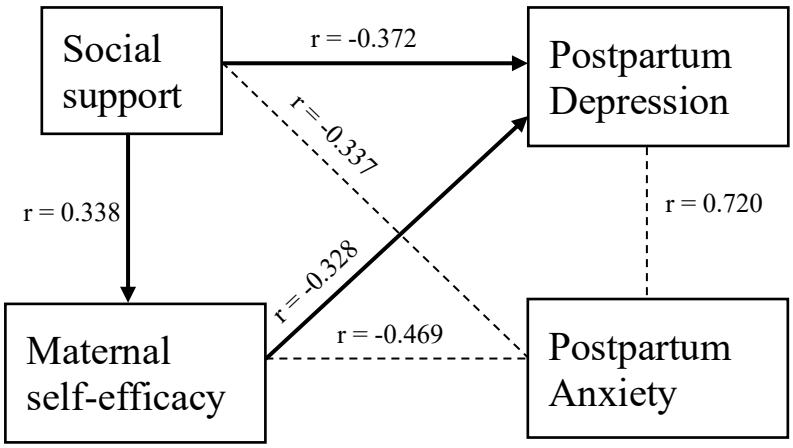


Figure 8.1. Postpartum adjustment theory developed by Leahy-Warren (2012), amendment to include postpartum anxiety (dashed lines indicate new relations)

Given the high rates of mental health challenges after birth, with one in five women experiencing some challenges (Goodman et al., 2016; Heron et al., 2004; Shorey et al., 2018; Wynter et al., 2013), maternal self-efficacy is an important psychosocial outcome to measure and develop interventions to target. The goal of health education during the postnatal period is not only to educate, but also to address the psychosocial health needs of mothers to ensure they are able to engage and improve outcomes for both the woman and her infant (Bryanton et al., 2013; World Health Organization, 2013).

Each of the studies included in this dissertation focused on the postpartum experience of all women, without differentiation based on race or socioeconomic status. While it was an intentional approach to this work to not focus on a sub-population, previous evidence show that postpartum health interventions are more effective for at-risk populations (Dennis et al., 2009; Shaw et al., 2006). For instance, a two-way text message program that targeted high-risk pregnant women showed improvements to

mental health while reducing stress (Song et al., 2013). Additionally, a Canadian study with peer provided telephone support for women at high risk of postpartum depression found that women who received the intervention had significantly lower postpartum depression scores at 12 weeks postpartum than women who did not (Dennis et al., 2009). This may be related to the baseline scores that at-risk populations may have or the effectiveness of the intervention. However, it is nonetheless important to consider the postpartum experience of all women, understanding that there might be differences between low-risk and high-risk women. While we cannot and should not ignore high-risk women due to the negative maternal and child outcomes associated with poor psychosocial outcomes, neither can the challenges faced by all postpartum women be ignored or minimized. Giving birth to an infant, whether the first or subsequent, is a life changing event requiring psychological adjustments to their new role and loss of self before the birth. It is this reason that providing support to assist in the postpartum transition is essential to improve outcomes for all women at all risk levels

While postpartum care and support can and does occur in-person with success, particularly for at-risk women (Shaw et al., 2006; Yonemoto et al., 2017), evidence shows that mothers are increasingly turning to electronic sources for information during the postpartum period (Madge & O'Connor, 2006; Plantin & Daneback, 2009). In general, there are three main proposed benefits of mHealth interventions that have been cited in the literature – effectiveness, cost efficiency, and empowerment (Al Dahdah, 2017). Effectiveness is the opportunity to reach people in remote or rural areas who may not have the same access to healthcare services as urban areas and to facilitate the connection between health services and patients (Al Dahdah, 2017). mHealth is promoted

as cost efficient as it decreases costs related to wait times and missed appointments (Al Dahdah, 2017). Additionally, since receiving text messages are free in most countries, there is a low barrier to entry from the demand side. Empowerment, the most patient-centered benefit of mHealth, is not related necessarily to traditional definitions of transactions of power, but instead increased autonomy and shared responsibility for their health with healthcare providers (Al Dahdah, 2017). mHealth can provide access to health information on which patients can act and improve their own or their families health (Al Dahdah, 2017). Overall, *Essential Coaching for Every Mother* seeks to utilize all of the aspects, as it is efficient as a means to complement existing in-person postpartum care provided by healthcare providers; it is cost-efficient for the women to receive the messages as it does not require access to data as a mobile application would and is cost-efficient to send messages; and finally, it empowers women through the aim of increasing maternal self-efficacy and feelings of social support and decreasing postpartum anxiety and depression.

While *Essential Coaching for Every Mother* was designed for initial implementation in Halifax, Nova Scotia, Canada targeting first time mothers, there is significant potential to scale up across Canada or around the world. Given the relative cost-effectiveness of the intervention, the ability to enrol anyone anywhere in the world, and to modify the messages as necessary. *Essential Coaching for Every Mother* is a feasible way to reach all women, anywhere, with important information during their first six weeks postpartum. Additionally, given the findings from Manuscript 2 (Chapter 5) and Manuscript 3 (Chapter 6) as well as the growing evidence of the negative impact of COVID-19 on maternal mental health (Davenport et al., 2020; Ollivier et al., 2020;

Pierce et al., 2020), multiparous women are also experiencing challenges in their psychosocial adjustment and may benefit from *Essential Coaching for Every Mother*.

8.4 Recommendations for Future Research

Looking at the overall findings and their relation to existing literature, there is a need for increased support during the postpartum period. As previously discussed, one in five women are experiencing some mental health challenges after giving birth (Goodman et al., 2016; Heron et al., 2004; Shorey et al., 2018; Wynter et al., 2013), with the prevalence of postpartum depression at 8% during the first year postpartum while the prevalence of sustained anxiety symptoms from pregnancy to 8 weeks postpartum is 12.6% (Dennis et al., 2012, 2017b; Lanes et al., 2011). In our work, we found that approximately 30.8% had postpartum anxiety symptoms and 51.7% of women had positive depressive symptoms, of which 20.2% had 'probable depression'. The prevalence of postpartum anxiety and depression symptoms were higher in our study, which raises questions as to why this may be occurring. Are there specific factors that increase the likelihood of women in the Maritimes of having higher postpartum anxiety and depression symptoms, such as rurality or limited access to healthcare? Given the challenges identified with accessing postpartum care and support, this relationship needs to be further explored and understood to create sufficient supports for postpartum women.

In relation to the use of mHealth interventions during the postpartum period, there is still much work that needs to be done to understand the opportunity and requirements to ensure success. Our review found that mHealth interventions that specifically targeted postpartum depression has a positive impact, but due to limited studies on the other

psychosocial outcomes, clear conclusions could not be drawn. However, given the findings from this dissertation as well as previous work, the importance of maternal self-efficacy, social support, and postpartum anxiety and depression are important psychosocial factors in the adjustment of women during the fourth trimester. Thus, questions arise related to what is required in an mHealth intervention to successfully target these outcomes? What elements are important to assist in women developing maternal self-efficacy? What can be provided to women through virtual technology to improve feelings of social support while reducing postpartum anxiety and depression? The goal of *Essential Coaching for Every Mother* is to target these psychosocial outcomes using maternal self-efficacy behaviour change theory (Bandura, 1977) as a guiding framework. Findings from this dissertation lends itself towards several recommendations for future research, some of which have already been implemented or are underway.

8.4.1 Implementing *Essential Coaching for Every Mother* During the COVID-19 Pandemic

As all academics in 2020 experienced modifications to existing or planned research due to the COVID-19 pandemic that swept the globe, this project was no exception. In the original plan, evaluation of *Essential Coaching for Every Mother* was to be included in this dissertation, but due to COVID-19 and the limits placed on all non-essential research, a shift in focus was required. In relation to postpartum care, COVID-19 physical distancing recommendations resulted in a decrease in in-person postpartum support, including both from healthcare providers and informal community groups and an increase in mental health concerns for mothers (Davenport et al., 2020; Lebel et al., 2020;

Nova Scotia Health Authority, 2020; Ollivier et al., 2020). As *Essential Coaching for Every Mother* was designed pre-COVID-19 as a remote, text message intervention, the next logical step was to modify some of the content to be consistent with new standards of care and conduct a feasibility pre-post intervention study to explore feasibility of remote recruitment and to determine preliminary effectiveness. This occurred in summer and fall of 2020. The results of this study were used to modify the second recommendation for research as outlined below.

8.4.2 Evaluation of *Essential Coaching for Every Mother* in an RCT to Determine Effectiveness

In order to determine the effectiveness of *Essential Coaching for Every Mother*, conducting an RCT is the next recommended step to ensure that the intervention works as anticipated. As evidenced in Manuscript 3 (Chapter 6), mHealth interventions in general have shown mixed findings so it is essential to evaluate *Essential Coaching for Every Mother* to ensure it creates the positive impact it is hypothesized to have on maternal self-efficacy, social support, postpartum anxiety and postpartum depression. A real world RCT with a process evaluation component is recommended for two reasons. First, a real world RCT is recommended to ensure that it can be translated and utilized by public health in practice, rather than conducting an RCT that rigorously controls for confounding factors which would impact its translation in practice (Zuidgeest et al., 2017). Second, an RCT with a process evaluation component is essential to examine if there was any difference between what was planned and what was carried out to examine whether failure was the result of intervention design or intervention implementation (Drabble & O'Cathain, 2015; Oakley et al., 2006). Both of these components are

essential in conducting the RCT to ensure that *Essential Coaching for Every Mother* can be used in practice and to identify where the shortcomings are so modifications can be made as necessary to future iterations.

8.4.3 Building on and Extending the Reach of *Essential Coaching for Every Mother*

Depending on the outcomes of the feasibility pre-post study and the RCT, there may be opportunity to expand the offerings of *Essential Coaching for Every Mother.* For instance, if proven effective, expanding into different languages (e.g., French, Arabic, Mi'kmaq) could allow a greater reach to more populations. Furthermore, while *Essential Coaching for Every Mother* was designed to minimize the burden on healthcare providers by solely being a one-way program, having access to a public health nurse or peer support within the intervention may be a benefit as shown in previous literature (Dennis, 2003; Dennis et al., 2009). Consideration of the creation of the *Essential Coaching for Every Mother* mobile application or the augmentation of antenatal text messages could be another potential area of expansion. A review on 48 postnatal mobile applications found that only 27% focused on maternal mental health and 44% provided some element of social support (e.g., integration with Facebook) (Sardi et al., 2020). In terms of content, approximately 40% provided monitoring and tracking the newborn infant development and activities and 35% provided postnatal education on newborn care and maternal postpartum care, with the remaining apps targeting postnatal fitness and weight loss (Sardi et al., 2020). Given the variation content and focus on postnatal mobile apps, *Essential Coaching for Every Mother* could translate well into a mobile application to help fill the gap.

8.4.4 Expanding *Essential Coaching for Every Mother* to Fathers and LGTBQ+ Partners

While there is significant focus on the transition to motherhood (Prinds et al., 2014; Walker et al., 2019), new fathers and LGBTQ+ partners are less supported in the transition to parenthood (Chin et al., 2011; Kowlessar et al., 2015; McKelvey, 2014). Both fathers (cisgender men/males) and LGBTQ+ partners (i.e., lesbians, transgender, genderqueer, or others identifying on the LGBTQ+ spectrum) face challenges adjusting to their new parenting role, shifting identities as parents, and feeling disconnected and unsupported by professionals providing maternal-focused perinatal services (Åsenhed et al., 2014; Chin et al., 2011; Hudson et al., 2001; Kowlessar et al., 2015; McKelvey, 2014; Pollock et al., 2005; StGeorge et al., 2011). These wide-ranging challenges place them at risk of developing mental health issues in the postpartum period (Paulson & Bazemore, 2010; Ross, 2005). While there is growing interest and research in the postpartum psychosocial adjustment of fathers, there is still much more work that needs to be done to understand the challenges that fathers face in the postpartum period. Furthermore, there is considerably less research that has been conducted on the postpartum experience of LGBTQ+ partners and their psychosocial adjustment. Therefore, this is a rich area for future research and a similar survey exploring their psychosocial outcomes and qualitative interviews to conduct a richer in-depth exploration is recommended. There is also opportunity to extend the *Essential Coaching* program to include fathers and LGBTQ+ partners to be the first comprehensive mHealth program providing remote, tailored support for all parents during the postpartum period. Using a similar model of iterative interviewing with fathers and LGBTQ+ partners for the development of their

messages and a real world RCT with process evaluation is recommended for design and evaluation. If proven successful, consideration of expanding to further populations may be an option, such as extended family (e.g., grandparents, other close caregivers) or friends.

8.5 Concluding Statement

This study advances what is known about the postpartum care experiences of women living in the Maritime provinces and the opportunity of mHealth to improve women's psychosocial adjustment in the postpartum period. The qualitative, quantitative, and systematic review methods used in this dissertation provides a rich understanding of current challenges and future opportunities. It is clear that women experience challenges in their psychosocial adjustment in the postpartum period, with women showing evidence of low maternal self-efficacy, social support, postpartum anxiety, and depression across the first six months after the birth of their most recent infant. While previous mHealth interventions show mixed results, mHealth interventions that target postpartum depression are effective at reducing postpartum depression compared to a pre-test group. With the development of *Essential Coaching for Every Mother*, targeting postpartum depression was one of the key psychosocial outcomes, in addition to maternal self-efficacy, social support, and postpartum anxiety.

Overall, this dissertation addressed a critical gap in the literature that links postpartum care experience and postpartum psychosocial adjustment and the opportunity of mHealth to address these challenges. To my knowledge, this is the first postpartum text message intervention designed for Canadian women. In conclusion, this dissertation is rooted in theory for identifying and improving the postpartum transition for women

through the development of an evidence-based postpartum text message program designed to improve women's self-efficacy, social support, postpartum anxiety, and postpartum depression in the postpartum period.

References

Aber, C., Weiss, M., & Fawcett, J. (2013). Contemporary Women's Adaptation to Motherhood: The First 3 to 6 Weeks Postpartum. *Nursing Science Quarterly*, *26*(4), 344–351. https://doi.org/10.1177/0894318413500345

Aboud, F. E., & Singla, D. R. (2012). Challenges to changing health behaviours in developing countries: A critical overview. *Social Science and Medicine*, *75*(4), 589–594. https://doi.org/10.1016/j.socscimed.2012.04.009

Abroms, L. C., Johnson, P. R., Heminger, C. L., Van Alstyne, J. M., Leavitt, L. E., Schindler-Ruwisch, J. M., & Bushar, J. A. (2015a). Quit4baby: Results From a Pilot Test of a Mobile Smoking Cessation Program for Pregnant Women. *JMIR MHealth and UHealth*, *3*(1), e10. https://doi.org/10.2196/mhealth.3846

Abroms, L. C., Whittaker, R., Free, C., Mendel Van Alstyne, J., & Schindler-Ruwisch, J. M. (2015b). Developing and pretesting a text messaging program for health behavior change: Recommended steps. *JMIR MHealth and UHealth*, *3*(4), e107. https://doi.org/10.2196/mhealth.4917

Al Dahdah, M. (2017). Health at her fingertips: development, gender and empowering mobile technologies. *Gender, Technology and Development*, *21*(1–2), 135–151. https://doi.org/10.1080/09718524.2017.1385701

Al hashmi, I. H. (2017). *The Effectiveness of a Health Education Intervention on Self-Efficacy for Adherence to Healthy Behaviors among Women with Gestational Diabetes*. University of California.

Albanese, A. M., Russo, G. R., & Geller, P. A. (2019). The role of parental self-efficacy in parent and child well-being: A systematic review of associated outcomes. *Child: Care, Health and Development*, *45*(3), 333–363. https://doi.org/10.1111/cch.12661

Ali, E. (2018). Women's experiences with postpartum anxiety disorders: A narrative literature review. *International Journal of Women's Health*, *10*, 237–249. https://doi.org/10.2147/IJWH.S158621

Almalik, M. (2017). Understanding maternal postpartum needs: A descriptive survey of current maternal health services. *Journal of Clinical Nursing*, *26*, 4654–4663. https://doi.org/10.1111/jocn.13812

American College of Obstetricians and Gynecologists. (2018). *ACOG Postpartum Toolkit*.

