Understanding needs and perspectives on remote technological interventions for perinatal mood and anxiety disorders: experiences of Black or African American women

Sakshi Taori, Sunwook Kim, Huaiyang Zhong, Sol Lim

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Sakshi Taori[1] MSc; Sunwook Kim[1] PhD; Huaiyang Zhong[1] PhD; Sol Lim[1] PhD

[1]Department of Industrial and Systems Engineering College of Engineering Virginia Polytechnic Institute and State University Blacksburg US

Corresponding Author:
Sol Lim PhD
Department of Industrial and Systems Engineering
College of Engineering
Virginia Polytechnic Institute and State University
1185 Perry Street
Blacksburg
US

Abstract

Background: Perinatal mood and anxiety disorders (PMADs) affect one in four women, contributing to maternal health complications and adversely affecting child development outcomes. While remote intervention systems can increase care access, lower costs, and reduce stigma, most are limited to either the pregnancy or postpartum phase—failing to provide continuous support across the entire perinatal period. Moreover, these systems are rarely designed with the specific cultural, social, and structural needs of racial and ethnic minority women, who face disproportionate barriers to mental health care. Given the evolving and complex nature of mental health challenges before and after childbirth, there is an urgent need for a remote intervention system that delivers effective, inclusive support throughout all phases of the perinatal journey.

Objective: This study aims to: 1) identify the challenges and needs of Black or African American women experiencing PMAD; 2) explore the benefits and barriers influencing their willingness to use remote intervention systems; and 3) determine essential features for such a system.

Methods: A mixed-methods approach was used, combining an online survey with semi-structured interviews from perinatal women who identify as Black or African American. The survey assessed mental health challenges, support preferences (in-person, remote, or both), and desired intervention features, with chi-square and ANOVA tests performed for quantitative analysis. Follow-up Zoom interviews were conducted, and responses were analyzed using thematic coding.

Results: While frequency of PMAD was not significant across the perinatal phases, a majority of support was sought during the second and third trimesters, suggesting the need for targeted interventions during these phases. Participants identified four key challenges: emotional, physical, financial, systemic and social barriers to support. The preference for remote or hybrid (in-person and remote) support was high during the second (72.4%) and third trimesters (79.2%). Major benefits of remote systems included easier appointment scheduling (90.3%), reduced travel time (90.3%), and lower costs (80.6%). However, primary barriers were missing in-person interaction (64.5%), and time constraints due to family responsibilities (67.7%). Key features preferred for remote systems included: communication with healthcare providers, cognitive behavioral therapy-based counseling services, symptom monitoring for anxiety or depression, calming music, positive affirmations or motivational quotes, and educational resources. Participants favored a customizable smartphone-based system, with sessions requiring minimal time commitment between 15-60 minutes, and flexible scheduling particularly during the postpartum period.

Conclusions: Findings suggest that mental health intervention systems for Black or African American women should primarily focus on the second and third trimesters, as participants seek more support in these phases. Further the interventions should be holistic, incorporating physical health tracking, emotional well-being tools, and education tools.

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Sakshi Taori, Sunwook Kim, Huaiyang Zhong, Sol Lim

Department of Industrial and Systems Engineering, Virginia Tech, VA, USA

Corresponding Author: Sol Lim, Ph.D.
Email: sol@vt.edu
Address:
549 Whittemore Hall
1185 Perry Street
Blacksburg, Virginia 24061
P: (540) 231-0083

Abstract

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This study aims to: 1) identify the challenges and needs of Black or African American women experiencing PMAD; 2) explore the benefits and barriers influencing their willingness to use remote intervention systems; and 3) determine essential features for such a system.

Methods

A mixed-methods approach was used, combining an online survey with semi-structured interviews from perinatal women who identify as Black or African American. The survey assessed mental health challenges, support preferences (in-person, remote, or both), and desired intervention features, with chi-square and ANOVA tests performed for quantitative analysis. Follow-up Zoom interviews were conducted, and responses were analyzed using thematic coding.

