

**The Utilization of Digital Technology and Electronic Health Platforms to Alleviate
Postpartum Depression in Medically Underserved Areas**

by

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Abstract

Postpartum depression symptoms include sadness, feelings of anger, crying more often, difficulty sleeping, feeling disconnected from the baby. Primary risk factors include a previous history of depression, anxiety, low social support, stress during pregnancy, traumatic birth experience, and early cessation of breastfeeding. Mothers who have postpartum depression can impact the development of their children including impaired mental and motor development, behavioral issues, self-regulation, and low self-esteem. The American College of Obstetrics and Gynecologists recommends that all providers screen for postpartum depression during each postpartum visit. As postpartum care is an on-going process, it is often hard for those from medically underserved and rural areas to travel every four to six weeks to receive care. Those in rural and underserved areas have to travel more than an hour to simply receive primary care, and many may not seek out specialty care. Therefore, it is important to have resources and adequate funding to provide for postpartum depression care within medically underserved areas.

The essay examines the current literature involving the utilization of digital technology and electronic health platforms to alleviate postpartum depression in medically underserved areas. The literature analysis was conducted with the OVID-Medline database; the literature found came from various locations, countries, demographic locations, and the type of digital technology utilized. The public health significance has been predominantly noted in the literature, as the women's inability to bond with her child, having lasting outcomes throughout the duration of the child's

life. As digital technology and various telehealth platforms become more prominent, it is important to have a sustainable and feasible plan written into policy to assist the areas most in need of healthcare to cause change on a national and state level. By making these platforms more available as well as providing education regarding their benefits, postpartum care for rural and medically underserved areas will be improved.

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Preface

I would like to sincerely thank Professor Tina Hershey, Professor Susan Graff, and Dr. Evan Cole for all their support, advice, and guidance throughout my Masters Essay Process. Their time and dedication to assisting me with this essay was very greatly appreciated; and their knowledge, expertise, and time is contributed to the success of this paper. I would also like to thank Helena Vonville from the Health Sciences Library at the University of Pittsburgh for her assistance with the literature search and for sharing her expertise and knowledge with me regarding the various platforms the literature searches were conducted in. I would also like to thank my professors for their guidance throughout my graduate studies at the University of Pittsburgh School of Public Health and my family for their support and guidance throughout the course of my graduate studies.

1.0 Overview of Postpartum Depression and Medically Underserved Areas

1.1 Difference Between Postpartum Depression and Baby Blues

Mothers experience a wide variety of emotions during the birth of a child. However, many may begin to feel anxious, sad, and depressed for a period of time. Many women who lack health literacy knowledge may fail to acknowledge the effects of their immediate emotions versus their emotions for a longer duration. The feelings of baby blues are feelings of sadness, fear, anxiety, or anger occurring about three days after childbirth. While the baby blues will usually go away within the first week of providing childbirth, postpartum depression has been clinically seen in many women for months. According to the American College of Obstetricians and Gynecologists (ACOG), postpartum depression is a type of depressive mood disorder that develops in the first year after the birth of a child (ACOG). Women will experience extreme feelings of sadness, anxiety and despair that will leave them with the inability to accomplish daily tasks and oftentimes be withdrawn from their daily lives. ACOG identifies several causes of postpartum depression and notes that postpartum depression is caused by a combination of these factors and not solely one factor. The factors that play a role in causing postpartum depression are a change in hormone levels where estrogen and progesterone sharply decrease in the hours following childbirth, a history of depression before, during, or shortly after pregnancy, emotional factors of doubt surrounding the inability to care for a child, and lifestyle factors including the loss of a child in the past or moving to a new city leave women with increased risk of having postpartum depression.

1.2 Postpartum Depression Screening Methods

Postpartum depression is very common after the birth of a child, and the diagnosis has a prevalence of 10-15% in new mothers, 50-60% in mothers of preterm infants and adolescents under the age of eighteen giving birth (Sit). Additionally, postpartum depression typically lasts for more than 7 months in 25-50% of the women (Sit). The Edinburgh PostNatal Depression Scale, which is utilized in healthcare delivery systems to screen for depression related to childbearing, asks a series of questions including questions related to mood, anxiety, and harmful thoughts (Sit). The answer choices are typically in the form of most of the time, not as often, very often, or not at all. If an individual has a score of 13 or higher, they are experiencing postpartum depression and should seek clinical attention. Clinicians should provide the screening survey to mothers approximately one month after childbirth and to patients who report depression symptoms immediately following childbirth. Women who are scoring around 20 on the Edinburgh PostNatal Depression Scale should schedule a postnatal exam before the one-month time period to follow up on their symptoms and well-being.

Additionally, there are other surveys and instruments that can be utilized for screening purposes. The Center for Epidemiological Studies Depression Instrument has created a twenty-question questionnaire which has been primarily utilized in culturally diverse populations and adolescent mothers. The questionnaire is also utilized for diagnosing depression in other populations including college aged personnel; it does not have specific questions targeted towards childbirth, in contrast to Edinburgh PostNatal Depression Scale. Another common measurement tool utilized for clinicians is a common and systematic Patient Health Questionnaire, which asks individuals to recall their symptoms and feelings dating back two weeks. However, women may have a difficult time recalling their exact feelings, and they may only be able to recall the specific

week that they took the questionnaire. While the specificity and sensitivity are 88% for diagnosing depression in patients, the questionnaire has yet to have validation and research for women who are undergoing postpartum depression after childbirth (Sit). Providers need to utilize these screening tools and be open to discussions and questions involving these various questionnaires. Providers should not be judgmental of a positive screen and should sympathize with the patient in all circumstances, and it is of utmost importance to keep in constant communication with the patient.

1.3 Effect on Child Upbringing

Research has revealed that children who are older than a year old whose mother has had postpartum depression displayed problems including insecure attachment, antisocial behavior, and cognitive deficits (Toth). Research studies were also conducted when the child reached five years old, and the problems displayed included frequent temper tantrums and uncontrollable behaviors multiple times a week (Toth). Additionally, throughout the duration of one's life span, the children whose mothers had postpartum depression were more neurotic and had greater behavioral difficulties than the children whose mothers who did not have postpartum depression. Research studies, including multiple longitudinal analyses, have indicated the importance of early interactions between the mother and the baby; these analyses have indicated the impact of adverse childhood outcomes in relation to behavior and cognition of the child later in life. All studies noted the importance of seeking treatment early on in a postpartum depression diagnosis, as well as having one's family members involved in the care of the child.