Amoakoh-Coleman, M., Borgstein, A. B.-J. J., Sondaal, S. F. V. F., Grobbee, D. E., Miltenburg, A. S., Verwijs, M., Ansah, E. K., Browne, J. L., & Klipstein-Grobusch, K. (2016). Effectiveness of mHealth interventions targeting health care workers to improve pregnancy outcomes in low- and middle-income countries: A systematic review. *Journal of Medical Internet Research*, *18*(8), e226. https://doi.org/10.2196/jmir.5533

Andersson, L., Sundström-Poromaa, I., Wulff, M., Åström, M., & Bixo, M. (2006). Depression and anxiety during pregnancy and six months postpartum: A follow-up study. *Acta Obstetricia et Gynecologica Scandinavica*, *85*(8), 937–944. https://doi.org/10.1080/00016340600697652

Åsenhed, L., Kilstam, J., Alehagen, S., & Baggens, C. (2014). Becoming a father is an emotional roller coaster - an analysis of first-time fathers′ blogs. *Journal of Clinical Nursing*, *23*(9–10), 1309–1317. https://doi.org/10.1111/jocn.12355

Association of Nova Scotia Midwives. (2020). *About Midwifery*. Webpage. https://www.novascotiamidwives.ca/about-midwifery/

Aston, M., Etowa, J., Price, S., Vukic, A., Hart, C., MacLeod, E., & Randel, P. (2016). Public Health Nurses and Mothers Challenge and Shift the Meaning of Health Outcomes. *Global Qualitative Nursing Research*, *3*, 233339361663212. https://doi.org/10.1177/2333393616632126

Aston, M. L. (2002). Learning to be a normal mother: Empowerment and pedagogy in postpartum classes. *Public Health Nursing*, *19*(4), 284–293. https://doi.org/10.1046/j.1525-1446.2002.19408.x

Aston, M., Price, S., Etowa, J., Vukic, A., Young, L., Hart, C., MacLeod, E., & Randel, P. (2015). The Power of Relationships: Exploring How Public Health Nurses Support Mothers and Families During Postpartum Home Visits. *Journal of Family Nursing*, *21*(1), 11–34. https://doi.org/10.1177/1074840714561524

Aston, M., Price, S., Hunter, A., Sim, M., Etowa, J., Monaghan, J., & Paynter, M. (2020). Second Opinions: Negotiating Agency in Online Mothering Forums. *Canadian Journal of Nursing Research*. https://doi.org/10.1177/0844562120940554

Aston, M., Price, S., Monaghan, J., Sim, M., Hunter, A., & Little, V. (2018). Navigating and negotiating information and support: Experiences of first-time mothers. *Journal of Clinical Nursing*, *27*(3–4), 640–649. https://doi.org/10.1111/jocn.13970

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall Inc.

Bandura, A. (1997). *Self-efficacy: the Exercise of Control*. Freeman and Co.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, *31*(2), 143–164. https://doi.org/10.1177/1090198104263660

Barkin, J. L., & Jani, S. (2016). Information Management in New Motherhood: Does the Internet Help or Hinder? *Journal of the American Psychiatric Nurses Association*, *22*(6), 475–482. https://doi.org/10.1177/1078390316659697

Barnes, C. R., & Adamson-Macedo, E. N. (2007). Perceived Maternal Parenting Self-Efficacy (PMP S-E) tool: Development and validation with mothers of hospitalized preterm neonates. *Journal of Advanced Nursing*, *60*(5), 550–560. https://doi.org/10.1111/j.1365-2648.2007.04445.x

Barnes, M., Pratt, J., Finlayson, K., Courtney, M., Pitt, B., & Knight, C. (2008). Learning About Baby: What New Mothers Would Like to Know. *Journal of Perinatal Education*, *17*(3), 33–41. https://doi.org/10.1624/105812408x329584

Bartholomew Eldredge, L., Markham, C., Ruiter, R., Fernandez, M., Kok, G., & Parcel, G. (2016). *Planning health promotion programs: An intervention mapping approach* (4th Editio). Jossey-Bass.

Baumel, A., Tinkelman, A., Mathur, N., & Kane, J. M. (2018). Digital peer-support platform (7Cups) as an adjunct treatment for women with postpartum depression: Feasibility, acceptability, and preliminary efficacy study. *Journal of Medical Internet Research*, *20*(2). https://doi.org/10.2196/mhealth.9482

Baynes, B., Gavin, N., & Meltzer-Brody, S. (2005). *Perinatal Depression: Prevalence, Screening Accuracy, and Screening Outcomes.* https://www.ncbi.nlm.nih.gov/books/NBK37740/

Bayrampour, H., Tomfohr, L., & Tough, S. (2016). Trajectories of perinatal depressive and anxiety symptoms in a community cohort. *Journal of Clinical Psychiatry*, *77*(11), e1467–e1473. https://doi.org/10.4088/JCP.15m10176

Bayrampour, H., Vinturache, A., Hetherington, E., Lorenzetti, D. L., & Tough, S. (2018). Risk factors for antenatal anxiety: A systematic review of the literature. *Journal of Reproductive and Infant Psychology*, *36*(5), 1–28. https://doi.org/10.1080/02646838.2018.1492097

Bernhardt, J. M., & Felter, E. M. (2004). Online pediatric information seeking among mothers of young children: Results from a qualitative study using focus groups. *Journal of Medical Internet Research*, *6*(1), 83–98. https://doi.org/10.2196/jmir.6.1.e7

Bhat, A., Reed, S., Mao, J., Vredevoogd, M., Russo, J., Unger, J., Rowles, R., & Unützer, J. (2018). Delivering perinatal depression care in a rural obstetric setting: a mixed methods study of feasibility, acceptability and effectiveness. *Journal of Psychosomatic Obstetrics and Gynecology*, *39*(4), 1–8. https://doi.org/10.1080/0167482X.2017.1367381

Bhati, S. R. (2015). The effect of the Sleep Support for Moms Intervention on postpartum sleep and depressive symptoms. a pilot Randomized Controlled Trial. In *Dissertation Abstracts International: Section B: The Sciences and Engineering* (Vol. 76, Issues 2-B(E)). George Masion University.

Blau, P. (1964). *Exchange and Power in Social Life*. Wiley & Sons.

Bowman, K. G. (2005). Postpartum learning needs. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *34*(4), 438–443. https://doi.org/10.1177/0884217505276054

Boyd, R., Le, H., & Somberg, R. (2005). Review of screening instruments for postpartum depression. *Arch Womens Ment Health*, *8*(3), 141–153.

Bradshaw, C., Atkinson, S., & Doody, O. (2017). Employing a Qualitative Description Approach in Health Care Research. *Global Qualitative Nursing Research*, *4*. https://doi.org/10.1177/2333393617742282

Brandon, A. D., Costanian, C., Sayed, M. F. El, & Tamim, H. (2016). Factors associated with difficulty accessing health care for infants in Canada: mothers' reports from the cross-sectional Maternity Experiences Survey. *BMC Pediatrics*, *16*(192), 1–9. https://doi.org/10.1186/s12887-016-0733-4

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/dx.doi.org/10.1191/1478088706qp063oa

Broom, M. A., Ladley, A. S., Rhyne, E. A., & Halloran, D. R. (2015). Feasibility and Perception of Using Text Messages as an Adjunct Therapy for Low-Income, Minority Mothers With Postpartum Depression. *JMIR Mental Health*, *2*(1), e4. https://doi.org/10.2196/mental.4074

Brown, M. (1986). Social support during pregnancy: a unidimensional or multidimensional construct? *Nursing Research*, *35*(1), 4–9.

Brown, M. (2018). *The Use of Mobile Technology in Managing Mild Depressive Symptomology in the Primipara of Low Socioeconomic Status: A Feasibility Study* (Issue May). Brandman University.

Bryanton, J., Beck, C. T., & Montelpare, W. (2013). Postnatal parental education for optimizing infant general health and parent-infant relationships. *The Cochrane*

Database of Systematic Reviews, *1*, CD004068. https://doi.org/10.1002/14651858.CD004068.pub3

Bryanton, J., Gagnon, A. J., Hatem, M., & Johnston, C. (2008). Predictors of early parenting self-efficacy: Results of a prospective cohort study. *Nursing Research*, *57*(4), 252–259. https://doi.org/10.1097/01.NNR.0000313490.56788.cd

Bujold, M., El Sherif, R., Bush, P. L., Johnson-Lafleur, J., Doray, G., & Pluye, P. (2018). Ecological content validation of the Information Assessment Method for parents (IAM-parent): A mixed methods study. *Evaluation and Program Planning*, *66*(August 2017), 79–88. https://doi.org/10.1016/j.evalprogplan.2017.09.011

Bull, J., & Swann, C. J. (2004). Ante- and post-natal home-visiting programmes: A review of reviews. In *Evidence Briefing*.

Buultjens, M., Robinson, P., & Milgrom, J. (2012). Online Resources for New Mothers: Opportunities and Challenges for Perinatal Health Professionals. *The Journal of Perinatal Education*, *21*(2), 99–111. https://doi.org/10.1891/1058-1243.21.2.99

Canadian Institute of Health Information. (2004). *Giving birth in Canada: providers of maternity and infant care.*

Canadian Midwives. (2020). *Midwifery across Canada*. Webpage. https://canadianmidwives.org/midwifery-across-canada/

Canadian Paediatric Society. (2020). *Schedule of well-child visits*. Webpage. https://www.caringforkids.cps.ca/handouts/schedule_of_well_child_visits

Canadian Radio-Televsion and Telecommunications Commission. (2016). *Communications Monitoring Report 2016*.

Chalmers, B., Dzakpasu, S., Heaman, M., & Kaczorowski, J. (2008). The Canadian Maternity Experiences Survey: An Overview of Findings. *Journal of Obstetrics and Gynaecology Canada*, *30*(3), 217–228. https://doi.org/10.1016/S1701-2163(16)32758-X

Chandler, C. I. R., Burchett, H., Boyle, L., Achonduh, O., Mbonye, A., DiLiberto, D., Reyburn, H., Onwujekwe, O., Haaland, A., Roca-Feltrer, A., Baiden, F., Mbacham, W. F., Ndyomugyenyi, R., Nankya, F., Mangham-Jefferies, L., Clarke, S., Mbakilwa, H., Reynolds, J., Lal, S., Leslie, T., Maiteki-Sebuguzi, C., Webster, J., Magnussen, P., Ansah, E., Hansen, K. S., Hutchinson, E., Cundill, B., Yeung, S., Schellenberg, D., Staedke, S. G., Wiseman, V., Lalloo, D. G., & Whitty, C. J. M. (2016). Examining intervention design: Lessons from the development of eight related malaria health care intervention studies. *Health Systems & Reform*, *2*(4), 373–388. https://doi.org/10.1080/23288604.2016.1179086

Chen, H., Chai, Y., Dong, L., Niu, W., & Zhang, P. (2018). Effectiveness and appropriateness of mHealth interventions for maternal and Child health: Systematic review. *JMIR MHealth and UHealth*, *6*(1), e7. https://doi.org/10.2196/mhealth.8998

Chin, R., Daiches, A., & Hall, P. (2011). A qualitative exploration of first-time fathers' experiences of becoming a father. *Community Practitioner : The Journal of the Community Practitioners' & Health Visitors' Association*, *84*(7), 19–23.

Chlan, L., Savik, K., & Weinert, C. (2003). Development of a Shortened State Anxiety Scale from the Spielberger State-Trait Anxiety Inventory (STAI) for patients recieving mechincal ventilatory support. *The Journal of Nursing Measurement*, *11*(3), 283–293.

Choi, J. W., Lee, J. hyeon, Vittinghoff, E., & Fukuoka, Y. (2016). mHealth Physical Activity Intervention: A Randomized Pilot Study in Physically Inactive Pregnant Women. *Maternal and Child Health Journal*, *20*(5), 1091–1101. https://doi.org/10.1007/s10995-015-1895-7

Cohen, J. (2002). The fourth trimester. *Midwifery Today*, *48*(61), 26–27.

Colaci, D., Chaudhri, S., & Vasan, A. (2016). mHealth Interventions in Low-Income Countries to Address Maternal Health: A Systematic Review. *Annals of Global Health*, *82*(5), 922–935. https://doi.org/10.1016/j.aogh.2016.09.001

Connor, K., Wambach, K., & Baird, M. B. (2018). Descriptive, Qualitative Study of Women Who Use Mobile Health Applications to Obtain Perinatal Health Information. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *47*(6), 728–737. https://doi.org/10.1016/j.jogn.2018.04.138

Cormick, G., Kim, N. A., Rodgers, A., Gibbons, L., Buekens, P. M., Belizán, J. M., & Althabe, F. (2012). Interest of pregnant women in the use of SMS (short message service) text messages for the improvement of perinatal and postnatal care. *Reproductive Health*, *9*(1), 1–7. https://doi.org/10.1186/1742-4755-9-9

Cox, J., Holden, J., & Henshaw, C. (2014). *The Edinburgh Post Natal Depression Scale (EPDS) Manual*.

Cox, J., Holden, J., & Sagovksy, R. (1987). Detection of Postnatal Depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry*, *150*, 782–786. https://doi.org/10.1007/978-94-007-1694-0_2

Cox, J. L., Murray, D., & Chapman, G. (1993). A controlled study of the onset, duration and prevalence of postnatal depression. *British Journal of Psychiatry*, *163*(JULY), 27–31. https://doi.org/10.1192/bjp.163.1.27

Crawford, J., Larsen-Cooper, E., Jezman, Z., Cunningham, S. C., & Bancroft, E. (2014). SMS versus voice messaging to deliver MNCH communication in rural Malawi: assessment of delivery success and user experience. *Global Health: Science and Practice*, *2*(1), 35–46. https://doi.org/10.9745/GHSP-D-13-00155

Creswell, J. W., & Poth, C. (2017). *Qualitative Inquiry and Research Design* (4th editio). SAGE Publications.

Črnčec, R., Barnett, B., & Matthey, S. (2008a). Development of an instrument to assess perceived self-efficacy in the parents of infants. *Research in Nursing and Health*, *31*(5), 442–453. https://doi.org/10.1002/nur.20271

Črnčec, R., Barnett, B., & Matthey, S. (2008b). *Karitane Parenting Confidence Scale: Manual*.

Cutrona, C. E., & Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. *Advances in Personal Relationships*, *1*(1), 37–67. https://doi.org/10.1017/CBO9781107415324.004

Cutrona, C. E., & Troutman, B. R. (1986). Social Support, Infant Temperament, and Parenting Self-Efficacy: A Mediational Model of Postpartum Depression. *Child Development*, *57*(6), 1507–1518.

Dalfra, M. G., Nicolucci, A., Lapolla, A., TISG, Dalfrà, M. G., Nicolucci, A., Lapolla, A., di Benedetto, A., di Cianni, G., Dolci, M. A., Franzetti, I., Galluzzo, A., Napoli, A., Salietti, G., Santini, C., Torlone, E., Tortul, C., & Vitacolonna, E. (2009). The effect of telemedicine on outcome and quality of life in pregnant women with diabetes. *Journal of Telemedicine and Telecare*, *15*(5), 238–242. https://doi.org/10.1258/jtt.2009.081213

Dalton, J. A., Rodger, D., Wilmore, M., Humphreys, S., Skuse, A., Roberts, C. T., & Clifton, V. L. (2018). The Health-e Babies App for antenatal education: Feasibility for socially disadvantaged women. *PLoS ONE*, *13*(5), 1–18. https://doi.org/10.1371/journal.pone.0194337

Daly, L. M., Horey, D., Middleton, P. F., Boyle, F. M., & Flenady, V. (2018). The effect of mobile application interventions on influencing healthy maternal behaviour and improving perinatal health outcomes: A systematic review. *JMIR MHealth and UHealth*, *6*(8), 1–9. https://doi.org/10.1186/s13643-017-0424-8

Dambi, J. M., Corten, L., Chiwaridzo, M., Jack, H., Mlambo, T., & Jelsma, J. (2018). A systematic review of the psychometric properties of the cross-cultural translations and adaptations of the Multidimensional Perceived Social Support Scale (MSPSS). *Health and Quality of Life Outcomes*, *16*(80). https://doi.org/10.1016/j.jaad.2014.01.810

Davenport, M., Meyer, S., Meah, V. L., Strynadka, M. C., & Khurana, R. (2020). Moms are not OK: COVID-19 and maternal mental health. *Frontiers in Global Women's Health*, *1*(June), 1–6. https://doi.org/10.3389/FGWH.2020.00001

Davis, D. W., Logsdon, M. C., Vogt, K., Rushton, J., Myers, J., Lauf, A., & Hogan, F. (2017). Parent education is changing: A review of smartphone apps. *The American Journal of Maternal Child Nursing*, 1–10. https://doi.org/10.1097/NMC.0000000000000353

de Montigny, F., & Lacharite, C. (2005). Perceived parental efficacy: Concept analysis. *Journal of Advanced Nursing*, *49*(4), 387–396.

Deave, T., Johnson, D., & Ingram, J. (2008). Transition to parenthood: The needs of parents in pregnancy and early parenthood. *BMC Pregnancy and Childbirth*, *8*, 1–11. https://doi.org/10.1186/1471-2393-8-30

Dennis-Tiwary, T. A., Denefrio, S., & Gelber, S. (2017). Salutary effects of an attention bias modification mobile application on biobehavioral measures of stress and anxiety during pregnancy. *Biological Psychology*, *127*(April), 148–156. https://doi.org/10.1016/j.biopsycho.2017.05.003

Dennis, C.-L., Falah-Hassani, K., & Shiri, R. (2017a). Prevalence of antenatal and postnatal anxiety: Systematic review and meta-analysis. *British Journal of Psychiatry*, *210*(5), 315–323. https://doi.org/10.1192/bjp.bp.116.187179

Dennis, C. (2005). Psychosocial and psychological interventions for prevention of postnatal depression: systematic review. *British Medical Journal*, *331*(July), 1–8.