Results

While frequency of PMAD was not significant across the perinatal phases, a majority of support was sought during the second and third trimesters, suggesting the need for targeted interventions during these phases. Participants identified four key challenges: emotional, physical, financial, systemic and social barriers to support. The preference for remote or hybrid (in-person and remote) support was high during the second (72.4%) and third trimesters (79.2%). Major benefits of remote systems included easier appointment scheduling (90.3%), reduced travel time (90.3%), and lower costs (80.6%). However, primary barriers were missing in-person interaction (64.5%), and time constraints due to family responsibilities (67.7%). Key features preferred for remote systems included: communication with healthcare providers, cognitive behavioral therapy-based counseling services, symptom monitoring for anxiety or depression, calming music, positive affirmations or motivational quotes, and educational resources. Participants favored a customizable smartphone-based system, with sessions requiring minimal time commitment between 15-60 minutes, and flexible scheduling particularly during the postpartum period.

Conclusion

Findings suggest that mental health intervention systems for Black or African American women should primarily focus on the second and third trimesters, as participants seek more support in these phases. Further the interventions should be holistic, incorporating physical health tracking, emotional well-being tools, and education tools.

Keywords: *PMAD*; *perinatal depression; perinatal anxiety; remote mental health; digital mental*

health; health equity; user-centered design; mixed methods

1. Introduction

Women in the perinatal period, spanning from conception to one year postpartum, undergo complex physiological and psychological changes that can adversely impact maternal mental health, increasing the risk of perinatal mood and anxiety disorders (PMADs)[1,2]. PMADs affect one in four women and contribute to an estimated $15 billion annual health care costs with short-term and long-term adverse outcomes for both parent and child in the U.S.[3,4]. These conditions can have serious consequences, affecting both maternal health (e.g., maternal suicide) and a child's psychological development[5–7]. The COVID-19 pandemic has further exacerbated psychological distress among perinatal women, with one in three experiencing clinical levels of depression.[8]

Racial and ethnic disparities in PMAD prevalence and treatment access are well-documented. In California, minority women—particularly Non-Latina Black women—experience higher rates of prenatal depression (54%)[9] and are less likely to receive adequate mental health care or paid sick leave compared to White women[10]. Between 2010 and 2021, postpartum depression prevalence among Black women in California rose by 140% (from 22.0%), compared to a 60% increase (from 21.8%) among White women[11]. Alarmingly, only 25.4% of women with postpartum depressive symptoms receive a formal mood disorder diagnosis, and just 52.8% access mental health care, with Black women being less likely than White women to receive proper treatment[12]. These disparities occur due to limited mental health services[13], inadequate training among obstetric practitioners[13], social stigma surrounding depression[3], lack of continuity of care[14], low income[14], and racial and ethnic disparities[9,15]. The maternal mortality rate for Non-Hispanic Black women is 3.55 times higher than that of Non-Hispanic White women[16]. Addressing the underlying barriers of PMAD diagnosis and care through improved screening, treatment, and follow-up care is therefore essential.

Remote intervention systems have emerged as promising solutions to address these barriers, offering cost-effective and accessible mental health support[2,17] . Mobile health (mHealth) applications and texting-based interventions have been developed for symptom monitoring[18], psychoeducation[2], psychological therapy[19], and peer support[2], and have shown effectiveness in improving perinatal mental health outcomes[20,21]. Collaborative care models, such as longitudinal remote coaching and group video conferencing, have also shown success in treating perinatal depression[22,23].

Despite the potential benefit of remote interventions (e.g., delivered via computer, web-based, or mobile platforms), the vast majority are suboptimal, limited in scope, targeting either pregnancy or postpartum[18], but rarely both. This episodic approach creates a gap in continuous care, overlooking the evolving and interconnected mental health needs that span the entire perinatal period. In fact, only 9% of currently available systems offer continuous care across this critical timeframe[2]. Moreover, existing interventions are rarely designed with the specific cultural, social, and structural needs of Black or African American women and other racial and ethnic minority groups in mind—populations that often face distinct perinatal stressors and barriers to care. Given the gap, there is a critical need for a remote intervention system that is not only continuous and comprehensive but also culturally responsive and inclusive.