1.4 Barriers in Medically Underserved Areas to Receiving Care

According to the Healthy People 2020 Survey, access to healthcare facilities is important for overall physical, social, and mental health, disease prevention, treatment of illness, quality of life, avoiding preventable deaths, and life expectancy (Rural Health Information Hub). In order to have good access to healthcare an individual in a rural or underserved area must have financial means to pay for the service, means to reach and use services, ability to understand basic healthcare knowledge and terminology, and the belief and understanding that they will be cared for. Furthermore, in rural and underserved areas, there is often a social stigma associated with receiving care, and more specifically, behavioral healthcare. For rural and underserved areas, it is important to incorporate behavioral health services in the same building as other common preventive services. The incorporation of behavioral health services within one facility and having appointments on one day will help lessen the travel for those in rural and underserved areas.

In relation to maternal healthcare services, ACOG notes in a committee opinion from Health Disparities in Rural Women that prenatal care initiation in the first trimester was lower for mothers in rural areas compared to those in suburban areas (ACOG). ACOG also reported that less than half of women in rural areas live within a 30-minute drive to the nearest hospital offering any kind of maternal healthcare services (ACOG). In rural and underserved areas, it is extremely important to address the workforce shortages, increase funding for research, increase pay for providers, and provide incentives to all workers to ensure there is an adequate patient to provider ratio. This will help alleviate concerns in the short term, and it is important to have a feasible solution for a longer duration.

In general, access to behavioral healthcare services is very sparse for rural and underserved areas. The Health Services and Resources Administration (HRSA), as of March 2021, reported a

shortage of 58.44% for mental health professionals (Rural Health Information Hub). For this reason alone, many healthcare systems have started to consider the utilization of telehealth care services and broadband internet services provided. In a report published by the Agency for Healthcare Research and Quality labeled “Mapping the Evidence for Patient Outcomes from Systematic Reviews”, mental healthcare services provided via telehealth were found to be very effective.

Various telehealth, digital technology, and electronic health platforms are an important solution to address the gap in rural and medically underserved areas (Rural Health Information Hub). It is important to deliver telehealth via various delivery systems with provided hotspots to these locations including rural clinics, rural hospitals, community-based practices, and locations where patients can come and utilize internet access for free. Healthcare systems in rural and medically underserved areas should work together to address the gap in care, and more should be focused on a state policy level regarding medical services via digital means.

1.5 Current Advances in Digital Technology and Electronic Health Platforms

HRSA defines telehealth as the use of electronic information and telecommunication technology to support long distance clinical care, patient and professional related education, public health, and health administration (Rural Health Information Hub). Telehealth, digital technology, and electronic health platforms have been delivered to transform care in rural and underserved areas to allow for communication with clinicians from the comfort of one’s home, schedule follow-up appointments from a web-based portal, and receive remote monitoring assistance from mobile applications. This will help offer those in rural and medically underserved areas an opportunity to

receive care from the comfort of their homes without having to burden the unforeseen cost of travel and often having multiple worries before going into care.

The most popular types of telehealth services utilized are mobile health, video conferencing, remote patient monitoring, store and forward, and lifestyle health coaching through telephonic and digital means. Mobile health is utilized through a cell phone, in which various applications can be downloaded to monitor heart rate, stress levels, and applications for various healthcare systems to view lab results. Mobile applications allow for easy communication providers via email and text messages, as well as easy scheduling for follow-up appointments. Specifically in relation to maternal health, an application called Due Date Plus allows women the ability to record pregnancy milestones and locate symptom related services to increase compliance with prenatal and postpartum care to decrease prevalence of preterm birth weight of babies born with low birth weight and receive postpartum care appointments. In addition, video communication platforms have been utilized to reach patients in rural and underserved areas for appointments.

Remote patient monitoring will allow providers to report, collect, and transmit information through wearable electronic watches/devices, smartphone applications, and web-based applications. This type of technology will also give providers opportunities to take a patient's weight, blood pressure, heart rate, glucose levels, heart rate, and stress level test. Essentially, remote patient monitoring has five cycles including collect, transmit, evaluate, notify, and intervene. Remote patient monitoring gives patients the option of alerting their providers of alarming heart rate or any complications to their providers that show on their device. Store and Forward allows the transmission of a primary care provider to release records of patient's information directly to the patient or to their specialists. Oftentimes, X-Rays and CT-Scans can

be sent to a patient for their review, and telehealth has enabled a platform for provider-to-provider collaboration to come to a specified diagnosis. Remote methods of health coaching for a healthy lifestyle intervention have been prominent amongst many healthcare systems. The means of health coaching can be through telephone with the utilization of motivational interviewing and live exercise classes to improve the physical and mental health of individuals involved in the program.