Dennis, C., Heaman, M., & Vigod, S. (2012). Epidemiology of postpartum depressive symptoms among canadian women: Regional and national results from a cross-sectional survey. *Canadian Journal of Psychiatry*, *57*(9), 537–546. https://doi.org/10.1177/070674371205700904

Dennis, C. L. (2003). The effect of peer support on postpartum depression: A pilot randomized controlled trial. *Canadian Journal of Psychiatry*, *48*(2), 115–124. https://doi.org/10.1177/070674370304800209

Dennis, C. L., Brown, H. K., Falah-Hassani, K., Marini, F. C., & Vigod, S. N. (2017b). Identifying women at risk for sustained postpartum anxiety. *Journal of Affective Disorders*, *213*, 131–137. https://doi.org/10.1016/j.jad.2017.02.013

Dennis, C. L., Falah-Hassani, K., Brown, H. K., & Vigod, S. N. (2016). Identifying women at risk for postpartum anxiety: a prospective population-based study. *Acta Psychiatrica Scandinavica*, *134*(6), 485–493. https://doi.org/10.1111/acps.12648

Dennis, C. L., Hodnett, E., Kenton, L., Weston, J., Zupancic, J., Stewart, D. E., & Kiss,

A. (2009). Effect of peer support on prevention of postnatal depression among high risk women: Multisite randomised controlled trial. *BMJ (Online)*, *338*(7689), 280–283. https://doi.org/10.1136/bmj.a3064

Denzin, N., & Lincoln, Y. (2018). *The Sage handbook of qualitative research* (5th Editio). SAGE Publications.

Dol, J., Campbell-Yeo, M., Tomblin Murphy, G., Aston, M., Mcmillan, D. D., & Richardson, B. (2019a). Impact of mobile health interventions during the perinatal period for mothers in low- and middle-income countries: a systematic review. *JBI Database of Systematic Reviews and Implementation Reports*, *17*(8), 1634–1667. https://doi.org/10.11124/JBISRIR-2017-004022

Dol, J., Richardson, B., Boates, T., & Campbell-Yeo, M. (2019b). Learning to parent from Google? Evaluation of available online health evidence for parents of preterm infants requiring neonatal intensive care. *Health Informatics Journal*, *25*(4), 1265–1277. https://doi.org/10.1177/1460458217752564

Dol, J., Richardson, B., Tomblin Murphy, G., Aston, M., McMillan, D. D., Campbell-Yeo, M., Tomblin-Murphy, G., Aston, M., McMillan, D. D., & Campbell-Yeo, M. (2019c). Impact of mHealth interventions during the perinatal period on maternal psychosocial outcomes: a systematic review protocol. *JBI Database of Systematic Reviews and Implementation Reports*, *17*(2), 137–146. https://doi.org/10.11124/JBISRIR-2017-003801

Drabble, S. J., & O'Cathain, A. (2015). Moving from randomized controlled trials to mixed methods intervention evaluations. In S. Hesse-Biber & R. Burke Jognson (Eds.), *The Oxford handbook of multimethod and mixed methods research inquiry.* (pp. 406–425). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199933624.013.26

Eberhard-Gran, M., Garthus-Niegel, S., Garthus-Niegel, K., & Eskild, A. (2010). Postnatal care: A cross-cultural and historical perspective. *Archives of Women's Mental Health*, *13*(6), 459–466. https://doi.org/10.1007/s00737-010-0175-1

Emmanuel, E. N., Creedy, D. K., St John, W., & Brown, C. (2011). Maternal role development: The impact of maternal distress and social support following childbirth. *Midwifery*, *27*(2), 265–272. https://doi.org/10.1016/j.midw.2009.07.003

Esmaelzadeh Saeieh, S., Rahimzadeh, M., Yazdkhasti, M., & Torkashvand, S. (2017). Perceived social support and maternal competence in primipara women during pregnancy and after childbirth. *International Journal of Community Based Nursing and Midwifery*, *5*(4), 408–416.

Evans, W. D., Bihm, J. W., Szekely, D., Nielsen, P., Murray, E., Abroms, L., Snider, J., Wallae, J., Szekely, D., Nielson, P., Murray, E., Abroms, L., & Snider, J. (2014). Initial Outcomes From a 4-Week Follow-Up Study of the Text4baby Program in the Military Women's Population: Randomized Controlled Trial. *Journal of Medical Internet Research*, *16*(5), 1–12. https://doi.org/10.2196/jmir.3297

Evans, W., Nielsen, P. E., Szekely, D. R., Bihm, J. W., Murray, E. A., Snider, J., & Abroms, L. C. (2015). Dose-Response Effects of the Text4baby Mobile Health Program: Randomized Controlled Trial. *JMIR MHealth and UHealth*, *3*(1), e12. https://doi.org/10.2196/mhealth.3909

Evans, W., Wallace, J. L., & Snider, J. (2012). Pilot evaluation of the text4baby mobile health program. *BMC Public Health*, *12*(1), 1. https://doi.org/10.1186/1471-2458-12-1031

Fahey, J. O., & Shenassa, E. (2013). Understanding and meeting the needs of women in the postpartum period: The perinatal maternal health promotion model. *Journal of Midwifery and Women's Health*, *58*(6), 613–621. https://doi.org/10.1111/jmwh.12139

Fallon, V., Halford, J. C. G., Bennett, K. M., & Harrold, J. A. (2016). The Postpartum Specific Anxiety Scale: development and preliminary validation. *Archives of Women's Mental Health*, *19*(6), 1079–1090. https://doi.org/10.1007/s00737-016-0658-9

Faulkner, L. (2003). Beyond the five-user assumption: Benefits of increased sample sizes in usability testing. *Behavior Research Methods, Instruments, & Computers*, *35*(3), 379–383. https://doi.org/10.1109/DCABES.2011.32

Field, T. (2017). Prenatal anxiety effects: A review. *Infant Behavior and Development*, *49*(September), 120–128. https://doi.org/10.1016/j.infbeh.2017.08.008

Finlayson, K., Crossland, N., Bonet, M., & Downe, S. (2020). What matters to women in the postnatal period: A meta-synthesis of qualitative studies. *PLoS ONE*, *15*(4), 1–23. https://doi.org/10.1371/journal.pone.0231415

Fisher, J. R., Wynter, K. H., & Rowe, H. J. (2010). Innovative psycho-educational program to prevent common postpartum mental disorders in primiparous women: a before and after controlled study. *BMC Public Health*, *10*(1), 432. https://doi.org/10.1186/1471-2458-10-432

Fletcher, R., May, C., Wroe, J., Hall, P., Cooke, D., Rawlinson, C., Redfern, J., & Kelly, B. (2016). Development of a set of mobile phone text messages designed for new fathers. *Journal of Reproductive and Infant Psychology*, *34*(5), 525–534. https://doi.org/10.1080/02646838.2016.1214250

Fogel, N. (2017). The inadequacies in postnatal health care. *Current Medicine Research and Practice*, *7*(1), 16–17. https://doi.org/10.1016/j.cmrp.2016.12.006

Forman, R., & Owen, S. (1989). Infant care self-efficacy. *Scholarly Inquiry for Nursing Practice: An International Journal*, *3*(3), 199–211.

Fujioka, N., Kobayashi, T., & Turale, S. (2012). Short-term behavioral changes in pregnant women after a quit-smoking program via e-learning: A descriptive study from Japan. *Nursing and Health Sciences*, *14*(3), 304–311. https://doi.org/10.1111/j.1442-2018.2012.00702.x

Gagnon, M. P., Ngangue, P., Payne-Gagnon, J., & Desmartis, M. (2016). M-Health adoption by healthcare professionals: A systematic review. *Journal of the American Medical Informatics Association*, *23*(1), 212–220. https://doi.org/10.1093/jamia/ocv052

Gallegos, D., Russell-Bennett, R., Previte, J., & Parkinson, J. (2014). Can a text message a week improve breastfeeding? *BMC Pregnancy and Childbirth*, *14*(1), 374. https://doi.org/10.1186/s12884-014-0374-2

Gardner, M. R., & Deatrick, J. a. (2006). Understanding interventions and outcomes in mothers of infants. *Issues in Comprehensive Pediatric Nursing*, *29*(1), 25–44. https://doi.org/10.1080/01460860500523756

Garfield, C. F., Lee, Y. S., Kim, H. N., Rutsohn, J., Kahn, J. Y., Mustanski, B., & Mohr, D. C. (2016). Supporting parents of premature infants transitioning from the NICU to home: A pilot randomized control trial of a smartphone application. *Internet Interventions*, *4*, 131–137. https://doi.org/10.1016/j.invent.2016.05.004

Gazmararian, J. A., Elon, L., Yang, B., Graham, M., & Parker, R. (2014). Text4baby program: An opportunity to reach underserved pregnant and postpartum women? *Maternal and Child Health Journal*, *18*(1), 223–232. https://doi.org/10.1007/s10995-013-1258-1

Gilmer, C., Buchan, J. L., Letourneau, N., Bennett, C. T., Shanker, S. G., Fenwick, A., & Smith-Chant, B. (2016). Parent education interventions designed to support the transition to parenthood: A realist review. *International Journal of Nursing Studies*, *59*, 118–133. https://doi.org/10.1016/j.ijnurstu.2016.03.015

Gjerdingen, D., Froberg, D., & Fontaine, P. (1991). The effects of social support on women's health during pregnancy, labour and delivery, and the postpartum period. *Family Medicine*, *23*(5), 370–375.

Globus, O., Leibovitch, L., Morag, I., Mazkereth, R., Glasser, S., Kaplan, G., & Strauss, T. (2016). The use of short message services (SMS) to provide medical updating to parents in the NICU. *Journal of Perinatology*, *36*(9), 739–743. https://doi.org/10.1038/jp.2016.83

Goodman, J. H., Watson, G. R., & Stubbs, B. (2016). Anxiety disorders in postpartum women: A systematic review and meta-analysis. *Journal of Affective Disorders*, *203*, 292–331. https://doi.org/10.1016/j.jad.2016.05.033

Government of Canada. (2020). *Health care in Canada*. Webpage. https://www.canada.ca/en/immigration-refugees-citizenship/services/new-immigrants/new-life-canada/health-care-card.html

Grimes, H. A., Forster, D. A., & Newton, M. S. (2014). Sources of information used by women during pregnancy to meet their information needs. *Midwifery*, *30*(1), e26–e33. https://doi.org/10.1016/j.midw.2013.10.007

Guerra-Reyes, L., Christie, V. M., Prabhakar, A., Harris, A. L., & Siek, K. A. (2016). Postpartum Health Information Seeking Using Mobile Phones: Experiences of Low-Income Mothers. *Maternal and Child Health Journal*, *20*(1), 13–21. https://doi.org/10.1007/s10995-016-2185-8

Guerra-Reyes, L., Christie, V. M., Prabhakar, A., & Siek, K. A. (2017). Mind the Gap: Assessing the Disconnect Between Postpartum Health Information Desired and Health Information Received. *Women's Health Issues*, *27*(2), 167–173. https://doi.org/10.1016/j.whi.2016.11.004

Hall, A. K., Cole-Lewis, H., & Bernhardt, J. M. (2015). Mobile text messaging for health: A systematic review of reviews. *Annual Review of Public Health*, *36*(1), 393–415. https://doi.org/10.1146/annurev-publhealth-031914-122855

Hannan, J., Brooten, D., Page, T., Galindo, A., & Torres, M. (2016). Low-Income First-Time Mothers: Effects of APN Follow-up Using Mobile Technology on Maternal and Infant Outcomes. *Global Pediatric Health*, *3*, 1–10. https://doi.org/10.1177/2333794X16660234

Hantsoo, L., Criniti, S., Khan, A., Moseley, M., Kincler, N., Faherty, L. J., Epperson, C. N., & Bennett, I. M. (2018). A Mobile Application for Monitoring and Management of Depressed Mood in a Vulnerable Pregnant Population. *Psychiatric Services*, *69*(1), 104–107. https://doi.org/10.1176/appi.ps.201600582

Haran, C., Driel, M. Van, Mitchell, B. L., & Brodribb, W. E. (2014). Clinical guidelines for postpartum women and infants in primary care – a systematic review. *BMC Pregnancy and Childbirth*, *14*(1), 1–9. https://doi.org/10.1186/1471-2393-14-51

Haslam, D., Pakenham, K., & Smith, A. (2006). Social support and postpartum depressive symptomatology: The mediating role of maternal self-efficacy. *Infant Mental Health Journal*, *27*(3), 276–291. https://doi.org/10.1002/imhj.

Head, K. J., Noar, S. M., Iannarino, N. T., & Grant Harrington, N. (2013). Efficacy of text messaging-based interventions for health promotion: A meta-analysis. *Social Science and Medicine*, *97*, 41–48. https://doi.org/10.1016/j.socscimed.2013.08.003

Health Canada. (2000). *Family-centred maternity and newborn care: National Guidelines*.

HealthyChildren.Org. (2020). *Ages & Stages: Baby*. Webpage. https://www.healthychildren.org/english/ages-stages/baby/Pages/default.aspx

Heminger, C., Schindler-Ruwisch, J., & Lorien Abroms, L. (2016). Smoking cessation support for pregnant women: role of mobile technology. *Substance Abuse and Rehabilitation*, 15. https://doi.org/10.2147/sar.s84239

Heron, J., O'Connor, T. G., Evans, J., Golding, J., & Glover, V. (2004). The course of anxiety and depression through pregnancy and the postpartum in a community sample. *Journal of Affective Disorders*, *80*(1), 65–73. https://doi.org/10.1016/j.jad.2003.08.004

Heslehurst, N., Brown, H., Pemu, A., Coleman, H., & Rankin, J. (2018). Perinatal health outcomes and care among asylum seekers and refugees: A systematic review of systematic reviews. *BMC Medicine*, *16*(89), 1–25.

Hetherington, E., McDonald, S., Williamson, T., Patten, S. B., & Tough, S. C. (2018). Social support and maternal mental health at 4 months and 1 year postpartum: analysis from the All Our Families cohort. *Journal of Epidemiology and Community Health*, *72*, 933–939. https://doi.org/10.1136/jech-2017-210274

Hodgkinson, E. L., Smith, D. M., & Wittkowski, A. (2014). Women's experiences of their pregnancy and postpartum body image: A systematic review and meta-synthesis. *BMC Pregnancy and Childbirth*, *14*(1). https://doi.org/10.1186/1471-2393-14-330

Hopkins, J., & Campbell, S. B. (2008). Development and validation of a scale to assess social support in the postpartum period. *Archives of Women's Mental Health*, *11*(1), 57–65. https://doi.org/10.1007/s00737-008-0212-5

Hudson, D. B., Elek, S. M., & Fleck, M. O. F. E. (2001). First-time mothers' and fathers' transition to parenthood: Infant care, self-efficacy, parenting satisfcation, and infant sex. *Comprehensive Pediatric Nursing*, *24*, 31–43.

Hurt, K., Walker, R. J., Campbell, J. A., & Egede, L. E. (2016). mHealth interventions in low and middle-income countries: A systematic review. *Global Journal of Health Science*, *8*(9), 183. https://doi.org/10.5539/gjhs.v8n9p183

IBM Corp. (2017). *IBM SPSS Statistics for Macs* (No. 25). IBM Corp.

International Telecommunication Union. (2016). *ICT facts and figures 2016*. https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf

Iribarren, S. J., Brown, W., Giguere, R., Stone, P., Schnall, R., Staggers, N., & Carballo-Diéguez, A. (2017). Scoping review and evaluation of SMS/text messaging platforms for mHealth projects or clinical interventions. *International Journal of Medical Informatics*, *101*, 28–40. https://doi.org/10.1016/j.ijmedinf.2017.01.017

Isaacs, D. (2018). The fourth trimester. *Journal of Paediatrics and Child Health*, *54*(11), 1174–1175. https://doi.org/10.1111/jpc.14257

IWK Health Centre. (2018). *Having a baby*. Webpage. http://www.iwk.nshealth.ca/women-and-newborns-health/services/having-a-baby#/women-and-newborns-health/birth-unit

Jallo, N., Thacker, L. R., Menzies, V., Stojanovic, P., & Svikis, D. S. (2017). A Stress Coping App for Hospitalized Pregnant Women at Risk for Preterm Birth. *MCN The American Journal of Maternal/Child Nursing*, *42*(5), 257–262. https://doi.org/10.1097/NMC.0000000000000355

Javadifar, N., Majlesi, F., Nikbakht, A., Nedjat, S., & Montazeri, A. (2016). Journey to Motherhood in the First Year After Child Birth. *Journal of Family & Reproductive Health*, *10*(3), 146–153.

Javanmardi, M., Noroozi, M., Mostafavi, F., & Ashrafi-Rizi, H. (2018). Internet usage among pregnant women for seeking health information: A review article. *Iran Journal Nurse Midwifery Research Centre*, *23*(2), 79–86. https://doi.org/10.4103/ijnmr.IJNMR

Johnson, S. A. (2015). 'Intimate mothering publics': comparing face-to-face support groups and Internet use for women seeking information and advice in the transition to first-time motherhood. *Culture, Health & Sexuality*, *17*(2), 237–251. https://doi.org/10.1080/13691058.2014.968807

Jones, T. L., & Prinz, R. J. (2005). Potential roles of parental self-efficacy in parent and child adjustment: A review. *Clinical Psychology Review*, *25*(3), 341–363. https://doi.org/10.1016/j.cpr.2004.12.004

Jordan, E. T., Ray, E. M., Johnson, P., & Evans, W. D. (2011). Text4Baby: Using text messaging to improve maternal and newborn health. *Nursing for Women's Health*, *15*, 206–212. https://doi.org/10.1111/j.1751-486X.2011.01635.x

Keim, S. A., Daniels, J. L., Dole, N., Herring, A. H., Siega-Riz, A. M., & Scheidt, P. C. (2011). A prospective study of maternal anxiety, perceived stress, and depressive symptoms in relation to infant cognitive development. *Early Human Development*, *87*(5), 373–380. https://doi.org/10.1016/j.earlhumdev.2011.02.004

Ketner, S. L., Gravesteijn, C., & Verschuur, M. J. (2019). Transition to parenthood: it does not get easier the next time. Exploring ways to support well-being among parents with newborns. *Journal of Family Social Work*, *22*(3), 274–291. https://doi.org/10.1080/10522158.2018.1499063

Khanlou, N., Haque, N., Skinner, A., Mantini, R., & Landy Kurtz, C. (2017). Scoping Review on Maternal Health among Immigrant and Refugee Women in Canada: Prenatal, Intrapartum, and Postnatal Care. *Journal of Pregnancy*, 1–14. https://doi.org/10.1155/2017/8783294

Kingston, D., Kehler, H., Austin, M. P., Mughal, M. K., Wajid, A., Vermeyden, L., Benzies, K., Brown, S., Stuart, S., & Giallo, R. (2018). Trajectories of maternal depressive symptoms during pregnancy and the first 12 months postpartum and child externalizing and internalizing behavior at three years. *PLoS ONE*, *13*(4), 1–19. https://doi.org/10.1371/journal.pone.0195365

Kitzinger, S. (1975). The Fourth Trimester? *Midwife, Health Vistor & Community Nurse*, *11*, 118–121.