Our study aims to inform the development of such an effective and inclusive system by identifying the needs of minority perinatal women across different pregnancy and postpartum phases. Using a mixed-methods approach—including surveys and interviews with Black or African American women across various perinatal phases—we addressed the following key research questions:

RQ1: What are the specific challenges and unmet needs experienced by Black or African American women experiencing PMAD?

RQ2: What factors (both benefits and barriers) promote or hinder their willingness to use remote mental health intervention systems?

RQ3: What key design features and considerations are essential for an effective, inclusive remote mental health intervention system?

By answering these questions, our long-term goal is to develop a phase-inclusive responsive intervention system that adapts to the evolving needs of perinatal women, with a particular focus on minority women.

2. Methods

To inform the development of a remote intervention system, we used a mixed-methods approach, integrating both quantitative and qualitative methods to gain a comprehensive understanding of the needs and perspectives of Black or African American women. We first conducted an online survey to explore the challenges women face at different phases of the perinatal period (1st, 2nd, and 3rd trimesters, as well as postpartum). Then, survey respondents were given the option to participate in a follow-up semi-structured interview via Zoom, allowing for a deeper exploration of their experiences and preferences regarding remote mental health interventions. The survey provided a broad overview of participant experiences, enabling statistical analysis of trends across a larger sample, while the qualitative interviews uncovered context-specific insights that could not be fully captured through survey data alone. Responses from both data sources were synthesized to inform the design of a responsive and inclusive remote intervention system tailored to the needs of perinatal women.

2.1 Survey Study

2.1.1 Respondents

Eligible respondents were women aged 18 and older who were either pregnant or had given birth within the past year. Recruitment was primarily conducted using snowball sampling[24]. Respondents were screened for depression or anxiety symptoms using the Edinburgh Postnatal Depression Scale (EPDS)[25], a 10-item questionnaire assessing experiences over the past seven days. A score of 10 (out of 30) indicates the potential presence of minor or major depression[25]. Consequently, women with an EPDS score of 10 or higher were eligible for the study. On average, the survey took 30.6 minutes to complete, and respondents received a $25 compensation upon completion. This study was approved by Virginia Tech's Institutional Review Board (IRB-23-353).

A total of 31 Black or African American respondents, including one identifying as Hispanic or Latino, completed the survey between October and December 2023. Among them, the majority (64.5%) were aged between 25-34, while the smallest proportion (3.3%) were aged between 45-54. Respondents were distributed across perinatal phases: 6.5% in the first trimester, 16.1% in the second trimester, 64.5% in the third trimester, and 12.9% in the postpartum phase. The mean EPDS score was 18.5 across all participants. Nearly all participants (except one) had taken maternity leave, and 29% had previous parenting experience. A detailed demographic breakdown by perinatal phase is provided in Table 1.

2.1.2 Survey Questions

The survey included different categories of questions concerning PMAD experiences, the types of support options sought (whether in-person, remote, or hybrid), preferences for these support options, and features considered essential for a remote intervention system. Table 2 lists the question categories along with examples. The complete list of questions can be found in Appendix 1.

Table 1: Demographic characteristics of survey participants by perinatal phase.