2.0 Methods

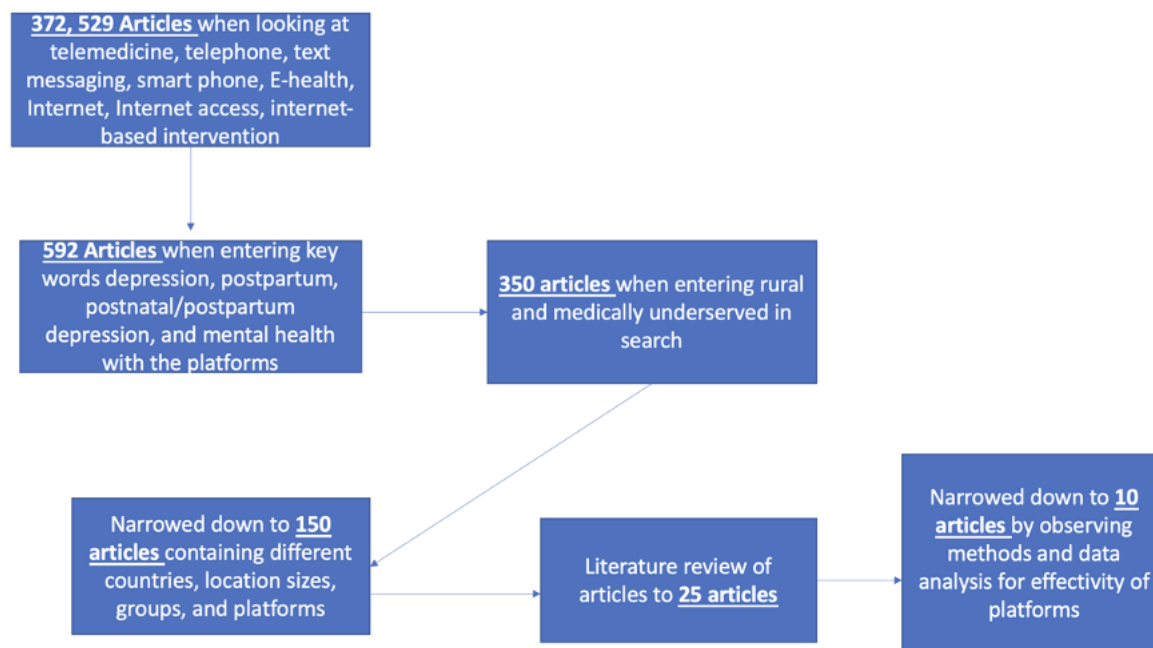


Figure 1: Analysis of the Literature

A literature search was conducted in the OVID Medline database. The OVID Medline database is the National database for bibliographic databases and articles that contain over 27 million references to journal articles. Figure 1 depicts the method to the literature search for the articles contained within this paper. Initially, the key terms involving telehealth and digital technology yielded 372, 529 articles. From this point, it was important to focus on postpartum depression and synonymous terms. This search yielded 592 articles, which were narrowed down to 350 articles when entering rural and medically underserved areas. Within this search, specific geographic regions including South Africa, China, United States, India, Nepal, South Asia, and Africa were entered to narrow down to 150 articles. From this point, it was essential to have a

review with multiple perspectives of different countries and different technologies to incorporate into the paper. Abstracts were examined with grouping of various articles into certain categories including: Digital Technology, Telehealth, Asynchronous modules, Live sessions, phone calls with clinical staff, and data collection methods. Additionally, various countries were noted in this stage of the process. With doing a deep analysis of the 150 articles, the articles were decreased to 25. From the 25 articles, vast notes were taken in regards to the article to focus in on the methods utilized, data collection method, screening mechanisms, and digital platform. Additionally, notes were taken regarding the most compelling approaches and data approaches. Based on these notes, the search was narrowed down to 10 with different locations around the world, digital technology utilized, wide variety of synchronous and asynchronous modules, compelling and distinct approaches to their methods, and population served.

3.0 Results: Literature Review and Analysis

3.1 Literature Review and Analysis

3.1.1 Be a Mom- A Web Based Intervention to Prevent Postpartum Depression: Results from a Randomized Control Trial

During the literature search, it was important to include literature from self-guided web-based interventions that had asynchronous components to them to be completed on an individual's own time. Be a Mom is a self-guided web-based intervention that is grounded in cognitive behavioral therapy, delivered to postpartum depression to prevent postpartum depression symptoms. Several characteristics were analyzed, and trends were observed throughout the duration of the study including depressive symptoms, anxiety symptoms, maternal confidence, baby motherhood thoughts, metacognitive appraisal, and dyadic satisfaction.

Figure 2 represents the depressive symptoms and anxiety symptoms of both the intervention and control group. A positive trend is seen in the decrease of the maintenance of clinical EFDS and the maintenance of non-clinically defined EFDS. As seen in Figure 2, many of the women displayed a positive trend when it came to improvement of both the depressive and anxiety symptoms. The results support the fact that the Be a Mom platform is effective in reducing early postpartum depressive and anxiety symptoms, and consequently the platform works to prevent the clinical diagnosis of postpartum depression (Fonseca). Table 2 displays the various outcome variables that were assessed with respect to the specific platform. The time of assessment was divided into two separate times throughout the duration of the study. There is more of an

increase in maternal confidence with Time Division 2 with the longer a woman is in the study. Additionally, women have a dyadic satisfaction the longer they complete the modules.

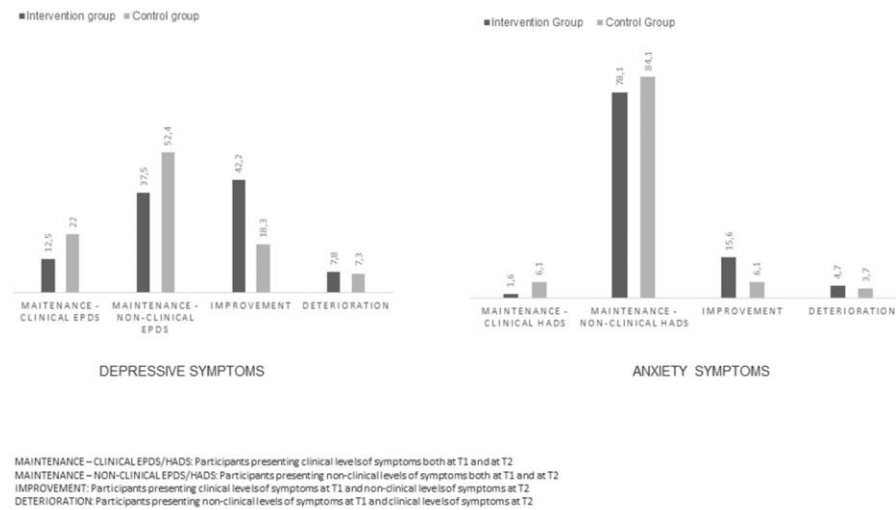


Figure 2: Depression and Anxiety Symptoms of the Intervention and Control Group

Reprinted from “Be a Mom, a Web-Based Intervention to Prevent Postpartum Depression: Results from a Pilot Randomized Controlled Trial by Anna F, Behavior Therapy 51.4, p 616-633, Copyright 2020 by Anna Fonseca

Table 1: Measures Recorded by the Study

Table 2
Primary and Secondary Outcome Measures: Estimated Marginal Means for Time and Group and Time, Group and Interaction Effects