Knight-Agarwal, C., Davis, D. L., Williams, L., Davey, R., Cox, R., & Clarke, A. (2015). Development and Pilot Testing of the Eating4two Mobile Phone App to Monitor Gestational Weight Gain. *JMIR MHealth and UHealth*, *3*(2), e44. https://doi.org/10.2196/mhealth.4071

Kohlhoff, J., & Barnett, B. (2013). Parenting self-efficacy: Links with maternal depression, infant behaviour and adult attachment. *Early Human Development*, *89*(4), 249–256. https://doi.org/10.1016/j.earlhumdev.2013.01.008

Kowlessar, O., Fox, J. R., & Wittkowski, A. (2015). First-time fathers' experiences of parenting during the first year. *Journal of Reproductive and Infant Psychology*, *33*(1), 4–14. https://doi.org/10.1080/02646838.2014.971404

Kristensen, I. H., Simonsen, M., Trillingsgaard, T., Pontoppidan, M., & Kronborg, H. (2018). First-time mothers' confidence mood and stress in the first months postpartum. A cohort study. *Sexual and Reproductive Healthcare*, *17*(June), 43–49. https://doi.org/10.1016/j.srhc.2018.06.003

Labrique, A., Vasudevan, L., Kochi, E., Fabricant, R., & Mehl, G. (2013). mHealth innovations as health system strengtehing tools: 12 common applications and a visual framework. *Global Health: Science and Practice*, *1*(2), 1–12.

Lamont, K., Sliwa, K., Stewart, S., Carrington, M., Pretorius, S., Libhaber, E., Wiysonge, C. S., Adebayo, E. F., & Klipstein-Grobusch, K. (2016). Short message service (SMS) as an educational tool during pregnancy: A literature review. *Health Education Journal*, *75*(5), 540–552. https://doi.org/10.1177/0017896915607910

Lanes, A., Kuk, J. L., & Tamim, H. (2011). Prevalence and characteristics of Postpartum Depression symptomatology among Canadian women: A cross-sectional study. *BMC Public Health*, *11*(1), 302. https://doi.org/10.1186/1471-2458-11-302

Langlois, É. V, Miszkurka, M., Zunzunegui, V., Ghaffar, A., Zunzunegui, M. V., Ghaffar, A., Ziegler, D., & Karp, I. (2015). Inequities in postnatal care in low- and middle-income countries: A systematic review and meta-analysis. *Bulletin of the World Health Organization*, *93*(4), 259-270G. https://doi.org/10.2471/BLT.14.140996

Lau, Y., Htun, T. P., Wong, S. N., Tam, W. S. W., & Klainin-Yobas, P. (2017). Therapist-supported internet-based cognitive behavior therapy for stress, anxiety, and depressive symptoms among postpartum women: A systematic review and meta-analysis. *Journal of Medical Internet Research*, *19*(4). https://doi.org/10.2196/jmir.6712

Lavender, T., Richens, Y., Milan, S., Smyth, R., & Doweswell, T. (2013). Telephone support for women during pregnancy and the first six weeks postpartum (Review). *The Cochrane Collaboration*, *7*, 1–104. https://doi.org/10.1002/14651858.CD009338.pub2.www.cochranelibrary.com

Law, K. H., Dimmock, J., Guelfi, K. J., Nguyen, T., Gucciardi, D., & Jackson, B. (2019). Stress, Depressive Symptoms, and Maternal Self-Efficacy in First-Time Mothers: Modelling and Predicting Change across the First Six Months of Motherhood. *Applied Psychology: Health and Well-Being*, *11*(1), 126–147. https://doi.org/10.1111/aphw.12147

Leahy-Warren, P. (2005). First-time mothers: Social support and confidence in infant care. *Issues and Innovations in Nursing Practice*, *50*(5), 479–488. https://doi.org/10.1111/j.1365-2648.2005.03425.x

Leahy-Warren, P., & McCarthy, G. (2011). Maternal parental self-efficacy in the postpartum period. *Midwifery*, *27*(6), 802–810. https://doi.org/10.1016/j.midw.2010.07.008

Leahy-Warren, P., Mccarthy, G., & Corcoran, P. (2012). First-time mothers: Social support, maternal parental self-efficacy and postnatal depression. *Journal of Clinical Nursing*, *21*(3–4), 388–397. https://doi.org/10.1111/j.1365-2702.2011.03701.x

Lebel, C., MacKinnon, A., Bagshawe, M., Tomfohr-Madsen, L., & Giesbrecht, G. (2020). Elevated depression and anxiety among pregnant individuals during the COVID-19 pandemic. *Journal of Affective Disorders*, *277*, 5–13. https://doi.org/10.31234/osf.io/gdhkt

Lee, H. S. (2016). Research trends in mothers' health information seeking behaviors: A review of the literature. *Proceedings of the Association for Information Science and Technology*, *53*(1), 1–6. https://doi.org/10.1002/pra2.2016.14505301130

Lee, S. H., Nurmatov, U. B., Nwaru, B. I., Mukherjee, M., Grant, L., & Pagliari, C. (2016). Effectiveness of mHealth interventions for maternal, newborn and child health in low- and middle-income countries: Systematic review and meta-analysis. *Journal of Global Health*, *6*(1), 010401. https://doi.org/10.7189/jogh.06.010401

Lemyre, B., Jefferies, A. L., & O'Flaherty, P. (2018). Facilitating discharge from hospital of the healthy term infant. In *Paediatrics and Child Health* (Vol. 23, Issue 8). https://doi.org/10.1093/pch/pxy127

Letourneau, N. L., Dennis, C. L., Benzies, K., Duffett-Leger, L., Stewart, M., Tryphonopoulos, P. D., Este, D., & Watson, W. (2012). Postpartum depression is a family affair: Addressing the impact on mothers, fathers, and children. *Issues in Mental Health Nursing*, *33*(7), 445–457. https://doi.org/10.3109/01612840.2012.673054

Letourneau, N., Secco, L., Colpitts, J., Aldous, S., Stewart, M., & Dennis, C. L. (2015). Quasi-experimental evaluation of a telephone-based peer support intervention for maternal depression. *Journal of Advanced Nursing*, *71*(7), 1587–1599. https://doi.org/10.1111/jan.12622

Liyana Amin, N. A., Tam, W. W. S., & Shorey, S. (2018). Enhancing first-time parents' self-efficacy: A systematic review and meta-analysis of universal parent education interventions' efficacy. *International Journal of Nursing Studies*, *82*(July 2017), 149–162. https://doi.org/10.1016/j.ijnurstu.2018.03.021

Loudon, K., Buchanan, S., & Ruthven, I. (2016). The everyday life information seeking behaviours of first-time mothers. *Journal of Documentation*, *72*(1), 24–46. https://doi.org/10.1108/JD-06-2014-0080

Lupton, D., & Pedersen, S. (2016). An Australian survey of women's use of pregnancy and parenting apps. *Women and Birth*, *29*(4), 368–375. https://doi.org/10.1016/j.wombi.2016.01.008

Madge, C., & O'Connor, H. (2006). Parenting gone wired: Empowerment of new mothers on the internet? *Social and Cultural Geography*, *7*(2), 199–220. https://doi.org/10.1080/14649360600600528

Marcolino, M. S., Oliveira, J. A. Q., D'Agostino, M., Ribeiro, A. L., Alkmim, M. B. M., & Novillo-Ortiz, D. (2018). The impact of mHealth interventions: Systematic review of systematic reviews. *JMIR MHealth and UHealth*, *6*(1). https://doi.org/10.2196/mhealth.8873

Martin, A., Horowitz, C., Balbierz, A., & Howell, E. A. (2014). Views of women and clinicians on postpartum preparation and recovery. *Maternal and Child Health Journal*, *18*(3), 707–713. https://doi.org/10.1007/s10995-013-1297-7

Mayberry, L. S., & Jaser, S. S. (2018). Should there be an app for that? The case for text messaging in mHealth interventions. *Journal of Internal Medicine*, *283*, 212–213. https://doi.org/10.1111/joim.12687

McColl, L. D., Rideout, P. E., Parmar, T. N., & Abba-Aji, A. (2014). Peer support intervention through mobile application: An integrative literature review and future directions. *Canadian Psychology*, *55*(4), 250–257. https://doi.org/10.1037/a0038095

Mckellar, L. V, Pincombe, J., & Henderson, A. M. (2002). Congratulations You're a mother: A strategy for enhancing postnatal education for first-time mothers investigated through an action research cycle. *Australian College of Midwives*, *15*(3).

McKelvey, M. M. (2014). The other mother: A narrative analysis of the postpartum experiences of nonbirth lesbian mothers. *Advances in Nursing Science*, *37*(2), 101–116. https://doi.org/10.1097/ANS.0000000000000022

Mcleish, J., & Redshaw, M. (2017). Mothers' accounts of the impact on emotional wellbeing of organised peer support in pregnancy and early parenthood: A qualitative study. *BMC Pregnancy and Childbirth*, *17*, 1–14. https://doi.org/10.1186/s12884-017-1220-0

Meades, R., & Ayers, S. (2011). Anxiety measures validated in perinatal populations: A systematic review. *Journal of Affective Disorders*, *133*(1–2), 1–15. https://doi.org/10.1016/j.jad.2010.10.009

Mihelic, M., Filus, A., & Morawaska, A. (2016). Correlates of Prenatal Parenting Expectations in new Mothers: Is Better Self-Efficacy a Potential Target for Preventing Postnatal Adjustment Difficulties? *Prevention Science*, *17*(8), 949–959. https://doi.org/10.1007/s11121-016-0682-z

Mildon, A., & Sellen, D. (2019). Use of mobile phones for behavior change communication to improve maternal, newborn and child health: a scoping review. *Journal of Global Health*, *9*(2), 020425. https://doi.org/10.7189/jogh.09.020425

Moller, A., Petzold, M., Chou, D., & Say, L. (2013). Early antenatal care visit: A systematic analysis of regional and global levels and trends of coverage from 1990 to 2013. *The Lancet Global Health*, *5*(10), e977–e983. https://doi.org/10.1016/S2214-109X(17)30325-X

Moon, R. Y., Hauck, F. R., Kellams, A. L., Colson, E. R., Geller, N. L., Heeren, T. C., Kerr, S. M., & Corwin, M. J. (2017). Comparison of Text Messages Versus E-mail When Communicating and Querying With Mothers About Safe Infant Sleep. *Academic Pediatrics*, *17*(8), 871–878. https://doi.org/10.1016/j.acap.2017.06.004

Naughton, F., Prevost, A. T., Gilbert, H., & Sutton, S. (2012). Randomized controlled trial evaluation of a tailored leaflet and SMS text message self-help intervention for pregnant smokers (MiQuit). *Nicotine and Tobacco Research*, *14*(5), 569–577. https://doi.org/10.1093/ntr/ntr254

Negron, R., Martin, A., Almog, M., Balbierz, A., Howell, E. A. E., Almong, M., Balbierz, A., & Howell, E. A. E. (2013). Social support during the postpartum period: Mothers' views on needs, expectations, and mobilization of support. *Maternal and Child Health Journal*, *17*(4), 616–623. https://doi.org/10.1007/s10995-012-1037-4

Nelson, A. M. (2003). Transition to motherhood. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *32*(4), 465–477. https://doi.org/10.1177/0884217503255199

Ngai, F. W., Wong, P. W. C., Leung, K. Y., Chau, P. H., & Chung, K. F. (2015). The Effect of Telephone-Based Cognitive-Behavioral Therapy on Postnatal Depression: A Randomized Controlled Trial. *Psychotherapy and Psychosomatics*, *84*(5), 294–303. https://doi.org/10.1159/000430449

Ni, P. K., & Siew Lin, S. K. (2011). The role of family and friends in providing social support towards enhancing the wellbeing of postpartum women: a comprehensive systematic review. *JBI Library of Systematic Reviews*, *9*(10), 313–370. https://doi.org/10.11124/jbisrir-2011-94

NICE. (2015a). *Postnatal care*. Quality Standard. nice.org.uk/guidance/qs37%0A©

NICE. (2015b). Postnatal care up to 8 weeks after birth. In *NICE Clinical Guideline* (Issue July).

Nova Scotia. (2018). *NS Births and Deaths with Rates and Natural Increase*.

Nova Scotia Department of Health. (2015). *How to feed your baby with infant formula*. https://novascotia.ca/dhw/healthy-development/documents/05115-How-to-Feed-Your-Baby-with-Infant-Formula-Linked-Index-En.pdf

Nova Scotia Health Authority. (2020). *Temporary service and facility closure notices from Nova Scotia Health Authority*. Webpage. http://www.nshealth.ca/temporary-service-and-facility-closure-notices-nova-scotia-health-authority-updated-310-pm-march-16

Nystr, K., & Kerstin, O. (2004). Parenthood experiences during the child's first year: Literature review. *Journal of Advanced Nursing*, *46*(3), 319–330. https://doi.org/10.1111/j.1365-2648.2004.02991.x

Oakley, A., Strange, V., Bonell, C., Allen, E., Stephenson, J., & Ripple Study Team. (2006). Process evaluation in randomised controlled trials of complex interventions. *British Medical Journal*, *332*(7538), 413–416. https://doi.org/10.1136/bmj.332.7538.413

Ollivier, R., Aston, D. M., Price, D. S., Sim, D. M., Benoit, D. B., Joy, D. P., Iduye, D., & Nassaji, N. A. (2020). Mental Health & Parental Concerns during COVID-19: The Experiences of New Mothers Amidst Social Isolation. *Midwifery*, 102902. https://doi.org/https://doi.org/10.1016/j.midw.2020.102902

Osborn, C. Y., & Mulvaney, S. A. (2013). Development and feasibility of a text messaging and interactive voice response intervention for low-income, diverse adults with type 2 diabetes mellitus. *Journal of Diabetes Science and Technology*, *7*(3), 612–622. https://doi.org/10.1177/193229681300700305

Özkan Şat, S., & Yaman Sözbir, Ş. (2018). Use of mobile applications and blogs by pregnant women in Turkey and the impact on adaptation to pregnancy. *Midwifery*, *62*(March), 273–277. https://doi.org/10.1016/j.midw.2018.04.001

Patel, A., Kuhite, P., Puranik, A., Khan, S. S., Borkar, J., & Dhande, L. (2018). Effectiveness of weekly cell phone counselling calls and daily text messages to improve breastfeeding indicators. *BMC Pediatrics*, *18*(1), 337. https://doi.org/10.1186/s12887-018-1308-3

Paul, I. M., Downs, D. S., Schaefer, E. W., Beiler, J. S., & Weisman, C. S. (2013). Postpartum anxiety and maternal-infant health outcomes. *Pediatrics*, *131*(4). https://doi.org/10.1542/peds.2012-2147

Paulson, J., & Bazemore, S. (2010). Prenatal and postpartum depression in fathers and its association with maternal depression: A meta-analysis. *JAMA*, *303*(19), 1961–1969.

Perinatal Services BC. (2016). *Postpartum and Newborn Care Summary Checklist for Primary Care Providers*.

Perriman, N., Davis, D. L., & Ferguson, S. (2018). What women value in the midwifery continuity of care model: A systematic review with meta-synthesis. *Midwifery*, *62*(April), 220–229. https://doi.org/10.1016/j.midw.2018.04.011

Petzoldt, J., Wittchen, H. U., Wittich, J., Einsle, F., Höfler, M., & Martini, J. (2014). Maternal anxiety disorders predict excessive infant crying: A prospective longitudinal study. *Archives of Disease in Childhood*, *99*(9), 800–806. https://doi.org/10.1136/archdischild-2013-305562

Pierce, M., Hope, H., Ford, T., Hatch, S., Hotopf, M., Kontopantelis, E., John, A., Webb, R. T., Wessely, S., McManus, S., & Abel, K. M. (2020). Mental Health Before and During the COVID-19 Pandemic: A Longitudinal Probability Sample Survey of the UK Population. *SSRN Electronic Journal*, *0366*(20), 1–10. https://doi.org/10.2139/ssrn.3624264

Plantin, L., & Daneback, K. (2009). Parenthood, information and support on the Internet. A literature review of research on parents and professionals online. *BMC Family Practice*, *10*, 34. https://doi.org/10.1186/1471-2296-10-34

Pollock, M. A., Amankwaa, L. C., & Amankwaa, A. A. (2005). First-Time Fathers and Stressors in the Postpartum Period. *Journal of Perinatal Education*, *14*(2), 19–25. https://doi.org/10.1624/105812405x44682

Poorman, E., Gazmararian, J., Parker, R. M., Yang, B., & Elon, L. (2015). Use of text messaging for maternal and infant health: A systematic review of the literature. *Maternal and Child Health Journal*, *19*(5), 969–989. https://doi.org/10.1007/s10995-014-1595-8

Porter, C. L., & Hsu, H. C. (2003). First-time mothers' perceptions of efficacy during the transition to motherhood: Links to infant temperament. *Journal of Family Psychology*, *17*(1), 54–64. https://doi.org/10.1109/ICUFN.2015.7182558

Prasad, V. (2018). *Efficacy of an electronic application to moderate symptoms or postpartum depression and improve postpartum well-being: A pilot study*. Texax A&M University - Corpus Christi.