Category		First trimester (*N* = 2)	Second trimester (*N* = 5)	Third trimester (*N* = 20)	Postpartum (*N* = 4)	Total (N = 31)
Mean EPDS Score		19.5	18.8	18.8	16	18.5
Age group (years)						
	18-24	-	1 (20%)	2 (10%)	-	3 (9.7%)
	25-34	2 (100%)	4 (80%)	11 (55%)	3 (75%)	20 (64.5%)
	35-44	-	-	6 (30%)	1 (25%)	7 (22.6%)
	45-54	-	-	1 (5%)	-	1 (3.2%)
Education level						
	High School Diploma	1 (50%)	1 (20%)	-	-	2 (6.5%)
	Associate Degree	1 (50%)	3 (60%)	12 (60%)	2 (50%)	18 (58.1%)
	Bachelor's Degree	-	1 (20%)	8 (40%)	1 (25%)	10 (32.3%)
	Master's Degree	-	-	-	1 (25%)	1 (3.2%)
Maternity leave taken						
	0-3 Months	2 (100%)	1 (20%)	5 (25%)	1 (25%)	9 (29%)
	4-6 Months	-	4 (80%)	12 (60%)	2 (50%)	18 (58.1%)
	7-9 Months	-	-	3 (15%)	-	3 (9.7%)
	>10 Months	-	-	-	1 (25%)	1 (3.2%)
Previous motherhood experience						
	No child	2 (100%)	3 (60%)	15 (75%)	2 (50%)	22 (71%)
	1 child	-	2 (40%)	3 (15%)	1 (25%)	6 (19.4%)
	2 children	-	-	2 (10%)	-	2 (6.5%)
	≧3 children	-	-	-	1 (25%)	1 (3.2%)
No. of family members						
	1	-	-	2 (10%)	-	2 (6.5%)
	2	-	2 (40%)	9 (45%)	2 (50%)	13 (41.9%)
	>=3	2 (100%)	3 (60%)	9 (45%)	2 (50%)	16 (51.6%)

2.1.3 Data Analysis

Numerical survey responses—frequency of PMAD, frequency of support sought, and type of remote options, measured using a Likert scale (Appendix 1), were analyzed using one-way analysis of variance (ANOVA) with the perinatal phase (1st, 2nd, and 3rd trimesters, and postpartum) as the independent variable. In the initial ANOVA analysis, respondent's education level was considered as a covariate; however, it was dropped later due to the absence of significant effects. Categorical survey responses—preference of support sought and types of support —were analyzed using the Chi-Square test of independence, with the perinatal phase as the independent variable. Analyses were conducted in Python v.3.9 (Centrum Wiskunde & Informatica, Netherlands) using the *scipy.stats* package. Statistical significance was set at $p < .05$, with post-hoc analyses performed to identify significant pairwise differences.

Table 2. Sample Survey Questions.

Question categories	Examples
Frequency of PMAD	During your perinatal period, how often have you felt depressed or anxious?
Factors contributing to PMAD	If you have experienced depression or anxiety in your perinatal period, which of the following factors do you think contributed to it?
Frequency and type of support sought	● During your perinatal period, how frequently have you sought any type of perinatal mental health support? ● What type of perinatal mental health support (for example, in-person, remote) have you sought? ● When seeking in-person perinatal mental health support, which of the following challenges have you experienced?
Preferences for remote intervention system	● During a specific perinatal period, would you prefer to receive perinatal mental health support in person or remotely? ● If you think remote mental health support could be useful for managing anxiety and/or depression during the perinatal period, what are some potential benefits of such support?
Features for remote intervention system	● During your perinatal period, how frequently have you used remote applications for mindfulness-based cognitive behavioral therapy to manage your mental health? ● During your perinatal period, how frequently have you interacted remotely with healthcare providers? ● If you were to use any remote mental health intervention system, what would be your preference for the time of participation? ● What is your preferred amount of time to participate in remote perinatal mental healthcare activities? ● Indicate level of importance for different features (some options listed below) ○ Positive quotes ○ Symptom monitoring ○ Breathing Exercises

2.2 Interview Study

Semi-structured interviews were conducted by the primary investigator (ST) between October and December 2023. Each interview lasted approximately one hour and was conducted via Zoom video conferencing platform (Zoom Video Communications, Inc., San Jose, California), with participant's consent, and recorded for subsequent analysis. Interview questions were structured around three key research questions: 1) the challenges faced during the perinatal period; 2) the factors (both benefits and barriers) that promote or hinder their willingness to use remote intervention systems; and 3) the key design features essential for an effective remote mental health intervention system. Follow-up questions were asked as needed to explore emerging themes in greater depth. A complete list of semi-structured interview questions is provided in Appendix 2.