Outcome variable	Group	Estimated Marginal Means		Linear Mixed Model Effects Estimates			
		Time 1 M (SE)	Time 2 M (SE)	Effect	B (SE)	95% CI	P
Depressive symptoms (EPDS)	Intervention	9.32 (0.51)	6.91 (0.45)	Time	2.41 (0.43)	[1.57, 3.26]	<.001
	Control	8.10 (0.46)	6.87 (0.41)	Group	-0.03 (0.62)	[-1.25, 1.19]	.958
				Time × Group	-1.18 (0.58)	[-2.32, -0.04]	.043
Anxiety symptoms (HADS)	Intervention	6.91 (0.36)	5.50 (0.42)	Time	1.41 (0.39)	[0.65, 2.17]	<.001
	Control	5.94 (0.36)	5.76 (0.38)	Group	0.26 (0.57)	[-0.87, 1.38]	.653
				Time × Group	-1.23 (0.52)	[-2.25, -0.21]	.019
Maternal confidence (QCP)	Intervention	4.24 (0.04)	4.31 (0.04)	Time	-0.13 (0.04)	[-0.21, -0.06]	.001
	Control	4.38 (0.04)	4.51 (0.04)	Group	0.14 (0.05)	[0.03, 0.24]	.010
				Time × Group	-0.07 (0.05)	[-0.017, 0.03]	.176
Baby-Motherhood Thoughts (BRMNT)	Intervention	2.74 (0.23)	2.39 (0.27)	Time	0.35 (0.25)	[-0.14, 0.85]	.161
	Control	2.19 (0.23)	1.46 (0.25)	Group	-0.93 (0.37)	[-1.66, -0.20]	.013
				Time × Group	0.37 (0.34)	[-0.29, 1.03]	.270
Metacognitive appraisal (ACES)	Intervention	3.71 (0.38)	3.30 (0.37)	Time	0.41 (0.38)	[-0.33, 1.16]	.273
	Control	3.35 (0.39)	2.74 (0.33)	Group	-0.56 (0.50)	[-1.56, 0.43]	.265
				Time × Group	0.20 (0.51)	[-0.81, 1.20]	.701
Dyadic Satisfaction (DAS-R)	Intervention	3.91 (0.08)	3.80 (0.08)	Time	0.12 (0.06)	[-0.00, 0.24]	.057
	Control	3.95 (0.08)	3.90 (0.09)	Group	0.10 (0.12)	[-0.13, 0.33]	.406
				Time × Group	-0.06 (0.09)	[-0.23, 0.11]	.509

Note: Estimated means adjusted for the covariates (marital status, educational level, income, socioeconomic status, and infant's age).

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3.1.2 Treating Postpartum Depression in Rural Veterans Using Internet Delivered

Cognitive Behavioral Therapy: Program Evaluation of *MomMoodBooster*

It was important throughout the literature search to identify a group of women who face additional barriers when it comes to receiving healthcare. Many women who serve in the military face additional stress along with becoming a mother including frequent location, working longer into pregnancy, less reported support, and increased incidence of sexual assault and harassment (Solness). Furthermore, rural veterans are less likely than urban veterans to receive any mental health treatment, face longer wait times between diagnosis and first appointment, and are less likely to receive specialty mental health care (Solness). *MomMoodBooster* is a secure, web-based, six module, coach supported intervention tailored for women who are experiencing postpartum depression (Solness). The study involved 54 rural veteran participants and 272 urban participants.

In Table 2, program use and engagement is identified in relation to the *MomMoodBooster* program. Rural program participants often completed more of the modules in the program, spent less time speaking on the phone to their coaches, completed less overall coaching sessions, and followed up via the baseline at a slower rate. The difference in call time between the urban and rural veteran women contributed to the distrust of science and technology in rural women veterans and skepticism of outsiders (Solness). Additionally, program participants in the Veterans *MomMoodBooster* program were very diverse in age, race, ethnicity, rurality, and represented 46 out of the 50 states including the District of Columbia. With the recruiting strategy, it was exceptionally strong with providing women with the support and an open environment to speak about their feelings (Solness). Overall, participation in the *MomMoodBooster* program is associated with decreased depressive symptoms, increased behavioral activation, and decreased dysfunctional automatic thoughts (Solness).

Table 2: Program Use and Engagement of MomMoodBooster**Table 2** Program use and engagement

	Overall	Urban	Rural	X ² /t-value
<i>Days in program</i>				
Baseline to follow-up (days)	121.44 (33.0)	122.18 (35.3)	117.52 (16.12)	.720
Welcome call to last log-in (days)	60.67 (43.78)	60.54 (37.58)	61.22 (65.49)	– .099
<i>Engagement</i>				
Welcome to last coaching (days)	61.33 (36.76)	61.63 (36.00)	59.64 (41.26)	.299
Coaching sessions completed	3.35 (2.55)	3.46 (2.56)	2.83 (2.49)	1.646
Total minutes with coach	47.19 (50.18)	50.14 (51.94)	33.16 (38.14)	2.748**
Average minutes per call	10.13 (7.93)	10.62 (8.13)	7.81 (6.49)	2.359*
Modules opened	3.85 (2.39)	3.86 (2.39)	3.81 (2.44)	.131
Mean completion (%)	60.63 (40.05)	60.29 (41.55)	62.35 (41.23)	– .332
80% completion: modules	50.0%	49.6%	51.9%	1.051
100% completion: modules	44.5%	43.8%	48.1%	2.287
N–C mean completion (%)	23.1 (24.17)	23.11 (24.61)	23.08 (22.15)	.007
<i>Program rating</i>				
Program helpful	3.21 (.876)	3.25 (.844)	2.97 (1.017)	1.632
Coach helpful	3.20 (.991)	3.28 (.932)	2.79 (1.197)	2.063*
Follow-up questionnaire completed	60.4%	60.7%	59.3%	.037

Reprinted from “Treating Postpartum Depression in Rural Veterans using Internet Delivered CBT: Program Evaluation of *MomMoodBooster* by Cara S et.al, Journal of Behavioral Medicine p 454-466, Copyright 2020 by Cara Solness et.al

3.1.3 Postpartum Depression Among Rural Women from Developed and Developing

Countries: A Systematic Review

It was important to have a study that focused on rural women from developed and developing countries to understand the needs of this population. The study conducted a systematic review of examining postpartum depression among rural women with a comprehensive literature search from researchers. Eight studies clearly defined women who had postpartum depression in

developed countries, and the articles ranged from states in the United States to other countries. The study reported on a rural population in North Carolina with a prevalence rate of 23.2% at 6 weeks postpartum with a sample of rural women who were mostly single women living in a rural area (Villegas). Three studies compared postpartum depression among women who lived in urban areas to rural areas. The studies that reported on the difference found a higher prevalence of postpartum depression by eight weeks postpartum compared to urban women (Villegas). There were many risk factors associated with living in a rural residence including past depression, psychiatric history, antenatal depression, antenatal depression, having no partner, low socioeconomic status, recent life events, and past sexual abuse (Villegas).

Postpartum depression remains more prevalent in rural women from developing countries compared to developed countries (Villegas). Rates of depression in developing countries can be as high as 60%, which demonstrates a higher rate of morbidity early on in the lifespan (Villegas). Those women who reside in a rural residence can have a wide variety of environmental and transportation barriers, which may limit their access to a healthcare facility in order to get to their appointments in a timely manner. Rural areas often have limited staff availability, and the opportunity to get to a mental healthcare professional in 3 months is not feasible for those who are in need of immediate attention for their overall wellbeing. The studies identified telehealth as viable in high-income countries with a structured healthcare system, but options of incorporating telehealth may be less likely in rural communities that are in developing areas (Villegas). Many in developing countries may not have adequate healthcare insurance, and it makes the cost of utilizing telehealth very costly (Villegas).