Prenoveau, J. M., Craske, M. G., West, V., Giannakakis, A., Zioga, M., Lehtonen, A., Davies, B., Netsi, E., Cardy, J., Cooper, P., Murray, L., & Stein, A. (2017). Maternal postnatal depression and anxiety and their association with child emotional negativity and behavior problems at two years. *Developmental Psychology*, *53*(1), 50–62. https://doi.org/10.1037/dev0000221

Price, S. L., Aston, M., Monaghan, J., Sim, M., Tomblin Murphy, G., Etowa, J., Pickles, M., Hunter, A., & Little, V. (2018). Maternal Knowing and Social Networks: Understanding First-Time Mothers' Search for Information and Support Through Online and Offline Social Networks. *Qualitative Health Research*, *28*(10), 1552–1563. https://doi.org/10.1177/1049732317748314

Prinds, C., Hvidt, N. C., Mogensen, O., & Buus, N. (2014). Making existential meaning in transition to motherhood-A scoping review. *Midwifery*, *30*(6), 733–741. https://doi.org/10.1016/j.midw.2013.06.021

Public Health Agency of Canada. (2009). What Mothers Say: The Canadian Maternity Experiences Survey. In *2009*. http://www.publichealth.gc.ca/mes

Public Health Agency of Canada. (2020a). Chapter 3: Care during pregnancy. In *Family-Centred Maternity and Newborn Care: National Guidelines*. PHAC. https://www.canada.ca/en/public-health/services/publications/healthy-living/maternity-newborn-care-guidelines-chapter-3.html

Public Health Agency of Canada. (2020b). Chapter 5: Postpartum Care. In *Family-Centred Maternity and Newborn Care: National Guidelines.* PHAC.

Racine, N., Madigan, S., Plamondon, A., Hetherington, E., McDonald, S., & Tough, S. (2018). Maternal Psychosocial Risk Profiles in Pregnancy: Associations With Postpartum Maternal Health and Child Outcomes. *Clinical Psychological Science*. https://doi.org/10.1177/2167702618788863

Rawlyk, G. (2015). *Maritime Provinces*. The Canadian Encyclopedia.

Razurel, C., Kaiser, B., Antonietti, J. P., Epiney, M., & Sellenet, C. (2017). Relationship between perceived perinatal stress and depressive symptoms, anxiety, and parental self-efficacy in primiparous mothers and the role of social support. *Women and Health*, *57*(2), 154–172. https://doi.org/10.1080/03630242.2016.1157125

Razurel, C., Kaiser, B., Sellenet, C., & Epiney, M. (2013). Relation Between Perceived Stress, Social Support, and Coping Strategies and Maternal Well-Being: A Review of the Literature. *Women and Health*, *53*(1), 74–99. https://doi.org/10.1080/03630242.2012.732681

Reck, C., Noe, D., Gerstenlauer, J., & Stehle, E. (2012). Effects of postpartum anxiety disorders and depression on maternal self-confidence. *Infant Behavior and Development*, *35*(2), 264–272. https://doi.org/10.1016/j.infbeh.2011.12.005

Reproductive Care Program of Nova Scotia. (2002). *Healthy Babies, Healthy Families: Postpartum & Postnatal Guidelines*. 1–116. http://novascotia.ca/dhw/publications/Public-Health-Education/Postpartum Guidelines.pdf

Reproductive Care Program of Nova Scotia. (2016). *Quality Assessment Review: Newborn Transition from Hospital to Home Nova Scotia 2010-2015* (Issue February).

Richardson, B., Dol, J., Rutledge, K., Monaghan, J., Orovec, A., Howie, K., Boates, T., Smit, M., & Campbell-Yeo, M. (2018). Evaluation of Mobile Applications Targeted to Parents of Infants in the Neonatal Intensive Care Unit: A Systematic Review (Preprint). *JMIR MHealth and UHealth*, *7*. https://doi.org/10.2196/11620

Rodgers, A., Corbett, T., Bramley, D., Riddell, T., Wills, M., Lin, R. B., & Jones, M. (2005). Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tobacco Control*, *14*(4), 255–261. https://doi.org/10.1136/tc.2005.011577

Rodrigues, A. M., Sniehotta, F. F., Birch-Machin, M. A., Olivier, P., & Araújo-Soares, V. (2017). Systematic and Iterative Development of a Smartphone App to Promote Sun-Protection Among Holidaymakers: Design of a Prototype and Results of Usability and Acceptability Testing. *JMIR Research Protocols*, *6*(6), e112. https://doi.org/10.2196/resprot.7172

Ross, L. (2005). Perinatal Mental Health in Lesbian Mothers: A Review of Potential Risk and Protective Factors. *Women & Health*, *41*(3), 113–128. https://doi.org/10.1300/J013v41n03

Sample Size Calculator. (2014). Raosoft, Inc. http://www.raosoft.com/samplesize.html

Sardi, L., Idri, A., Readman, L. M., Alami, H., Bezad, R., & Fernández-Alemán, J. L. (2020). Mobile health applications for postnatal care: Review and analysis of functionalities and technical features. *Computer Methods and Programs in Biomedicine*, *184*, 105114. https://doi.org/10.1016/j.cmpb.2019.105114

Sayil, M., Gure, A., & Ucanok, Z. (2007). First Time Mothers' Anxiety and Depressive Symptoms Across the Transition to Motherhood: Associations with Maternal and Environmental Characteristics. *Women & Health*, *44*(3), 1–18. https://doi.org/10.1300/J013v44n03

Shafaie, F. S., Mirghafourvand, M., & Bagherinia, M. (2017). The association between maternal self-confidence and functional status in primiparous women during postpartum period, 2015-2016. *International Journal of Women's Health and Reproduction Sciences*, *5*(3), 200–204. https://doi.org/10.15296/ijwhr.2017.36

Shaw, E., Levitt, C., Wong, S., & Kaczorowski, J. (2006). Systematic review of the literature on postpartum care: Effectiveness of postpartum support to improve maternal parenting, mental health, quality of life, and physical health. *Birth*, *33*(3), 210–220. https://doi.org/10.1111/j.1523-536X.2006.00106.x

Shen, N., Levitan, M.-J., Johnson, A., Bender, J. L., Hamilton-Page, M., Jadad, A. (Alex) R., & Wiljer, D. (2015). Finding a Depression App: A Review and Content Analysis of the Depression App Marketplace. *JMIR MHealth and UHealth*, *3*(1), e16. https://doi.org/10.2196/mhealth.3713

Shorey, S., Chan, S. W. C., Chong, Y. S., & He, H. G. (2014). Maternal parental self-efficacy in newborn care and social support needs in Singapore: A correlational study. *Journal of Clinical Nursing*, *23*(15–16), 2272–2283. https://doi.org/10.1111/jocn.12507

Shorey, S., Chee, C. Y. I., Ng, E. D., Chan, Y. H., Tam, W. W. S., & Chong, Y. S. (2018). Prevalence and incidence of postpartum depression among healthy mothers: A systematic review and meta-analysis. *Journal of Psychiatric Research*, *104*(July), 235–248. https://doi.org/10.1016/j.jpsychires.2018.08.001

Shorey, S., Lau, Y., Dennis, C. L., Chan, Y. S., Tam, W. W. S., & Chan, Y. H. (2017a). A randomized-controlled trial to examine the effectiveness of the 'Home-but not Alone' mobile-health application educational programme on parental outcomes. *Journal of Advanced Nursing*, *73*(9), 2103–2117. https://doi.org/10.1111/jan.13293

Shorey, S., Ng, Y. P. M., Danbjørg, D. B., Dennis, C.-L., & Morelius, E. (2017b). Effectiveness of the 'Home-but not Alone' mobile health application educational programme on parental outcomes: a randomized controlled trial, study protocol. *Journal of Advanced Nursing*, *73*(1), 253–264. https://doi.org/10.1111/jan.13151

Shumaker, S. A., & Brownell, A. (1984). Toward a Theory of Social Support: Closing Conceptual Gaps. *Journal of Social Issues*, *40*(4), 11–36. https://doi.org/https://doi.org/10.1111/j.1540-4560.1984.tb01105.x

Sink, K. K. (2009). Seeking newborn information as a resource for maternal support. *The Journal of Perinatal Education*, *18*(3), 30–38. https://doi.org/10.1624/105812409X461207

Skouteris, H., Wertheim, E. H., Rallis, S., Milgrom, J., & Paxton, S. J. (2009). Depression and anxiety through pregnancy and the early postpartum: An examination of prospective relationships. *Journal of Affective Disorders*, *113*(3), 303–308. https://doi.org/10.1016/j.jad.2008.06.002

Slomian, J., Bruyère, O., Reginster, J. Y., & Emonts, P. (2017). The internet as a source of information used by women after childbirth to meet their need for information: A web-based survey. *Midwifery*, *48*(March), 46–52. https://doi.org/10.1016/j.midw.2017.03.005

SmartMom Mobile Health Education. (2020). *Smart Moms Canada*. Webpage. https://www.smartmomcanada.ca/

Smith, E. K., Gopalan, P., Glance, J. B., & Azzam, P. N. (2016). Postpartum depression screening: A review for psychiatrists. *Harvard Review of Psychiatry*, *24*(3), 173–187. https://doi.org/10.1097/HRP.0000000000000103

Smith, L. E., & Howard, K. S. (2008). Continuity of Paternal Social Support and Depressive Symptoms Among New Mothers. *Journal of Family Psychology*, *22*(5), 763–773. https://doi.org/10.1037/a0013581

Society of Obstetricians and Gynaecologists of Canada. (2020). *Postpartum health care and 6-week postpartum visit*. Webpage. https://www.pregnancyinfo.ca/postpartum/postpartum/postpartum-health-care-and-6-week-postpartum-visit/

Sondaal, S. F. V., Browne, J. L., Amoakoh-Coleman, M., Borgstein, A., Miltenburg, A. S., Verwijs, M., & Klipstein-Grobusch, K. (2016). Assessing the Effect of mHealth Interventions in Improving Maternal and Neonatal Care in Low- and Middle-Income Countries: A Systematic Review. *PloS One*, *11*(5), e0154664. https://doi.org/10.1371/journal.pone.0154664

Song, H., May, A., Vaidhyanathan, V., Cramer, E. M., Owais, R. W., & McRoy, S. (2013). A two-way text-messaging system answering health questions for low-income pregnant women. *Patient Education and Counseling*, *92*(2), 182–187. https://doi.org/10.1016/j.pec.2013.04.016

Spelke, B., & Werner, E. (2018). The Fourth Trimester of Pregnancy: Committing to Maternal Health and Well-Being Postpartum. *RIMJ Arches*, *101*(October), 30–33. http://www.ncbi.nlm.nih.gov/pubmed/30278599

Statistics Canada. (n.d.). *Live births, by place of residence of mother*. 2020. Retrieved June 10, 2020, from https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310041401&pickMembers%5B0%5D=2.8

Statistics Canada. (2011). *Population and Dwelling Count Highlight Tables, 2016 Census*. Census. http://www12.statcan.ca/census-recensement/2011/dp-pd/hlt-fst/pd-pl/Table-Tableau.cfm?LANG=Eng&T=703&PR=13&S=80&O=A&RPP=99

Statistics Canada. (2019a). *Annual demographic estimates: Canada, provinces and territories*. https://www150.statcan.gc.ca/n1/pub/91-215-x/91-215-x2019001-eng.htm

Statistics Canada. (2019b). *Maternal Mental Health in Canada, 2018/2019*. https://www150.statcan.gc.ca/n1/en/daily-quotidien/190624/dq190624b-eng.pdf?st=BwX67wnT

StGeorge, J. M., Fletcher, R. J., St George, J. M., Fletcher, R. J., StGeorge, J. M., & Fletcher, R. J. (2011). Fathers Online: Learning About Fatherhood Through the Internet. *The Journal of Perinatal Education*, *20*(3), 154–162. https://doi.org/10.1891/1058-1243.20.3.154

Stumbras, K., Rankin, K., Caskey, R., Haider, S., & Handler, A. (2016). Guidelines and Interventions Related to the Postpartum Visit for Low-Risk Postpartum Women in High and Upper Middle Income Countries. *Maternal and Child Health Journal*, *20*(1), 103–116. https://doi.org/10.1007/s10995-016-2053-6

Sword, W., Watt, S., & Krueger, P. (2006). Postpartum Health, Service Needs, and Access to Care Experiences of Immigrant and Canadian-Born Women. *JOGNN - Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *35*, 717–727. https://doi.org/10.1111/J.1552-6909.2006.00092.x

Sword, W., Watt, S., Krueger, P., Thabane, L., Landy, C. K., Farine, D., & Swinton, M. (2009). The Ontario Mother and Infant Study (TOMIS) III: A multi-site cohort study of the impact of delivery method on health, service use, and costs of care in the first postpartum year. *BMC Pregnancy and Childbirth*, *9*, 1–12. https://doi.org/10.1186/1471-2393-9-16

Takeuchi, S., & Horiuchi, S. (2016). Randomised controlled trial using smartphone website vs leaflet to support antenatal perineal massage practice for pregnant women. *Women and Birth*, *29*(5), 430–435. https://doi.org/10.1016/j.wombi.2016.01.010

Taylor, J., & Johnson, M. (2013). The role of anxiety and other factors in predicting postnatal fatigue: From birth to 6 months. *Midwifery*, *29*(5), 526–534. https://doi.org/10.1016/j.midw.2012.04.011

The GRADE Working Group. (2013). *Handbook for grading the quality of evidence and the strength of recommendations using the GRADE approach* (O. A. Schünemann H, Brożek J, Guyatt G (Ed.)). https://gdt.gradepro.org/app/handbook/handbook.html

The Joanna Briggs Institute. (2017). *Joanna Briggs Institute Reviewers' Manual*. https://wiki.joannabriggs.org/display/MANUAL/Joanna+Briggs+Institute+Reviewer's+Manual

The Nova Scotia Department of Health and Wellness. (2015a). *Breastfeeding Basics: Learning makes it natural*. https://novascotia.ca/dhw/healthy-communities/documents/Breastfeeding-Basics.pdf

The Nova Scotia Department of Health and Wellness. (2015b). *Loving Care: Birth to 6 Months*. https://novascotia.ca/dhw/lovingcare/docs/09045_LCBirthto6MonthsBook_En.pdf

The Vanier Institute of the Family. (2017). *In context: Understanding maternity care in Canada*. In Context Series. https://vanierinstitute.ca/context-understanding-maternity-care-canada/

Thiessen, K., Haworth-Brockman, M., Nurmi, M. A., Demczuk, L., & Sibley, K. M. (2020). Delivering Midwifery: A Scoping Review of Employment Models in Canada. *Journal of Obstetrics and Gynaecology Canada*, *42*(1), 61–71. https://doi.org/10.1016/j.jogc.2018.09.012

Toohill, J., Fenwick, J., Gamble, J., Creedy, D. K., Buist, A., Turkstra, E., & Ryding, E. L. (2014). A Randomized Controlled Trial of a Psycho-Education Intervention by Midwives in Reducing Childbirth Fear in Pregnant Women. *Birth*, *41*(4), 384–394. https://doi.org/10.1111/birt.12136

Tufanaru, C., Munn, Z., Stephenson, M., & Aromataris, E. (2015). Fixed or random effects meta-analysis? Common methodological issues in systematic reviews of effectiveness. *International Journal of Evidence-Based Healthcare*, *13*(3), 196–207. https://doi.org/10.1097/XEB.0000000000000065

Tully, K. P., Stuebe, A. M., Verbiest, S. B., Parides, M., Bickell, N., & Leventhal, H. (2017). The fourth trimester: a critical transition period with unmet maternal health needs. *American Journal of Obstetrics and Gynecology*, *127*(0), e86–e92. https://doi.org/10.1016/j.ajog.2017.03.032

Twilio. (2018). *Twilio*. https://www.twilio.com

van den Heuvel, J., Groenhof, K., Veerbeek, J., van Solinge, W., Lely, A., Franx, A., & Bekker, M. (2018). eHealth as the Next-Generation Perinatal Care : An Overview of the Literature. *Journal of Medical Internet Research*, *20*(6), e202. https://doi.org/10.2196/jmir.9262

Verbiest, S., Bonzon, E., & Handler, A. (2016). Postpartum Health and Wellness: A Call for Quality Woman-Centered Care. *Maternal and Child Health Journal*, *20*(1), 1–7. https://doi.org/10.1007/s10995-016-2188-5

Verbiest, S., Tully, K. P., & Stuebe, A. M. (2017). Promoting Maternal and Infant Health in the 4th Trimester. In *Zero to Three*.