2.2.1 Participants

A total of 16 survey respondents completed the interview, with a mean age of 28.7 years (SD = 5.5).

Among them, three participants were in their second trimester [mean (SD) of age = 27 (3.6) years], including two first-time mothers and one second-time mother. Twelve participants were in their third trimester [mean (SD) of age = 29.5 (5.9) years], including ten first-time mothers and two second-time mothers. One participant, aged 24, was in the postpartum period and was a first-time mother. No participants were in their first trimester.

2.2.2 Data Analysis

All 16 interviews were recorded and transcribed verbatim using Microsoft Word's (Washington, USA) automated transcription service. Thematic analysis was conducted using the small-Q approach[26], a structured qualitative data analysis method focused on identifying patterns and coding schemes using a deductive approach. To enhance traditional coding, we integrated the Large Language Model (LLM) named GPT-4o[27,28] in the analysis process. Specifically, LLMs were used for initial coding to extract third-level codes, which represent deeper, more abstract thematic categories emerging from the transcripts. While it is still new and emerging, the LLM-assisted content analysis (LACA) framework has shown potential to augment traditional qualitative coding methods[29]. In our study, LLMs provided both code suggestions and justifications, enabling researchers to review conceptual reasoning and identify potential misclassifications. All LLM-assisted processes were reviewed and edited by the first-author to ensure analytic rigor and reliability.

The analysis followed three key phases:

- *Phase 1 (Familiarization)*: Each transcript segment was analyzed using the LLM accessed via an API. For every combination of research question and transcript, the model generated three key elements: a concise third-level code summarizing a distinct idea, a brief explanation providing context or interpretation, and a supporting quote from the original transcript. These outputs were saved in structured text files, organized to reflect both the question and transcript identifiers, facilitating downstream thematic analysis. The exact LLM prompt is provided in Appendix 3. The first-author (primary coder) reviewed and refined these codes, using them as a starting point for manual analysis. A secondary coder then reviewed the transcripts to ensure a comprehensive understanding of the data prior to detailed coding.
- *Phase 2 (Initial Coding)*: A draft codebook was developed and iteratively refined as new codes emerged[26]. To establish coding reliability, one randomly selected transcript was independently coded by two human coders, and inter-rater reliability (IRR) was assessed using Cohen's Kappa[30]. Discrepancies were discussed and resolved. This process was repeated until IRR fell above the 0.8 threshold (indicating strong agreement[30]). The final overall IRR was 0.89, with category-specific scores as follows: challenges faced during the perinatal period (0.82), utilization factors for remote intervention systems (0.88), and effective features for remote intervention systems (0.96). Following the establishment of reliability, the first author proceeded with coding the remaining transcripts[31].
- *Phase 3 (Theme Development and Refinement)*: Higher-level themes were synthesized to capture shared meanings across identified codes. These themes were refined collaboratively through iterative discussion among the first and corresponding authors to ensure a comprehensive and coherent representation of perinatal women's experiences with mental health challenges and remote intervention systems.

3. Results

The results section is organized around the three research questions, integrating both survey and interview data to provide a comprehensive mixed-methods analysis. Quantitative findings are presented in Tables 2, 3, and 4, which summarize survey responses and chi-square test outcomes related to each RQ. All data are stratified by perinatal phase (1st, 2nd, and 3rd trimesters, and

postpartum). Since participants reflected on both current and past perinatal phases, the total number of responses (*N*) in these tables may exceed the number of participants currently in each perinatal phase. To ensure transparency in representing interviewees' perspective, illustrative quotations are included throughout the results. Minor edits are made to these quotes for clarity, with changes indicated by square brackets[31].