3.1.4 Strongest Families TM Managing Our Mood (MOM): A Randomized Control Trial of a Distance Intervention for Women with Postpartum Depression

The article was chosen to focus on an education program that helps women with the identification of their symptoms. Managing our Mom (MOM) is a 12 session, cognitive behavioral based education intervention. The sessions are divided up into 12 sessions related to postpartum depression. Table 3 summarizes the sessions with the specific aims and focuses of each section. The content flowed from making women recognize what postpartum depression is, changing behaviors with a changing environment, advanced thinking strategies, and dealing with setbacks. 54 mothers were self-referred to the program, and the remaining eight women were referred by a healthcare provider (Wozney). Out of the 62 mothers who participated in the program, 22 intervention participants completed all 12 sessions in the MOM program (Wozney).

The findings from the study suggested that the intervention supports the reduction of proportion of depression diagnosis outcomes at each time point (Wozney). The intervention had follow ups at 3 months, 6 months, and 12 months, there was a positive correlation with those receiving the intervention at all points during the touch bases (Wozney). Additionally, the utilization of a mobile phone, the coach interventions remained confidential, convenient, and non-stigmatizing for mothers that reduce health care barriers including acceptable because of no limitations on travel and geography (Wozney). Similar studies should be conducted to better showcase the efficacy of the telephonic intervention.

Table 3: Managing Our Moms Outline Session

Session	Title	Focus of session content
1	What is postpartum depression?	Why mothers are at risk of depression and the connection between what you do and how you feel
2	Motivation and changing behaviour	Changing behaviours that affect depression and how to stay motivated to change
3	What you think	Recognizing negative thinking patterns
4	Learning to change negative thoughts	Three approaches (Good Friend, ADAPT and Label the Error) to developing more realistic thinking
5	Postpartum depression and feeling alone	Changing isolating and avoidance behaviours to break the cycle of loneliness
6	Anxiety	The body, mind, behaviour connections of anxiety and relaxation strategies
7	Children, partners and friends	Steps to building strong friendships, mother-child interactions and partner relationships
8	Food, exercise, sleep	Lifestyle impacts on depression and steps on how to track choices to develop healthier habits
9	Trauma, alcohol and recreational drugs	How traumatic experiences, alcohol and other drugs affect depression and how to lessen the impact
10	Advanced thinking strategies	Uncovering thinking patterns and beliefs that trigger negative thoughts and low mood
11	How to get what you want	Learning to assert yourself and be empowered to ask for what you need
12	Dealing with setbacks	Recognizing that setbacks are part of the path out of depression and self-care steps you can take to get through them

Reprinted from “Strongest Families™ Managing Our Mood (MOM): A Randomized Controlled Trial of a Distance Intervention for Women with Postpartum Depression” by Lori W et.al, Archives of Women’s Health p525-537, Copyright 2017 by Lor Wozney et.al

3.1.5 A Study Protocol of Mobile Phone-Based Application-Based Cognitive Behavior

Training for the Prevention of Postpartum Depression Among High Risk Mothers

It was important to specifically highlight the importance a mobile phone-based intervention that specifically had the focus population of high-risk mothers. Additionally, it was important to highlight healthcare within a global context. The study was conducted in Changhasa City, China and one health center from the community health centers was selected within five districts in the City. There are very few health programs for pregnant women that are organized by hospitals or the community which provide information about mental health, but this is not very personable and only available if no follow up postpartum visits are given to women (Sun). Oftentimes, postnatal visits are provided during the postpartum period, but mental health check ups are not part of their daily routine (Sun). The topic of mental health remains a very stigmatized concept, and women

may not be open about coming out about their struggles. The specific mobile application participants were utilizing had six modules; and participants completed one module each week for six consecutive weeks (Sun).

Modules open up every week, and after the fourth day of a module, if someone has not started, they are alerted to start the module. Table 4 summarizes how the control group and the intervention group differed as they were going through the modules. The data with the study has not been published to date with the statistical significance calculations post interventions, and this is one of the implications of the data analysis. There is often lag time associated with when a study is published regarding this topic with the screening process and data analysis. The development of mobile health technology offers insight into the incorporation of cognitive behavioral therapy, the study offers promise into the future from a global perspective with tackling the stigma behind postpartum depression.

Table 4: Comparison of Post Intervention and Control Groups

Time	Intervention group	Control group
1 week	Prologue will help participant to understand the postpartum depression a. Using examples to introduce what is postpartum depression, PPD symptoms, and how to differentiate PPD with the normal changes which might happen after delivery b. New progress of the treatment and intervention of PPD c. Skill learning: Self-evaluate the status of PPD	a. Postpartum perineum incision care or caesarean section wounds; b. Explanation of lochia postpartum; c. Prevention of postpartum constipation
2 week	Emotion will help participants a. Understand what negative emotions is. b. Record negative emotions and the corresponding behavioral responses c. Skill learning: think differently	Neonatal feeding (breast feeding or bottle feeding) a. Encourage breastfeeding, and how to breastfeeding correctly. b. Identify situations that require bottle feeding
3 week	Recognition will assist participants understand a. What is the biased habitual thinking? b. What is the relationship between biased habitual thinking and negative emotions? c. Skill learning: identify the biased habitual thinking.	Neonatal care (bathing and touch) a. Time, temperature and supplies of bathing; b. Navel nursing c. Neonatal touch method
4 week	Amendment will provide some strategies for participants to deal with the biased habitual thinking a. Using example to help participants understand what is the consequences of the biased habitual thinking. b. How to divert their attentions from the troublesome thing. c. Skill learning: introspect your thinking.	Postpartum recovery (early training) a. The timing and frequency of getting out of bed b. Intensity of postpartum exercise
5 week	Rebound will help participants focus on the present life and avoid immersing in negative emotions. a. Record the daily life b. Balance your life c. Skill learning: Set short-term goals and long-term goals and	neonatal vaccination a. Knowledge of infant vaccination
6 week	Remain happiness will help participants a. Review the techniques of emotion management and getting rid of biased thinking b. Skill learning: Record the daily happy things	postpartum reproductive health (contraception) a. Choice of contraceptive methods

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3.1.6 Antenatal Depression Case Finding by Community Health Workers in South Africa: Feasibility of a Mobile Phone Application

The article was chosen to highlight an area of the world that has limited resources and to better understand the roles that community health workers can have in providing mobile based screenings for postpartum depression. Community health workers who had no training in healthcare were trained to administer the Edinburg Postnatal Depression Scale during a routine visit for community-based outreach (Tsai). The study took place in different areas of Khayelitsha,

which is a socioeconomically deprived informal settlement on the outskirts of Cape Town, South Africa (Tsai). Many of those who live in Khayelitsha reside in informal housing on unserved land, unemployment, food insecurity, and substance level poverty rates that are extremely high (Tsai).