Walker, L., Mackert, M. S., Ahn, J., Vaughan, M. W., Sterling, B. S., Guy, S., & Hendrickson, S. (2017). e-Health and new moms: Contextual factors associated with sources of health information. *Public Health Nursing*, *34*(6), 561–568. https://doi.org/10.1111/phn.12347

Walker, L., Murphey, C. L., & Nichols, F. (2015). The broken thread of health promotion and disease prevention for women during the postpartum period. *The Journal of Perinatal Education*, *24*(2), 81–92. https://doi.org/10.1891/1058-1243.24.2.81

Walker, L. O., Xie, B., Hendrickson, S. G., & Sterling, B. S. (2016). Behavioral and Psychosocial Health of New Mothers and Associations With Contextual Factors and Perceived Health. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *45*(1), 3–16. https://doi.org/10.1016/j.jogn.2015.10.012

Walker, S. B., Rossi, D. M., & Sander, T. M. (2019). Women's successful transition to motherhood during the early postnatal period: A qualitative systematic review of postnatal and midwifery home care literature. *Midwifery*, *79*, 102552. https://doi.org/10.1016/j.midw.2019.102552

Warren, C., Daly, P., Toure, L., Mongi, P., & NICE. (2015). Postnatal care. In J. Lawn & K. Kerber (Eds.), *Opportunities for African newborns* (Issue July 2013). Partnership for Maternal, Newborn, and Child Health. nice.org.uk/guidance/qs37%0A©

Wen, K.-Y., Miller, S. M., Kilby, L., Fleisher, L., Belton, T. D., Roy, G., & Hernandez, E. (2014). Preventing Postpartum Smoking Relapse Among Inner City Women: Development of a Theory-Based and Evidence-Guided Text Messaging Intervention. *JMIR Research Protocols*, *3*(2), e20. https://doi.org/10.2196/resprot.3059

Whitaker, C., Stevelink, S., & Fear, N. (2017). The use of Facebook in recruiting participants for health research purposes: A systematic review. *Journal of Medical Internet Research*, *19*(8). https://doi.org/10.2196/jmir.7071

Whittaker, R., Matoff-Stepp, S., Meehan, J., Kendrick, J., Jordan, E., Stange, P., Cash, A., Meyer, P., Baitty, J., Johnson, P., Ratzan, S., & Rhee, K. (2012). Text4baby: Development and implementation of a national text messaging health information service. *American Journal of Public Health*, *102*(12), 2207–2213. https://doi.org/10.2105/AJPH.2012.300736

WHO/UNICEF, & World Health Organization. (2008). *Home visits for the newborn child: a strategy to improve survival*. http://www.unicef.org/health/files/WHO_FCH_CAH_09.02_eng.pdf

Wiklund, I., Wiklund, J., Pettersson, V., & Boström, A. M. (2018). New parents' experience of information and sense of security related to postnatal care: A systematic review. *Sexual and Reproductive Healthcare*, *17*(May), 35–42. https://doi.org/10.1016/j.srhc.2018.06.001

Willoughby, J. F., & Furberg, R. (2015). Underdeveloped or underreported? Coverage of pretesting practices and recommendations for design of text message-based health behavior change interventions. *Journal of Health Communication*, *20*(4), 472–478. https://doi.org/10.1080/10810730.2014.977468

Wittkowski, A., Garrett, C., Calam, R., & Weisberg, D. (2017). Self-Report Measures of Parental Self-Efficacy: A Systematic Review of the Current Literature. *Journal of Child and Family Studies*, *26*(11), 2960–2978. https://doi.org/10.1007/s10826-017-0830-5

Woody, C. A., Ferrari, A. J., Siskind, D. J., Whiteford, H. A., & Harris, M. G. (2017). A systematic review and meta-regression of the prevalence and incidence of perinatal depression. *Journal of Affective Disorders*, *219*(April), 86–92. https://doi.org/10.1016/j.jad.2017.05.003

Woolhouse, H., Gartland, D., Perlen, S., Donath, S., & Brown, S. J. (2014). Physical health after childbirth and maternal depression in the first 12 months post partum: Results of an Australian nulliparous pregnancy cohort study. *Midwifery*, *30*(3), 378–384. https://doi.org/10.1016/j.midw.2013.03.006

World Bank Group. (2020). *World Bank Country and Lending Groups*. World Bank. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

World Health Organization. (2010). *WHO technical consultation on postpartum and postnatal care*. http://apps.who.int/iris/bitstream/handle/10665/70432/WHO_MPS_10.03_eng.pdf?sequence=1%0Ahttp://www.who.int/maternal_child_adolescent/documents/WHO_MPS_10_03/en/

World Health Organization. (2011). *mHealth: New Horizons for Health through Mobile Technologies*. World Health Organization. https://doi.org/10.4258/hir.2012.18.3.231

World Health Organization. (2013). *Postnatal care of the mother and newborn 2013*. World Health Organization. https://doi.org/978 92 4 150664 9

World Health Organization. (2016). *WHO Recommendation on Antenatal care for positive pregnancy experience*. https://doi.org/ISBN 978 92 4 154991 2

World Health Organization. (2018). *Intrapartum care for a positive childbirth experience*. World Health Organization. http://apps.who.int/iris/bitstream/10665/260178/1/9789241550215-eng.pdf?ua=1%0Ahttp://www.who.int/reproductivehealth/publications/intrapartum-care-guidelines/en/

Wynter, K., Rowe, H., & Fisher, J. (2013). Common mental disorders in women and men in the first six months after the birth of their first infant: A community study in Victoria, Australia. *Journal of Affective Disorders*, *151*(3), 980–985. https://doi.org/10.1016/j.jad.2013.08.021

Ybarra, M. L., Holtrop, J. S., Bosi, A. T. B., & Emri, S. (2012). Design considerations in developing a text messaging program aimed at smoking cessation. *Journal of Medical Internet Research*, *14*(4). https://doi.org/10.2196/jmir.2061

Yonemoto, N., Dowswell, T., Nagai, S., & Mori, R. (2017). Schedules for home visits in the early postpartum period. *Cochrane Library*, *7*. https://doi.org/10.1002/14651858.CD009326.pub3.www.cochranelibrary.com

Zimet, G. D., Dahlem, N., Zimet, S. G., & Farley, G. K. (1988). The multidemensional scale of perceived social support. *Journal of Personality Assessment*, *52*(1), 30–41.

Zimet, G. D., Powell, S. S., Farley, G. K., Werkman, S., & Berkoff, K. A. (1990). Psychometric Characteristics of the Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, *55*(3–4), 610–617. https://doi.org/10.1080/00223891.1990.9674095

Zuidgeest, M. G. P., Goetz, I., Groenwold, R. H. H., Irving, E., van Thiel, G. J. M. W., & Grobbee, D. E. (2017). Series: Pragmatic trials and real world evidence: Paper 1. Introduction. *Journal of Clinical Epidemiology*, *88*, 7–13. https://doi.org/10.1016/j.jclinepi.2016.12.023

Appendix A: Essential Coaching for Every Mother Original Messages

* Indicates messages sent to both control and intervention groups

Message type includes education, reminder, social support, interactive

N.B. These messages on currently organized by topic for ease of review. Once the messages are finalized, they will be rearranged to send messages on different topics each day throughout the six-week period.

Message	**Topic**	**Message Type**
Hi [mothers name]! Welcome to the Essential Coaching for Every Mother study. We are happy you are joining us. You will receive messages starting after birth.	Study	Welcome message*
We are so happy you are part of this study. However, if you want to stop receiving these messages at any time, just text "STOP".	Study	Welcome message* Reminder*
If your baby passes away or is seriously ill and want to stop receiving message, you can message "STOP" at any time.	Study	Reminder*
If messages "STOP": Sorry to see you go, this is your last message from us. If you are willing, could you let us know why you want to stop receiving these messages?	Study	Interactive*
[Part 1] Hi [mother's name]! Welcome home. Breastmilk is best for your baby for the first six months. Babies do not need supplements during the first 6 months. [Part 2] While breastfeeding is important, if you use formula, ensure you use only clean water and bottles. If the water is dirty or bottles are dirty, your baby can become sick and unwell.	Feeding	Education
It is normal for [child's name] to feed 8-12 times per day. [Child's name] may experience lots of growing during the next 6 weeks. Frequent feedings is a sign of a healthy baby.	Feeding	Education
[Child's name] might be ready to breastfeed if they open their eyes, looks towards your breast, tilts head back slightly, tongue is down and forward, and their mouth is open.	Feeding	Education
Some moms have trouble with breastfeeding. You can seek additional help through lactation consultations, your	Feeding	Social Support

family doctor, nurse practitioner a public health nurse, or family resource center.		
Hi [mother's name], have you checked the temperature of [child's name] this morning? If it feels high for a few hours and you are worried, you seek medical help.	Fevers	Education
To measure your baby's temperature, you can put a thermometer under their armpit. If it is over 37.5 degrees C, this is high, and you should seek medical help.	Fevers	Education
If [child's name] has a fever or feels cold to the touch, make sure you seek immediate care. This is a sign of an infection and [child's name] might need to see a healthcare provider.	Fevers	Education
Hi [mother's name], have you checked the temperature of [child's name] this morning? Reply 1 if yes and 2 if no. If reply was yes: Great job! Remember, if [child's name] temperature is above 37.5 degrees or hot or cold to the touch, this is a concern and you should seek medical help. If reply was no: That's okay, you can do it now. Remember, if [child's name] temperature is above 37.5 degrees or hot or cold to the touch, this is a concern and you should seek medical help.	Fevers	Interactive
Has [child's name] stopped feeding? This is a danger sign and you should visit your nearest hospital or clinic as soon as possible.	Danger sign - feeding	Education
If you are having trouble feeding due to breast pain or if [child's name] does not want to feed, your doctor, midwife or nurse practitioner can help. A visit to a hospital or a medical center is recommended.	Danger sign – feeding	Education
When [child's name] is 6 days old, they usually have at least 6 wet diapers a day and should poop at least once per day. If they don't, this could be a sign of feeding issues.	Danger sign – feeding	Education
Some moms have trouble recognizing trouble feeding. If you have any doubts, seek medical help. It is better to seek help – you don't need to do it alone.	Danger sign – feeding	Social support
Check your baby's breathing. If [child's name] is breathing faster than one breathe a second for 10-15 minutes, this is a danger sign. Seek medical help immediately.	Danger sign - breathing	Education
To check your baby's breathing, put your ear next to [child's name] mouth and nose and listen for sounds of	Danger sign – breathing	Education

breath. If it over 60 breaths per minute, you should seek medical help.		
If it looks like your baby is working hard to breathe, you should go visit your doctor. To check, you can put your ear next to [child's name] mouth, watch for chest movement.	Danger sign – breathing	Education
Hi [mothers name]. Let's check your baby's breathing. Can you count how many times [child's name] chest rises and falls in the next minute and let me know a number? If between 40-60: This is good. Your baby is breathing well. If it increases to over 60 per minute, make sure you seek medical help right away. If above 60: Oh this is not good. You should take [child's name] to a clinic or hospital as soon as you can. They might need some help from a healthcare provider.	Danger sign – breathing	Interactive
If you notice [child's name] moving a lot less or their arms and legs are floppy visit your nearest healthcare provider. This is a danger sign.	Danger sign – Poor movement	Education
When active, your baby should freely move their arms and legs on both sides. [Child's name] limbs should be flexed at rest. Visit your healthcare provider if you are concerned.	Danger sign – Poor movement	Education
A baby should move spontaneously on their own. If they don't move until you move them, seek medical help. This could be a danger sign.	Danger sign – Poor movement	Education
Lots of moms have questions about caring for a newborn. You know your baby better than anyone. If [child's name] stops moving on their own, is limp, and unresponsive to your touch, seek medical help immediately.	Danger sign – Poor movement	Social support
While rare, if [child's name] has seizures, seek immediate medical care. This can be a sign of a serious problem.	Danger sign - Convulsions	Education
Seizures involve quick jerking movements involving one arm or leg or even the whole body. If this happens, seek immediate medical care from your doctor.	Danger sign – Convulsions	Education
If your baby has a seizure, it is important to protect [baby's name] from injury. Call 911 if your baby has trouble breathing, turns blue, seizes for more than five minutes.	Danger sign – Convulsions	Education
Lots of moms have questions about caring for a newborn. You know your baby better than anyone. If	Danger sign – Convulsions	Social Support

your baby is showing signs of jerking movements, go a healthcare provider immediately.		
Jaundice can be checked by looking at [child's name] hands or feet. If they look yellow in the face, palms, soles or limbs, seek professional help.	Danger sign – Jaundice	Education
If [child's name] hand, feet, or eyes look yellow, this may be jaundice, a serious health concern. Treatment is simple and effective if you seek medical help.	Danger sign – Jaundice	Education
Today is day 3. It is recommended you check your baby for signs of jaundice. If you notice any worsening yellowing of the skin, notify your healthcare provider.	Danger sign – Jaundice	Education
Many moms notice jaundice within 1-4 days of taking their babies home. If you notice that [child's name] has yellow hands and feet, be sure to seek medical help.	Danger sign – Jaundice	Social Support
If [child's name] umbilical cord is red or oozing pus, this is a sign of infection. Go to a medical center to get [child's name] some help.	Danger sign – cord infection	Education
When you get home from the hospital, make sure [child's name] cord is kept dry and clean. This will help stop [child name] from getting an infection in their umbilical cord.	Danger sign – cord infection	Education
Signs of infection can include a foul-smelling discharge, red skin around the umbilical cord, or if the cord or skin around it becomes tender. If this happens, call your healthcare provider.	Danger sign – cord infection	Education
Some moms worry about their child's umbilical cords. While the stump usually falls off within 1-2 weeks after birth, it may take longer. Keep it dry and clean until it does.	Danger sign – cord infection	Social Support
It is important to not put anything on [child's name] umbilical cord. It is best when kept dry and clean.	Cord care	Education
Make sure [child's name] umbilical cord is kept outside their diaper to help prevent infection. If the cord does becomes dirty, you can wipe it with a clean cloth.	Cord care	Education
You can keep the umbilical cord exposed to air or loosely covered by a clean cloth by folding your baby's diaper down. This will stop the cord from getting soaked with urine.	Cord care	Education
Since [child's name] has been delivered, have you put anything on their umbilical cord? If yes: It is best to keep your baby's umbilical cord dry and clean to prevent infections. If no: That's great! It is best to keep your baby's umbilical cord dry and clean or use	Cord care	Interactive

It is important to wash your hands after using the toilet or cooking and before touching [child's name] to prevent infections.	Handwashing	Education
Every time you clean [child's name] diaper, make sure you wash your hands before picking up [child's name]! This is important to stop infections.	Handwashing	Education
Keep yourself and your baby clean is important to prevent infections. Regular handwashing is important.	Handwashing	Education
Being a mom is hard work! So much to remember and do. It is especially important to wash your hands frequently and always before you touch your baby to prevent spreading infections.	Handwashing	Social support
[Child's name] can get cold very easily. When bathing [child's name], use warm water and dry them quickly when finished. Keep the room at a warm temperature.	Thermal care	Education
Each morning when getting [child's name] dressed, make sure you cover [child's name] in a clean, dry blanket to keep them warm. Make sure their head is covered too.	Thermal care	Education
Skin-to-skin contact is when you hold [child's name] unclothed directly to your bare and covered with a blanket. This keeps [child's name] warm. Try it today.	Thermal care	Interactive
Many moms enjoy doing skin-to-skin with their babies because it helps to bond with their baby, keeps their baby warm, and helps to breastfeed better.	Thermal care	Social Support
While many mothers are aware of signs of postpartum depression, feelings of anxiety are also common. Your healthcare provider can help if you are feeling anxious.	Anxiety	Education
Feelings of postpartum anxiety can include excessive and persistent fear, worry, tension as well as sleeping difficulties and inability to concentrate. Your healthcare provider can help.	Anxiety	Education
Severe postpartum anxiety symptoms can include panic and recurrent unpleasant thoughts or images, often related to the harm of your child. Seek medical care if you are concerned.	Anxiety	Education
Did you know that 18% of mothers report feeling increased anxiety between up to birth and 4 weeks postpartum? You are not alone if you feel anxious. Contact your healthcare provider if you are concerned.	Anxiety	Social support
Symptoms of postpartum depression can include anxiety, guilt, negative maternal attitudes and attachment, poor parenting self-efficacy and coping skills. Your healthcare provider can help.	Depression	Education

Mood swings are common after giving birth. Talking about your feelings with someone you trust can help you cope with feelings of 'baby blues'.	Depression	Education
Feelings of sadness or dips in moods can start as early as 3 days post birth. If feelings of sadness last longer than 2 weeks or worsen over time, seek help from your healthcare provider.	Depression	Education
17% of mothers in Canada experience some feelings of postpartum depression. You are not alone if you are feeling sad or depressed. Your healthcare provider can help.	Depression	Social support
I know it feels like you just gave birth, but a public health nurse should come by to visit you within the first week. Please contact your public health office if they don't.	PNC follow-up	Reminder*
Today is six-weeks since you had your baby. Congratulations! Please visit your healthcare provider today for you and [newborn's name] check-up.	PNC Follow-up	Reminder*
Have you attended any postnatal care follow-up appointments for yourself or your baby? Reply 1 if yes, let us know how many. Reply 2 if you have not yet had your follow-up. If Yes: This is great! You are doing a great job taking care of yourself and [child's name]. If No: That's okay, there is still time. You should try to go as soon as you can to ensure the best health for you and [child's name]	PNC Follow-up	Interactive*
Thank you for participating in the *Essential Coaching for Every Mother* study. Please complete the survey to help us understand how it helped you: [survey link]. We also emailed you the same link. Please complete this as soon as possible.	Study	Interactive*
Hi [Mom Name]. Just a reminder to please complete the survey now that the study has finished to help us understand how it helped you: [survey link]. We also emailed you the same link. Please complete this as soon as possible.	Study	Interactive*
Hi [Mom Name]. Just a reminder to please complete the survey now that the study has finished to help us understand how it helped you: [survey link]. If we don't hear from you within the next few days, someone from the research team will call you to complete the survey by phone.	Study	Interactive*

Appendix B: Essential Coaching for Every Mother – Phase I Interview Guide (Mothers)

ESSENTIAL COACHING FOR EVERY MOTHER MESSAGE FEEDBACK

[For each topic, please provide the list of text messages to each participant. Then ask the following questions, prompting if necessary. Repeat for each topic area until completed.]