RQ1: What are the specific challenges and unmet needs experienced by Black or African American women experiencing PMAD?

Survey

Table 3 presents the ANOVA results from the survey regarding the challenges and needs of women experiencing PMAD. Though PMAD had a higher frequency in the second (3.3) and third (3.0) trimesters, no significant difference was found.

Table 3: Summary of ANOVA test outcome for self-reported frequency of PMAD, stratified by perinatal phase (1st, 2nd, and 3rd trimesters, and postpartum). PMAD = Perinatal mood and anxiety disorders

Survey metrics	First trimester (*N* = 31)	Second trimester (*N* = 29)	Third trimester (*N* = 24)	Postpartum (*N* = 4)	Total N (*N* = 88)	F, *P*
Frequency of PMAD	2.8 (1.3)	3.3 (0.9)	3 (1.3)	1.8 (1.0)	3.0 (1.2)	2.46, .068

Survey respondents identified several key contributors to their mental health challenges (see Figure 1). The most frequently cited contributors (Figure 1-a) were hormonal changes during pregnancy (80.6%), financial or occupational stress (77.4%), and lack of time for hobbies (54.8%). Additionally, 41.9% of respondents attributed their mental health struggles to a lack of family or partner support. Regarding assistance from family members (Figure 1-b), respondents more often reported receiving financial (58.1%) and physical support unrelated to childcare (54.8%), with 41.9% reported receiving help for mental and psychological well-being. However, 12.9% indicated receiving no family support. Friends were also a primary source of physical and emotional support, with 64.5% of respondents receiving assistance with physical needs unrelated to childcare and 54.8% receiving emotional support (Figure 1-c).