Study 1 utilized trained research assistants and Study 2 utilized community health workers who had no previous research training. The community health workers utilized short and ultrashort screening instruments programmed into mobile phones. However, with the data in the study, there were no significant differences in data obtained from a paper survey compared to a mobile phone, which had a different shorter survey for screening antenatal depression. The public health significance of postpartum depression needs an increasing emphasis on shifting tasks to non-specialist and other healthcare workers for screening purposes within the scope of global mental health (Tsai). Many third world countries have no policies or scope of practice under each healthcare professional. Additionally, community health workers are often burdened by heavy workloads, which contributes to their high turnover and low job satisfaction (Tsai). Community-based depression screenings in South Africa should not be overlooked, and it could improve the emotional well-being of high-risk women and the health of their children (Tsai).

3.1.7 Mother Matters: Pilot-Randomized Wait-List Control Trial of an Online Therapist

Facilitated Discussion Board and Support Group for Postpartum Depression

The study was chosen for inclusion based on the incorporation of an online therapist facilitated discussion and the engagement of discussion boards within an asynchronous modules. The Mother Matters intervention was set up in 10 weekly topics set in order from: psychoeducation around the common types of postpartum mental illness, treatment, and etiology in weeks 1 and 2;

issues related to adequate social support in week 3, and interpersonal support through weeks four through nine (Vigod).

Through the results, the feasibility and acceptance of the group members remained conclusive with many indicating they felt included by the group's leaders, they were satisfied with the involvement of the facilitators, and would highly recommend the platform to other women. Overall, there was a high level of engagement with the Mother Matters platform which contributed to the on-boarding of participation and group norms and many women had all their concerns addressed through reporting and getting their questions addressed in a timely manner. However, the Mother Matters research may not work for women with all symptoms, and researchers understood that the program would work best for those with milder symptoms (Vigod). It would be important to assess the intervention in a follow-up discussion to show the full support for the intervention.

3.1.8 A Mobile Health Mindfulness Intervention for Women with Moderately Severe

Postpartum Depressive Symptoms: feasibility Study

The article was chosen to highlight how mindfulness can be incorporated within postpartum depression symptoms. Mindfulness is a psychological process of bringing attention to the current moment (Avalos). The study draws attention to the fact that women in rural areas may often have accessibility barriers to traditional mindfulness programs in person, and the study sought to deal with this broader problem when it comes to rural and underserved areas. Oftentimes, people may not fully be able to attend an in-person class at the specific time, a self-paced mobile lifestyle intervention that can be a potential behavioral intervention that addresses behavioral interventions to traditional mindfulness programs (Avalos).

It was important to understand the acceptability of the study through a post intervention survey. Many of the participants were very satisfied with the Headspace application, and they felt like the platform allowed them the opportunity to carve out time to relax (Avalos). At the same time, two participants reported that they wanted more freedom to explore different meditations within the same platform to follow the guidelines set forth by the study to alleviate postpartum depression. Many common benefits were recorded including improved stress management, reduced anxiety, improved sleep, and increased physical activity. With the study conducting a mobile health intervention, the mindfulness intervention was feasible in a large integrated healthcare system utilizing the electronic health record in identifying women with postpartum depression eligible for the intervention. The intervention highlighted the importance of utilizing mobile health platforms before burdening the healthcare system's understaffed mental healthcare workforce which includes psychiatrists, counselors, and psychologists. The findings from the study highlighted the importance of further studies on mobile health platforms to implement low cost technologies into healthcare systems. The data analysis indicated a significant decrease in the levels of stress, depression, and sleep quality, which is highlighted in Figure 3.

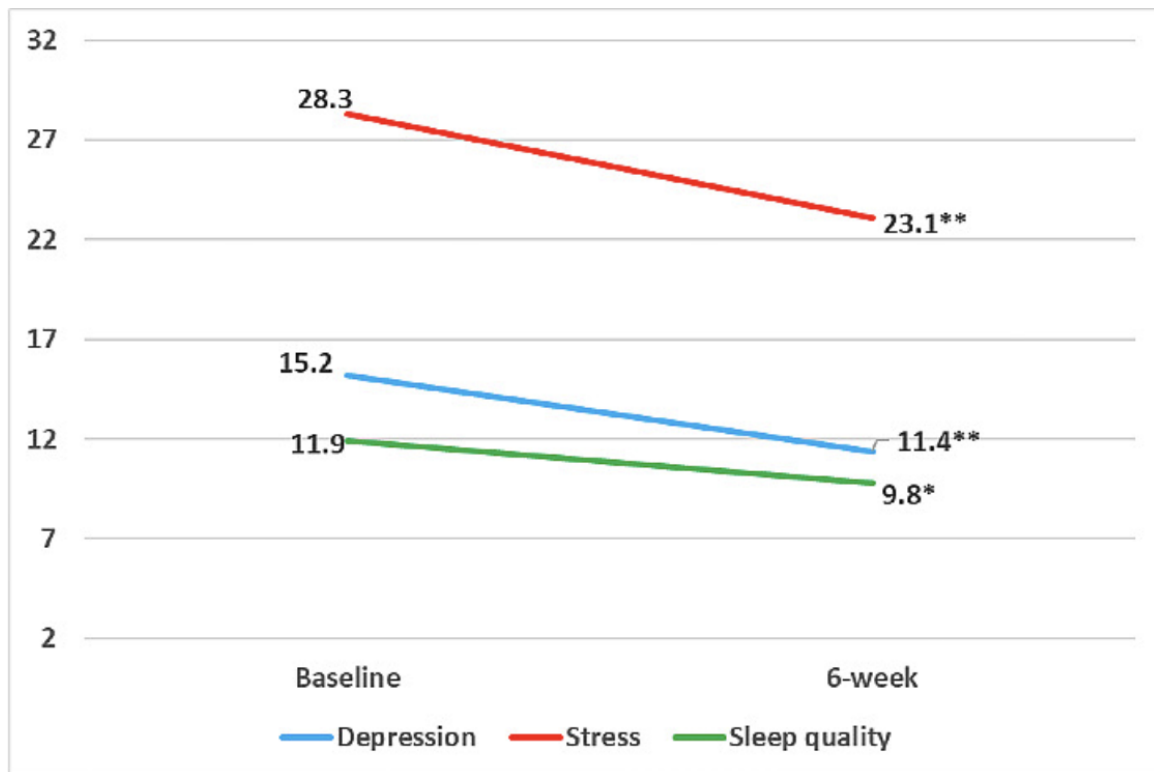


Figure 3: Pre and Post-Intervention Follow-up with Program Participants

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3.1.9 A Group Video Conference Intervention for Reducing Perinatal Depressive