- How would you feel about receiving these SMS' during your first six-weeks after your infant was born?
- Does anything come to mind when you read the messages on this topic? Are there any words that you did not understand?
- Was anything in this unacceptable or offensive?
- Is there a different way you would say this? If so, how would you like this message to be shared with you?
- Do you think these messages are sufficient for this topic? Is there anything you would add/remove?
- When during the first six-weeks would you prefer to receive this message? *Prompt: would you like it closer to discharge? Anytime?*

[Once the participant has completed the above for each of the topics, please proceed to the following questions.]

Thank you for providing this feedback. I have a few other general questions about the messages.

1. Is there additional information you would like to have that was not covered in the SMS'?

2. Do you feel that this information would be helpful to you as a new mother? Why/Why not?
3. Do you see any challenges with receiving information related to caring for your baby via SMS? If so, please describe.
4. What areas of caring for your baby do you feel unsure about?
5. What areas of caring for your baby do you feel confident about?

Thank you for answering these questions. I now have a brief survey for you to complete on your own. It should only take a few minutes.

IAM-PARENT SURVEY (Bujold et al., 2018)

For the following questions, please reflect on the messages as a whole.

1. Is this information relevant?

 Very relevant (this is the information I expected)

 Relevant

 Somewhat relevant

 Not very relevant (this is not the information I expected)

2. Do you understand this information?

 Very well (I completely understood)

 Well

 Poorly

 Very poorly (I did not understand much)

3. What do you think about this information? Check all that apply

 This information teaches me something new

- ☐ This information allows me to validate what I do or I did
- ☐ This information reassures me
- ☐ This information refreshes my memory
- ☐ This information motivates me to learn more
- ☐ I think there is a problem with this information
- ☐ I disagree with this information
- ☐ This information can have negative consequences
- ☐ Please tell us what the possible negative consequences are

4. Will you use this information?

☐ Yes ☐ No

If yes, how will you use this information for you or your child? Check all that apply.

- ☐ This information will help me to better understand something
- ☐ I did not know what to do, and this information will help me to do something
- ☐ I knew what to do, and this information convinced me to do it
- ☐ I will use this information to do something in a different manner
- ☐ I will use this information to speak with someone

5. Do you expect any benefit for you and/or your child from using this information?

   Check all that apply.

- ☐ This information will help me to improve the health or well-being of my child
- ☐ This information will help me to be less worried
- ☐ This information will help me to prevent a problem or the worsening of a problem
- ☐ This information will help me to handle a problem
- ☐ This information will help me to be better prepared to speak with someone

- □ This information will help me to be more confident to make a decision about something with someone
- □ No, I expect no benefits

ADDITIONAL FEEDBACK

6. Would you have liked to receive these messages during you first six-weeks after the birth of your newborn?

□ Yes □ Maybe □ No □ Not sure

   a. Please explain your answer:

7. If you were to receive these messages, how often they would like to receive such messages?

□ Once per day □ Twice per day □ Every 2 days □ Every 3 days

□ Every 4 days □ Every 5 days □ Every 6 days □ Once a week

□ Every other week □ Other: □ Not sure □ No response

8. When during the day they would like to receive these messages?

□ Early morning □ Late morning □ Early Afternoon □ Late afternoon

□ Evening □ No preference □ Not sure □ No response

DEMOGRAPHICS

Please complete the following demographic questions.

1. What is your year of birth? _____ __Prefer not to answer
2. What is your postal code? _____ __Prefer not to answer

3. During your pregnancy, which type of caregiver was most directly involved in providing you care?

    - An obstetrician-gynecological doctor
    - Family doctor
    - A midwife
    - Nurse Practitioner
    - A nurse who was not a midwife
    - Other (list):_____
    - Not sure
    - Prefer not to answer

4. Do you consider yourself:

    - White/European
    - Black or African American/Nova Scotian
    - Asian
    - Middle-Eastern
    - Aboriginal
    - Other:
    - Prefer not to answer

5. What is your income?

    - Under $29,999
    - $30,000-$49,999
    - $50,000-$74,999
    - $75,000-$119,999

- $120,000-$149,000
- $150,000 or greater
- Prefer not to answer

6. What is your current occupation (prior to your maternity leave, if applicable)?

__Prefer not to answer

7. What is your marital status?

- Single
- In a relationship
- Common-law
- Married
- Separated
- Divorced
- Widowed
- Prefer not to answer

8. What is the highest level of education you have achieved?

- Primary school
- Some high school
- High school diploma
- Some college but no degree
- College diploma
- Some university but no degree
- University degree (BA, BSc)
- Graduate degree (MSc, PhD)

- Prefer not to answer

Please complete the following demographic questions about your newborn.

9. What was the date of your infant's birth? DD:_____MM:___ YY:__
10. What was your infant's birth weight? _____ grams __ Prefer not to answer
11. What is your infants' sex? __ Male __ Female __ Other
12. What was the delivery method?

    - Caesarian section
    - Vaginal birth
    - Prefer not to answer

13. Was this a planned pregnancy?

    __Yes __ No __ Prefer not to answer

14. Did you provide skin-to-skin contact immediately after birth?

    __Yes __ No __Don't recall __ Prefer not to answer

15. Did you provide skin-to-skin contact at least once before discharge?

    __Yes __ No __Don't recall __ Prefer not to answer

16. Did you breastfeed within 1 hour after birth?

    __Yes __ No __Don't recall __ Prefer not to answer

17. Did you breastfeed at least once before discharge?

    __Yes __ No __Don't recall __ Prefer not to answer

Appendix C: Essential Coaching for Every Mother – Phase I Interview Guide (Healthcare Providers)

ESSENTIAL COACHING FOR EVERY MOTHER MESSAGE FEEDBACK

[For each topic, please provide the list of text messages to each participant. Then ask the following questions, prompting if necessary. Repeat for each topic area until completed.]

- How would you feel about these SMS' being sent to mothers during their first six-weeks after their infant was born?
- Does anything come to mind when you read this? Are there any words that you did not understand?
- Was anything in this unacceptable or offensive?
- Is there a different way you would say this? If so, how would you like this message to be shared with mothers?
- Do you think these messages are sufficient for this topic? Is there anything you would add/remove?
- When during the first six-weeks do you think mothers should to receive these messages? *Prompt: close to discharge? Anytime?*

ADDITIONAL FEEDBACK

Next, I would just like to ask you a few questions providing this information to new mothers from your perspective as a healthcare provider.

1. If you were to provide these messages to new mothers, how often do you think these messages should be sent?

□ Once per day □ Twice per day □ Every 2 days □ Every 3 days

□ Every 4 days □ Every 5 days □ Every 6 days □ Once a week

□ Every other week □ Other: □ Not sure □ No response

2. When during the day do you think it would be best for mothers to receive these messages?

□ Early morning □ Late morning □ Early Afternoon □ Late afternoon

□ Evening □ No preference □ Not sure □ No response

3. Is there additional information you would like to see included that was not covered in the SMS?
4. Do you feel that this information would be helpful to new mothers? Why/Why not?
5. Do you see any challenges with providing information for mothers related to caring for their baby via SMS? If so, please describe.

DEMOGRAPHICS

Next, I would just like to ask you a few demographic questions.

1. What is your role?

□ Staff Nurse (Postpartum unit)

□ Public Health Nurse

□ Advanced Practice Nurse

□ Nurse practitioner

□ Family Doctor

□ Staff Physician

□ Fellow

□ Resident

- Occupational Therapist
- Social worker
- Reproductive Care Program representative
- Other _____

2. Please indicate the number of years working professionally (overall). ___
3. Please indicate the number of years working with postpartum mothers/newborns ___
4. Please indicate the number of years in current role in current setting ____
5. What is your sex?
   - Male
   - Female
   - Other: _____
   - Prefer not to answer
6. What is your age? ____
7. Do you consider yourself:
   - White/European
   - Black or African American/Nova Scotian
   - Asian
   - Middle-Eastern
   - Aboriginal
   - Other:
   - Prefer not to answer

Appendix D: Search Strategy

PubMed Date Searched: December 16, 2018. English language only. Records retrieved = 1144.

(Self Efficacy[MeSH Terms] OR Self Concept[MeSH Terms] OR Anxiety[MeSH Terms] OR Depression[MeSH Terms] OR Depression, Postpartum[MeSH Terms] OR Social Support[MeSH Terms] OR Maternal Health[MeSH Terms] OR Maternal Behavior[MeSH Terms] OR Self Care[MeSH Terms] OR Psychosocial Deprivation[MeSH Terms] OR self-efficacy[Title/Abstract] OR "social support"[Title/Abstract] OR depression[Title/Abstract] OR depressed[Title/Abstract] OR depressive[Title/Abstract] OR anxiety[Title/Abstract] OR anxious*[Title/Abstract] OR confidence[Title/Abstract] OR "maternal health"[Title/Abstract] OR "self care"[Title/Abstract] OR self concept[Title/Abstract] OR psychosocial[Title/Abstract] OR psycho-social[Title/Abstract]) AND (family[Title/Abstract] OR familial[Title/Abstract] OR maternal[Title/Abstract] OR paternal[Title/Abstract] OR caregiver*[Title/Abstract] OR mother*[Title/Abstract] OR father*[Title/Abstract] OR parent[Title/Abstract] OR parents[Title/Abstract] OR parental[Title/Abstract] OR parenting[Title/Abstract] OR women[Title/Abstract] OR woman[Title/Abstract] OR parents[MeSH Terms] OR caregiver[MeSH Terms] OR caregiver, family[MeSH Terms]) AND (neonatal[Title/Abstract] OR postnatal[Title/Abstract] OR post-natal[Title/Abstract] OR postpartum[Title/Abstract] OR post-partum[Title/Abstract] OR newborn*[Title/Abstract] OR baby[Title/Abstract] OR babies[Title/Abstract] OR infant[Title/Abstract] OR infants[Title/Abstract] OR infancy[Title/Abstract] OR neonat*[Title/Abstract] OR antenatal[Title/Abstract] OR prenatal[Title/Abstract] OR pre-

natal[Title/Abstract] OR ante-natal[Title/Abstract] OR perinatal[Title/Abstract] OR peri-natal[Title/Abstract] OR pregnant[Title/Abstract] OR pregnancy[Title/Abstract] OR postpartum[MeSH Terms] OR postnatal care[MeSH Terms] OR Infant, Newborn[MeSH Terms] OR care, prenatal[MeSH Terms] OR prenatal education[MeSH Terms] OR Perinatal Care[MeSH Terms]) AND (eHealth[Title/Abstract] OR e-Health[Title/Abstract] OR mHealth[Title/Abstract] OR m-Health[Title/Abstract] OR mobile health[Title/Abstract] OR cellphone*[Title/Abstrast] OR cell-phone*[Title/Abstract] OR information technology[Title/Abstract] OR FaceTime[Title/Abstract] OR smartphone*[Title/Abstract] OR smart phone*[Title/Abstract] OR mobile phone*[Title/Abstract] OR iPhone*[Title/Abstract] OR iPad*[Title/Abstract] OR handheld[Title/Abstract] OR text messag*[Title/Abstract] OR tele-medicine[Title/Abstract] OR telemedicine[Title/Abstract] OR tele-health[Title/Abstract] OR telehealth[Title/Abstract] OR SMS[Title/Abstract] OR MMS[Title/Abstract] OR cell phone[MeSH Terms] OR text messaging[MeSH Terms] OR telemedicine[MeSH Terms] OR mobile health[MeSH Terms] OR mobile phone[MeSH Terms] OR medical informatics[MeSH Terms] OR computer, handheld[MeSH Terms])

Embase Date Searched: December 16, 2018. English language only. Records retrieved = 597.

'self concept'/exp OR 'anxiety'/exp OR 'postnatal depression'/exp OR 'depression'/exp OR 'social support'/exp OR 'maternal care'/exp OR 'maternal behavior'/exp OR 'self care'/exp OR 'social psychology'/exp OR 'self-efficacy':ti,ab,kw OR 'social support':ti,ab,kw OR

'depression':ti,ab,kw OR 'depressed':ti,ab,kw OR ‘depressive’:ti,ab,kw OR 'anxiety':ti,ab,kw OR ‘anxious’:ti,ab,kw OR 'confidence':ti,ab,kw OR 'maternal health':ti,ab,kw OR 'self care':ti,ab,kw OR 'psychosocial':ti,ab,kw OR 'psycho-social':ti,ab,kw OR ‘self concept’:ti,ab,kw AND 'family':ti,ab,kw OR 'familial':ti,ab,kw OR 'maternal':ti,ab,kw OR 'paternal':ti,ab,kw OR 'caregiver*':ti,ab,kw OR 'mother*':ti,ab,kw OR 'father*':ti,ab,kw OR 'parent':ti,ab,kw OR 'parents':ti,ab,kw OR 'parental':ti,ab,kw OR 'parenting':ti,ab,kw OR 'women':ti,ab,kw OR 'woman':ti,ab,kw OR 'family history':ti,ab,kw OR 'parent'/exp OR 'caregiver'/exp OR 'family'/exp AND 'perinatal period'/exp OR 'prenatal care'/exp OR 'postnatal care'/exp OR 'childbirth education'/exp OR 'newborn'/exp OR 'neonatal':ti,ab,kw OR 'postnatal':ti,ab,kw OR 'post-natal':ti,ab,kw OR 'postpartum':ti,ab,kw OR 'post-partum':ti,ab,kw OR 'newborn*':ti,ab,kw OR 'baby':ti,ab,kw OR 'babies':ti,ab,kw OR 'infant':ti,ab,kw OR 'infants':ti,ab,kw OR ‘infancy’:ti,ab,kw OR 'neonat*':ti,ab,kw OR 'antenatal':ti,ab,kw OR 'prenatal':ti,ab,kw OR 'pre-natal':ti,ab,kw OR 'ante-natal':ti,ab,kw OR 'perinatal':ti,ab,kw OR ‘peri-natal’:ti,ab,kw OR 'pregnant':ti,ab,kw OR 'pregnancy':ti,ab,kw AND 'ehealth':ti,ab,kw OR 'mhealth':ti,ab,kw OR 'mobile health':ti,ab,kw OR 'information technology':ti,ab,kw OR 'facetime':ti,ab,kw OR 'smartphone*':ti,ab,kw OR 'iphone*':ti,ab,kw OR 'ipad*':ti,ab,kw OR 'handheld computer*':ti,ab,kw OR 'text messag*':ti,ab,kw OR 'sms':ti,ab,kw OR 'mms':ti,ab,kw OR 'e-health':ti,ab,kw OR 'm-health':ti,ab,kw OR 'smart phone':ti,ab,kw OR 'cellphone':ti,ab,kw OR 'cell phone':ti,ab,kw OR 'telemedicine':ti,ab,kw OR 'tele-medicine':ti,ab,kw OR 'tele-health':ti,ab,kw OR 'telehealth':ti,ab,kw OR 'mobile phone*':ti,ab,kw OR 'mhealth'/exp

OR 'mobile phone'/exp OR 'mobile health'/exp OR 'text messaging'/exp OR 'medical informatics'/exp

CINAHL Date Searched: December 16, 2018. English language only. Records retrieved = 248.