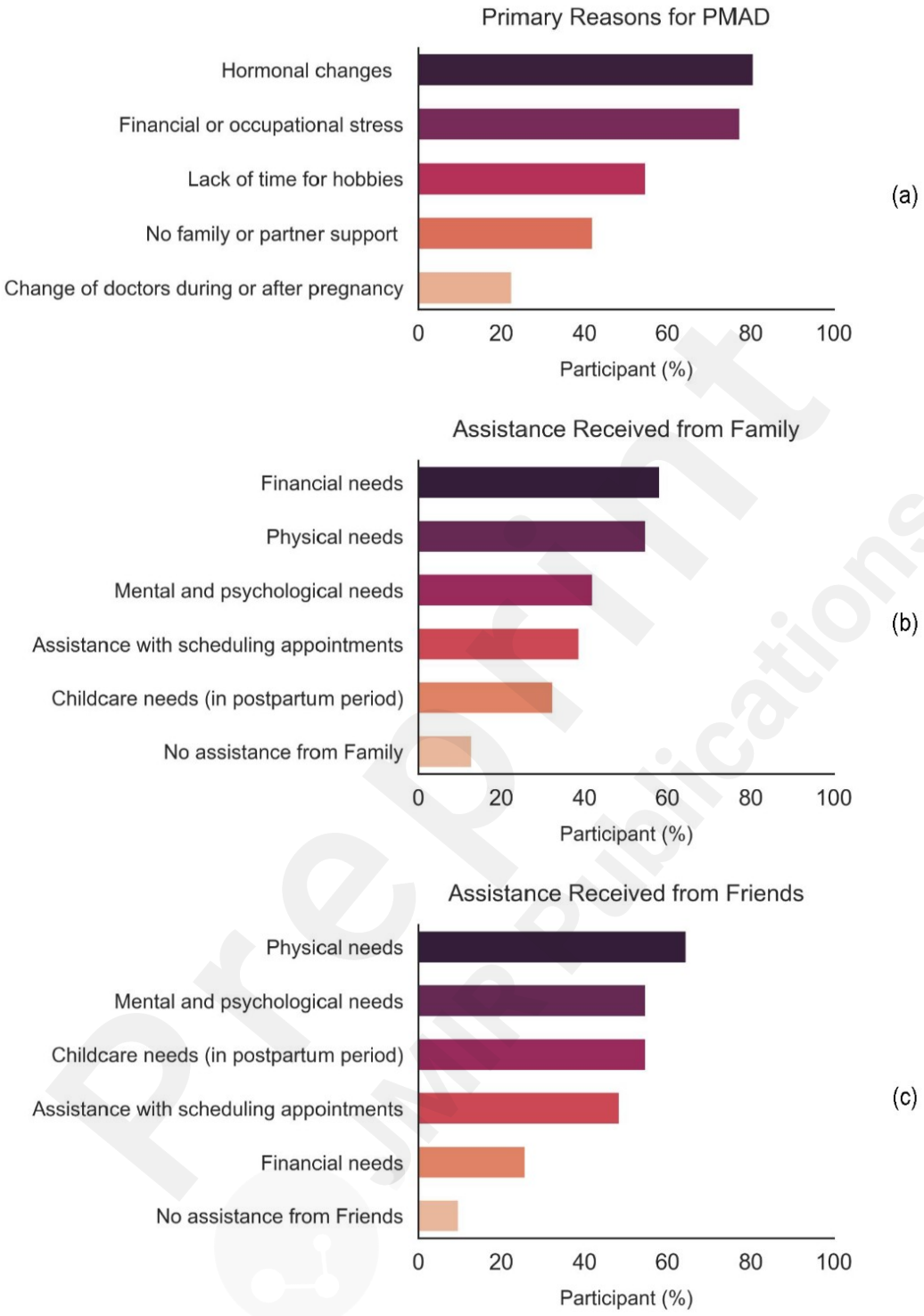


Figure 1. Horizontal bar plots illustrating survey outcomes related to: (a) Primary reasons for PMAD, (b) Assistance received from family, and (c) Assistance received from friends. PMAD = Perinatal mood and anxiety Disorders.

Interview

Thematic analysis of the interview data revealed a range of emotional, physical, financial, and logistical challenges during the perinatal period, all of which substantially impacted their mental well-being. Figure 2 illustrates a summary results from the thematic analysis, showing four second-level themes (rounded boxes with a dotted line) and multiple third-level themes (rectangular boxes),

corresponding such challenges. While some representative comments are included in this section, Appendix 4 provides additional example quotations for each theme and code.