Symptoms: A Telehealth Pilot Study

It was important to have an article within the results identifying group video conferences and their effectivity with postpartum depression. The study sites included one clinic in an urban area associated with an academic science center and a rural clinic associated with a public health clinic serving rural communities with a largely white population (Latendresse). At targeted times throughout the study, universal screenings were conducted at 28 and 36 weeks and postpartum at six months. The video conference was a total of 8 weeks in length via synchronous video

conferencing, and the intervention was facilitated by a psychiatric mental health and nurse practitioner. Specifically, the facilitators utilized a model called Using Practice and Learning to Increase Favorable Thoughts (UPLIFT). The UPLIFT model combines cognitive behavioral therapy and mindfulness-based practice that teaches women skills to reduce symptoms of depression. The Utah Telehealth Network provided a stable and Health Insurance Portability and Accountability Act compliant video conference infrastructure for delivery.

The results, the study did not divide the participants in two separate groups for those from the urban academic medical center to those from the rural clinic. Thus, this defines a limitation of the study in comparing both a larger urban academic medical center to a rural clinic. The study identified 47 participants: 23 women were identified as asymptomatic and showed risk factors at the original screening and 24 were symptomatic on the EFDS Scale scoring 10 or higher on the Postpartum Depression screening. On average, the participants had an average of 30 years old, had reported they were married or living with a partner, and had a Bachelor's degree or greater education level.

Prior to the emergence of the COVID-19 pandemic, isolation was a very big problem for women who are pregnant. Rural pregnant women report financial stress, transportation, isolation, and loneliness as predominant stressors for them on top of the stressors that come with women who are pregnant (Latendresse). The group-based video conference discussed in the study provides rural women more access to healthcare; however, at the same time it is more cost effective than one on one healthcare with a mental healthcare professional. There is a huge shortage of mental health providers across the whole entire region, with a dire shortages in rural areas. One factor that needs to be addressed in future studies in a rural area is the acceptability and overall effectiveness of distance interventions when it comes to mental healthcare.

4.0 Discussion

The results from the literature review demonstrate that digital technology and electronic health platforms are beneficial for postpartum treatment as well as general education regarding postpartum depression. For those in rural and medically underserved areas, the self-paced modules offered educational resources and the opportunity to access personal coaches and medical professionals from the comfort of home. Additionally, with transportation barriers, many of the studies provided insight into the incorporation of multiple services in one's primary care providers office, including behavioral healthcare.

4.1 Policy Analysis and Implications

All of the articles found in the literature review were from before the COVID-19 pandemic, and it is important for researchers to continue highlighting the importance of how digital technology can be effectively incorporated into the overall healthcare system. The COVID-19 has shown that telehealth and electronic health platforms can be utilized to create a more accessible healthcare landscape. A lot of important lessons were learned from the pandemic, including how effective telehealth can be in reaching and accessing more patients. In the future, there should be an increased emphasis on policy change within the context of digital technology and electronic health platforms for care for postpartum depression.

Many states have not enacted policies to screen women with postpartum depression during postpartum checkups, and it is essential that states move in this direction to diagnose and

treatment for women experiencing postpartum depression. However, when enacting policies, all parts of the utilization of digital technology and electronic health platforms need to be incorporated. Any digital technology and electronic health platform from a healthcare perspective will bring up many ethical concerns regarding privacy. Due to the sensitive nature of many conversations in mental health, it is important for everyone to have the space in their houses to freely speak with a provider. Additionally, it is important for both the provider and the patient to fully understand the platform in which they choose to communicate. Oftentimes with electronic health platforms and even utilization of the telephone, it is important to know what buttons to click within the platform. The policies enacted must address the privacy and security concerns.

Additionally, when it comes to policy, it is important to have all providers complete mandatory telehealth training, if they are utilizing any kind of telecommunication platform. Increased training provides resources and an avenue to ask questions to information technology personnel before going into their first telehealth appointment. The various platforms with asynchronous modules will be important to assess the feasibility and usability of the asynchronous modules. If these modules are created well before the recruitment of potential participants, they should be tested with a pilot group to ensure usability and make any necessary changes if needed. Many of the modules were not interactive, which makes it difficult for the women to engage in a completely remote environment with minimal engagement.

Broadband internet access in rural areas should also be considered as a need for policy interventions in rural and underserved areas. The Federal Communications Commission defines broadband internet as having a minimum of 25 megabits per second download speed and 3 megabytes of download speed (Federal Communications Commission). The Pew Research Center found that 43% of adults with income below \$30,000 a year report not having broadband internet

services, compared to 7% of adults whose households earn above \$100,000 a year (Vogels). According to the Census Bureau, about 19% of rural households compared to 14% of urban areas are without broadband internet access. An adequate amount of funding should be provided to increase broadband internet access and make it more accessible for those who live in rural areas.

4.2 Telehealth Reimbursement

Additionally, very few articles shed light on the reimbursement of payers for telehealth services. Providers may be reluctant to roll out various programs within their healthcare systems with the unknown of the value of reimbursement, return on investment, and the cost of services for the visits. Reimbursement can differ from location to location and from state to state as well. The reimbursements for telehealth are consistently changing, and with the COVID-19 pandemic, the various protocols are continually shifting. Furthermore, various states have different policies enacted related to reimbursement. Different positions within the healthcare industry (physician assistants, physicians, nurses), and appropriate duties need to be allocated when it comes to telehealth for reimbursement. The variation in various insurance models and roles could become a barrier for the implementation of telehealth, and certain health insurers will only cover certain aspects of care postpartum. Moreover, the variation in policies can lead to slower implementation due to the complexities in understanding reimbursement policies.

4.3 Limitations of the Literature

The literature found only a few articles that represented those in rural and medically underserved areas in the United States. Additionally, many of the articles did not discuss racial and economic disparities with travel when it comes to postpartum depression. Much of the literature was also before the onset of the COVID-19 pandemic when telehealth, digital technology, and electronic health platforms were less prevalent in United States. Additionally, the literature consistently mentioned women working through modules asynchronously and many mentioned the utilization of Cognitive Behavioral Therapy. The asynchronous modules focused on lifestyle interventions with a mental health professional calling the women with postpartum depression. The data varied greatly from article to article based on the intervention, and many of the rural participants did not answer phone calls for post intervention. A longitudinal study would show more prevalence of how the intervention is in a long-term for women in showing the signs of postpartum depression and recognize the signs and symptoms of postpartum depression.