(AB (self-efficacy or “social support” or depression or depressed or anxiety or confidence or “maternal health” or “self care” or psychosocial or psycho-social)) OR (TI (self-efficacy or “social support” or depression or depressed or depressive or anxious or anxiety or confidence or “maternal health” or “self care” or psychosocial or psycho-social or “self concept”)) OR (MH Self Care) OR (MH "Maternal-Child Health") OR (MH "Maternal Health Services") OR (MH "Support, Psychosocial") OR (MH "Depression") OR (MH "Depression, Postpartum") OR (MH "Anxiety") OR (MH "Self-Efficacy") OR (MH "Maternal Behavior")

AND (MH "Cellular Phone+") OR (MH "Telehealth+") OR (MH "Health Informatics+") OR (AB (“e-health” or “m-health” or "smart phone*" or cellphone* or "cell phone*" or “tele-medicine” or telemedicine or “tele-health” or Telehealth or eHealth or mHealth or "mobile health" or "information technology" or FaceTime or smartphone* or iPhone* or iPad* or handheld or "text messag*" or SMS or MMS)) OR TI ((“e-health” or “m-health” or "smart phone*" or cellphone* or "cell phone*" or “tele-medicine” or telemedicine or “tele-health” or Telehealth or eHealth or mHealth or "mobile health" or "information technology" or FaceTime or smartphone* or iPhone* or iPad* or handheld or "text messag*" or SMS or MMS)) AND(AB (neonatal or postnatal or “post-natal” or postpartum or “post-partum” or newborn* or baby or babies or infant or infants or

infancy or neonate* or antenatal or prenatal or “pre-natal” or “ante-natal” or perinatal or “peri-natal” or pregnant or pregnancy)) OR (TI (neonatal or postnatal or “post-natal” or postpartum or “post-partum” or newborn* or baby or babies or infant or infants or infancy or neonate* or antenatal or prenatal or “pre-natal” or “ante-natal” or perinatal or “peri-natal” or pregnant or pregnancy)) OR MH (postnatal care+) MH (prenatal care) OR MH (perinatal care) OR MH (infant, newborn+)

AND (AB (mother* or father* or parent or parents or parental or parenting or women or woman or family or familial or maternal or caregiver*)) OR (TI (mother* or father* or parent or parents or parental or parenting or women or woman or family or familial or maternal or caregiver*)) OR MH (parent+) OR MH (caregiver+) OR MH (family+)

PsycINFO Date Searched: December 16, 2018. English language only. Records retrieved = 108.

(AB (self-efficacy or “social support” or depression or depressed or anxiety or confidence or “maternal health” or “self care” or psychosocial or psycho-social)) OR (TI (self-efficacy or “social support” or depression or depressed or depressive or anxious or anxiety or confidence or “maternal health” or “self care” or psychosocial or psycho-social or “social concept”))) OR (DE ("Major Depression" or "Postpartum Depression" or "Depression (Emotion)" or "Social Support" or "Anxiety" or "Self-Efficacy" or "Self-Confidence" or "Mother Child Relations")) AND (AB (“e-health” or “m-health” or "smart phone*" or cellphone* or "cell phone*" or “tele-medicine” or telemedicine or “tele-health” or Telehealth or eHealth or mHealth or "mobile health" or "information technology" or FaceTime or smartphone* or iPhone* or iPad* or handheld or "text

messag*" or SMS or MMS)) OR TI ((“e-health” or “m-health” or "smart phone*" or cellphone* or "cell phone*" or “tele-medicine” or telemedicine or “tele-health” or Telehealth or eHealth or mHealth or "mobile health" or "information technology" or FaceTime or smartphone* or iPhone* or iPad* or handheld or "text messag*" or SMS or MMS)) OR (DE ("Cellular Phones" or "Mobile Devices" or "Telemedicine" or "Text Messaging")) AND (AB (neonatal or postnatal or “post-natal” or postpartum or “post-partum” or newborn* or baby or babies or infant or infants or infancy or neonate* or antenatal or prenatal or “pre-natal” or “ante-natal” or perinatal or “peri-natal” or pregnant or pregnancy)) OR (TI (neonatal or postnatal or “post-natal” or postpartum or “post-partum” or newborn* or baby or babies or infant or infants or infancy or neonate* or antenatal or prenatal or “pre-natal” or “ante-natal” or perinatal or “peri-natal” or pregnant or pregnancy)) OR (DE ("Postnatal Period" or "Prenatal Care" or “Perinatal Period" or "Neonatal Period")) AND (AB (mother* or father* or parent or parents or parental or parenting or women or woman or family or familial or maternal or caregiver*)) OR (TI (mother* or father* or parent or parents or parental or parenting or women or woman or family or familial or maternal or caregiver*)) OR (DE ("Caregivers" or “Family" or "Mothers"))

Appendix E: Studies Ineligible Following Full Text Review

Dalton JA, et al. The Health-e Babies App for antenatal education: feasibility for socially disadvantaged women PLoS One. 2018;13(5):1–18.

Reason for exclusion: Unclear reported outcomes and participant groups.

Song H, et al. A two-way text-messaging system answering health questions for low-income pregnant women. Patient Educ Couns. 2013;92(2):182–7.

Reason for exclusion: Unclear reported outcomes and participant groups.

Hantsoo L, et al. A mobile application for monitoring and management of depressed mood in a vulnerable pregnant population. Psychiatr Serv. 2018;69(1):104–7.

Reason for exclusion: Unclear reported outcomes and participant groups.

Appendix F: Summary of Findings Table

Outcomes	Anticipated absolute effects* (95% CI)		№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk before mHealth intervention	Risk after mHealth intervention			
Self-efficacy	—	—	156 (4 observational studies) 689 (6 RCTs)	⊕◯◯◯ VERY LOW [a]	Four studies found a positive impact on self-efficacy while six studies did not find a significant difference. No further comparison was possible.
Social support	—	—	77 (2 observational studies) 463 (4 RCTs)	⊕◯◯◯ VERY LOW [a]	Two studies found a positive impact on social support, two had mixed findings, one reported no significant impact, and one was unreported. No further comparison was possible.
Postpartum anxiety	—	—	123 (2 observational studies) 29 (1 RCT)	⊕⊕◯◯ LOW	All three studies that reported on postpartum anxiety did not report any significant change. No further comparison was possible.
Postpartum depression (follow-up: mean 14 weeks)	The mean postpartum depression score ranged from **6.26-13.53** on the EPDS	The mean postpartum depression score in the intervention group was 6.01 lower when using the EPDS (8.34 lower to 3.67 lower)	430 (6 observational studies) 800 (6 RCT)	⊕⊕⊕◯ MODERATE	mHealth interventions likely result in a reduction in postpartum depression when comparing participants before and after receiving the intervention. In two studies that were meta-analyzed comparing intervention and control groups, no significant differences were found when measured between three and six weeks postpartum.

*The risk in the intervention group (and its 95% CI) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RCT: randomized controlled trial; EPDS: Edinburgh Postnatal Depression Scale

GRADE Working Group grades of evidence
High certainty: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[a] *Significant mixed findings on this outcome*

Appendix G: Characteristics of Included Studies

Study	Study design	Location	Participants	Topic and intervention approach (sample size)	Control group/ comparator	Timing	Length of intervention	Outcomes
Abroms	Quasi-experimental (pilot evaluation)	United States	Pregnant women who were current smokers or had quit within the last 4 weeks (gestational requirement not specified)	Smoking cessation, SMS (n=13)	N/A	Antenatal	43 days	Self-efficacy
Al Hashmi	Quasi-experimental (pre/post)	Oman	Pregnant women diagnosed with gestational diabetes (gestational requirement not specified)	Gestational diabetes mellitus, SMS (n =45)	Standard care (n =45)	Antenatal	4 weeks	Self-efficacy
Baumel	Quasi-experimental (pilot evaluation)	United States	Pregnant women (any gestation) diagnosed with perinatal mood disorder	Prenatal mood, mobile app (n=19)	Pre/post (n=19) and retrospective control (n=17)	Unclear	1 month	Anxiety, depression
Bhat	Quasi-experimental (pilot evaluation)	United States	Pregnant (any gestation) and postpartum women (up to 1 year) diagnosed with depression	Depression, SMS (n=25)	N/A	Antenatal and postnatal	6-8 weeks	Depression
Bhati	Pilot RCT	United States	Primipara pregnant women between 36-42 weeks' gestation who were recruited from a low socioeconomic area	Postpartum depression and sleep disturbance, SMS and mobile	Active control group (n=unclear, total n=34)	Postnatal	6 weeks	Depression

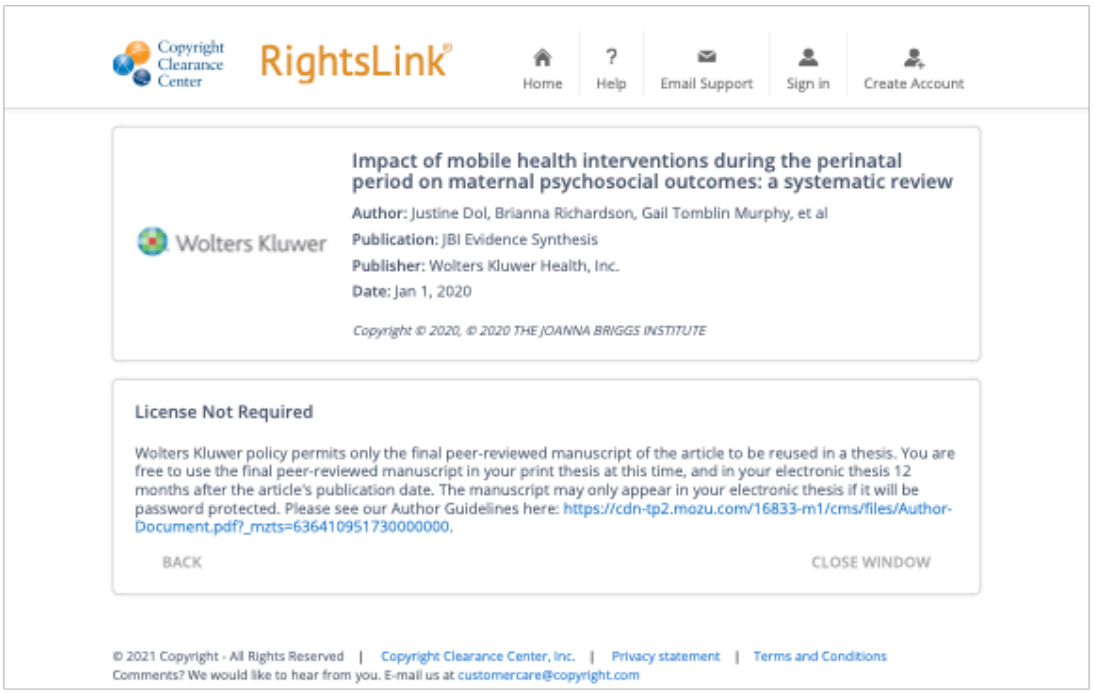
Study	Study design	Location	Participants	Topic and intervention approach (sample size)	Control group/ comparator	Timing	Length of intervention	Outcomes
				app (n=unclear, total n=34)				
Brown	Quasi-experimental (feasibility study)	United States	Postpartum women diagnosed with depression and low socioeconomic status	Depression, mobile app (n=57)	N/A	Postnatal	1 month	Depression
Choi	Pilot RCT	United States	Pregnant women between 10- and 20-weeks' gestation with a sedentary lifestyle	Physical activity, mobile app (n=14)	(n=15)	Antenatal	12 weeks	Self-efficacy, social support, depression
Dalfrà	Quasi-experimental	Italy	Pregnant women diagnosed with gestational diabetes or type I diabetes	Gestational diabetes mellitus, telemedicine (n=105)	Standard care (n=130)	Antenatal	10 weeks for gestational diabetes and 28 for type I diabetes	Depression
Dennis-Tiwary	Pilot RCT	United States	Pregnant women between 19- and 29-weeks' gestation	Perinatal threat, anxiety and stress, mobile app (n=15)	Placebo control (n=14)	Antenatal	4 weeks	Anxiety, depression
Fujioka	Quasi-experimental (descriptive study)	Japan	Pregnant women over 20 weeks' gestation	Smoking cessation, e-learning program via cell phone internet (n=48)	N/A	Antenatal	3 months	Self-efficacy
Gallegos	RCT	Australia	Breastfeeding, postpartum women with	Breastfeeding, SMS (n=114)	Standard care (n=86)	Postnatal	8 weeks	Self-efficacy, social support

Study	Study design	Location	Participants	Topic and intervention approach (sample size)	Control group/ comparator	Timing	Length of intervention	Outcomes
			infant younger than 3 months					
Garfield	Pilot RCT	United States	Postpartum parents of very low-birth-weight infants	NICU transition, mobile app (n=30)	Standard care (n=31)	Postnatal	4 weeks	Self-efficacy
Globus	Quasi-experimental (pre/post)	Israel	Postpartum parents of infants in the NICU	NICU, SMS (n=87)	Pre-implementation control group (n=91)	Postnatal	Varied dependent on length of NICU stay	Anxiety
Hannan	RCT	United States	Primipara postpartum women with a low socioeconomic status	General postpartum adjustment and follow-up, SMS and phone calls (n=63)	Standard care (n=66)	Postnatal	6 months	Social support
Jallo	Quasi-experimental (pre/post)	United States	Pregnant women between 22- and 37-weeks' gestation considered high risk of preterm labor	Stress, mobile app (n=15)	N/A	Antenatal	8 days	Self-efficacy
Letourneau	Quasi-experimental (pre/post)	Canada	Postpartum women (less than 2 years) diagnosed with depression	Depression, phone calls (n=34)	N/A	Postnatal	12 weeks	Social support, depression

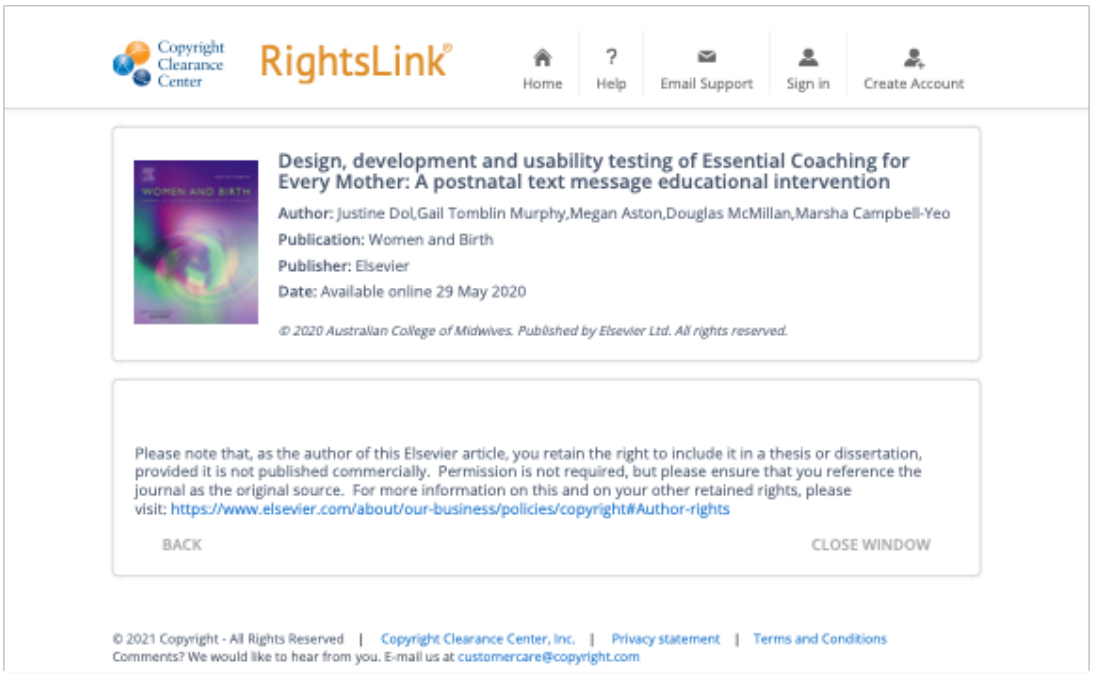
Study	Study design	Location	Participants	Topic and intervention approach (sample size)	Control group/ comparator	Timing	Length of intervention	Outcomes
Ngai	RCT	Hong Kong	Primipara postpartum women diagnosed with depression	Depression, phone calls (n=174)	Standard care (n=197)	Postnatal	5 weeks	Depression
Prasad	Quasi-experimental (pilot evaluation)	United States	Postpartum women (with one or two children only) diagnosed with depression	Depression, mobile app (n=23)	Standard care (n=20)	Postnatal	3 weeks	Social support, depression
Shorey	RCT	Singapore	Postpartum mothers	Newborn care, mobile app (n=51)	Standard care (n=54)	Postnatal	4 weeks	Self-efficacy, social support, depression
Takeuchi	RCT	Japan	Primipara pregnant women between 30 and 33 weeks' gestation	Perinatal massage, smartphone website (n=47)	Pamphlet only (n=49)	Antenatal	3 weeks	Self-efficacy
Toohill	RCT	Australia	Pregnant women between 13 and 23 weeks' gestation	Childbirth fear, phone calls (n=101)	Standard care (n=97)	Antenatal	Not reported	Self-efficacy, depression

app, application; NICU, neonatal intensive care unit; N/A, not applicable; RCT, randomized controlled trial; SMS, short message service

Appendix H: Copyright Release for Manuscript 3



Appendix I: Copyright Release for Manuscript 4



Copyright Clearance Center RightsLink®

Home | Help | Email Support | Sign in | Create Account

Design, development and usability testing of Essential Coaching for Every Mother: A postnatal text message educational intervention

Author: Justine Dol,Gail Tomblin Murphy,Megan Aston,Douglas McMillan,Marsha Campbell-Yeo

Publication: Women and Birth

Publisher: Elsevier

Date: Available online 29 May 2020

© 2020 Australian College of Midwives. Published by Elsevier Ltd. All rights reserved.

Please note that, as the author of this Elsevier article, you retain the right to include it in a thesis or dissertation, provided it is not published commercially. Permission is not required, but please ensure that you reference the journal as the original source. For more information on this and on your other retained rights, please visit: https://www.elsevier.com/about/our-business/policies/copyright#Author-rights

BACK CLOSE WINDOW

© 2021 Copyright - All Rights Reserved | Copyright Clearance Center, Inc. | Privacy statement | Terms and Conditions

Comments? We would like to hear from you. E-mail us at customercare@copyright.com