Additionally, many of the articles did not address internet connectivity issues in rural and underserved areas. Also, transportation as a general barrier to healthcare was not addressed in very many articles. Insurance coverage in relation to the United States based articles and the articles in global context would be important to understand if insurance covers these services in the United States and what the insurance structure is like globally, with a specific focus on new and expecting mothers. It is important to have more in depth research focusing on a global healthcare system's family planning policies, postpartum depression statistics, and have more literature on the exact usage of digital technology and electronic health platforms to alleviate postpartum depression.

5.0 Public Health Significance

The public health significance of postpartum depression is well-documented; offering a solution through the utilization of digital technology and electronic health platforms is a step in the right direction. Postpartum depression requires continuous health sector support to not only benefit women, but it is also important to support the family and community as a large (Shrivastava). Depression has been acknowledged as one of the major public health problems, and postpartum depression is expected to become the second most prevalent of all health problems globally by the year 2020 amongst women (Shrivastava). Postpartum depression not only affects the mother, but it also affects the ability for the mother to bond with her child and the child's development. Moving forward, there needs to be a comprehensive and worldwide public health policy to ensure universal psychosocial assessment in perinatal women within the primary healthcare system. The testing being built into the primary healthcare system will allow more women to have access to and offering it within a digital means through telehealth will provide better access to care for many women in rural and medically underserved areas.

6.0 Conclusion

The incorporation of digital technology and electronic health platforms will be beneficial to women throughout their postpartum care and offers a cost-efficient method to access care. Furthermore, the literature has proven that asynchronous modules with roots in cognitive behavioral therapy and mindfulness are effective in alleviating postpartum depression. The continued support in rural and medically underserved areas through community health workers and increasing broadband internet access will serve as solutions to the barriers in a rural area. More women will feel at ease if there is more incorporation of safety protocols in place for data and electronic health records. More studies connecting urban areas to rural areas will show which areas have a higher prevalence and getting into the root cause as to why these exist will serve as important research questions heading into the future after the COVID-19 pandemic.

Bibliography

- Avalos, Lyndsay A et al. "A Mobile Health Mindfulness Intervention for Women With Moderate to Moderately Severe Postpartum Depressive Symptoms: Feasibility Study." *JMIR mental health* 7.11 (2020): e17405–e17405.
- Bervell, Brandford, and Hosam Al-Samarraie. "A Comparative Review of Mobile Health and Electronic Health Utilization in Sub-Saharan African Countries." *Social science & medicine* (1982) 232 (2019): 1–16.
- "Broadband Speed Guide." *Federal Communications Commission*, 11 Mar. 2020, <https://www.fcc.gov/consumers/guides/broadband-speed-guide>.
- Fonseca, Ana et al. "Be a Mom, a Web-Based Intervention to Prevent Postpartum Depression: Results From a Pilot Randomized Controlled Trial." *Behavior therapy* 51.4 (2020): 616–633.
- Latendresse, Gwen et al. "A Group Videoconference Intervention for Reducing Perinatal Depressive Symptoms: A Telehealth Pilot Study." *Journal of midwifery & women's health* 66.1 (2021): 70–77.
- "Postpartum Depression." *ACOG*, Dec. 2021, <https://www.acog.org/womens-health/faqs/postpartum-depression>.
- "Rural Health Information Hub." *Healthcare Access in Rural Communities Overview*, <https://www.ruralhealthinfo.org/topics/healthcare-access>.
- Poudyal, Anubhuti et al. "Wearable Digital Sensors to Identify Risks of Postpartum Depression and Personalize Psychological Treatment for Adolescent Mothers: Protocol for a Mixed Methods Exploratory Study in Rural Nepal." *JMIR research protocols* 8.8 (2019): e14734–e14734.
- "Rural Health Information Hub." *Healthcare Access in Rural Communities Overview*, 8 Aug. 2021, <https://www.ruralhealthinfo.org/topics/healthcare-access>.
- Shrivastava, Saurabh R et al. "Antenatal and postnatal depression: A public health perspective." *Journal of neurosciences in rural practice* vol. 6,1 (2015): 116-9. doi:10.4103/0976-3147.143218
- Sit, Dorothy K Y, and Katherine L Wisner. "Identification of postpartum depression." *Clinical obstetrics and gynecology* vol. 52,3 (2009): 456-68. doi:10.1097/GRF.0b013e3181b5a57c

- Solness, Cara L et al. "Treating Postpartum Depression in Rural Veterans Using Internet Delivered CBT: Program Evaluation of MomMoodBooster." *Journal of behavioral medicine* 44.4 (2020): 454–466.
- Sun, Mei et al. "A Study Protocol of Mobile Phone App-Based Cognitive Behaviour Training for the Prevention of Postpartum Depression Among High-Risk Mothers." *BMC public health* 19.1 (2019): 710–710.
- Toth, Sheree L et al. "Maternal depression, children's attachment security, and representational development: an organizational perspective." *Child development* vol. 80,1 (2009): 192-208. doi:10.1111/j.1467-8624.2008.01254.x
- Tsai, Alexander C et al. "Antenatal Depression Case Finding by Community Health Workers in South Africa: Feasibility of a Mobile Phone Application." *Archives of women's mental health* 17.5 (2014): 423–431.
- Vigod, Simone N et al. "Mother Matters: Pilot Randomized Wait-list Controlled Trial of an Online Therapist-facilitated Discussion Board and Support Group for Postpartum Depression Symptoms." *Depression and anxiety* 38.8 (2021): 816–825.
- Villegas, Laura et al. "Postpartum Depression Among Rural Women From Developed and Developing Countries: A Systematic Review: Postpartum Depression in Rural Women." *The Journal of rural health* 27.3 (2011): 278–288.
- Vogels, Emily A. "Digital Divide Persists Even as Americans with Lower Incomes Make Gains in Tech Adoption." *Pew Research Center*, Pew Research Center, 10 Sept. 2021, <https://www.pewresearch.org/fact-tank/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption/>.
- Wozney, Lori et al. "Strongest Families™ Managing Our Mood (MOM): a Randomized Controlled Trial of a Distance Intervention for Women with Postpartum Depression." *Archives of women's mental health* 20.4 (2017): 525–537.