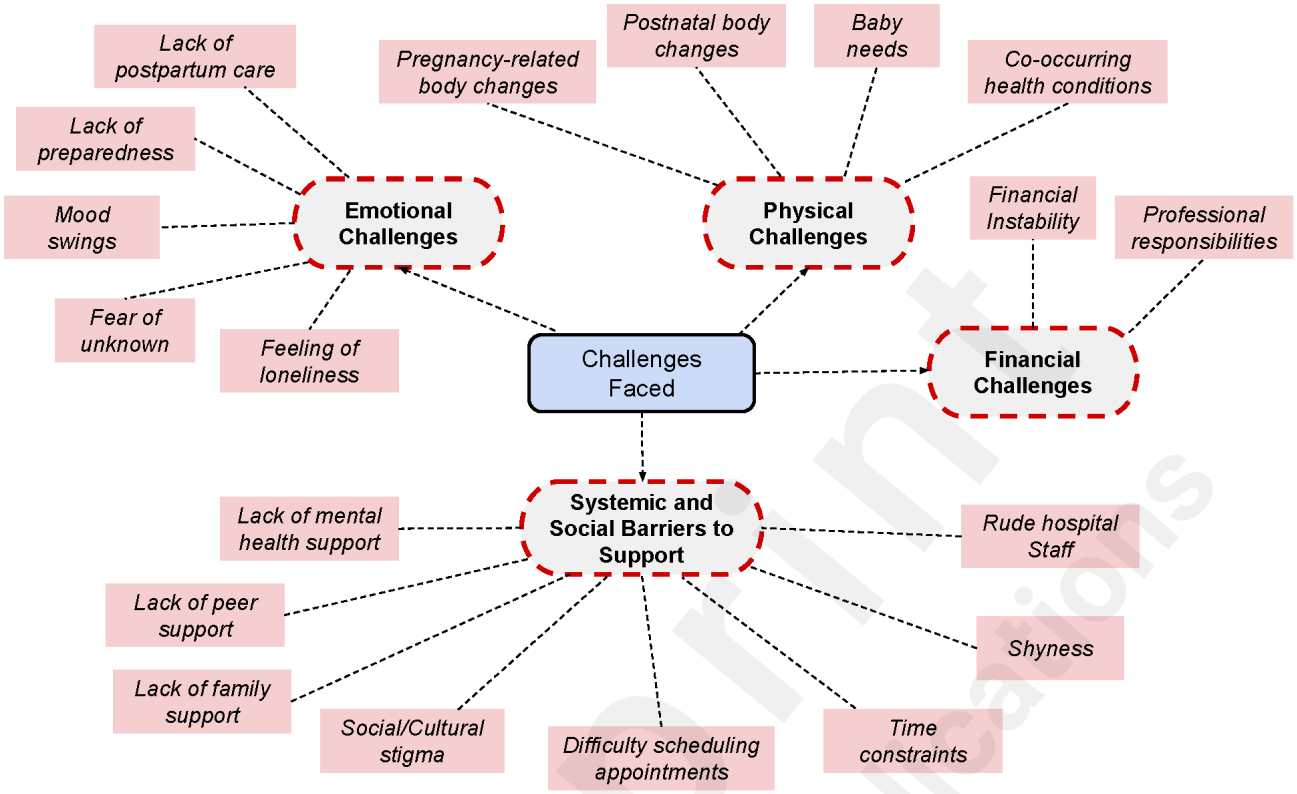


Figure 2. Illustration of second-level themes (rounded boxes with a dotted line), and third-level codes (rectangular boxes) for challenges faced by women during the perinatal period.

Emotional Challenges: Many participants experienced emotional distress due to anxiety, mood fluctuations, stress, and uncertainty about childbirth and parenting.

- *Lack of postpartum care*: Some participants reported inadequate follow-up care after childbirth, leading to feelings of neglect and struggles with recovery and mental health.

  "I also didn't receive any care continuity during the postpartum period. It seems like the healthcare providers don't really value the postpartum period. They stop giving you the maximum attention they were giving you. So that might affect mental health."

- *Lack of preparedness*: Participants felt unprepared for the physical, emotional, and lifestyle changes associated with pregnancy, birth, and postpartum care.

  "I wasn't ready for it [pregnancy]. I was in that state of acceptance. I have to accept it [pregnancy] has happened. Now you have to accept this condition that you are in. So this just gave me depression."

- *Mood swings*: Emotional fluctuations such as heightened anxiety, irritability, and sadness were common and difficult to manage.

  "I was very irritable. I thought about it [pregnancy] most of the time and I had no energy to do most of the things that I was excited to do. At times I blame myself for certain beings and

thoughts of harming myself cross my mind."

- *Fear of the unknown*: Anxiety and uncertainty regarding labor, delivery, and postpartum challenges led to emotional distress.

  "Not everyone is able to deliver safely. I have my family history of my aunt dying while she was giving birth, so at times I fear that maybe it will happen to me."

- *Feeling of loneliness*: Many participants experienced isolation due to a lack of social interactions, emotional support, or understanding from their friends and family.

  "I feel lonely most of the time and the thought of being a new mom makes me feel like my normal life has been robbed from me. I feel caged and wish to get back to my normal life."

Physical Challenges: The physiological demands of pregnancy and postpartum recovery posed substantial difficulties.

- *Pregnancy-related body changes*: Participants reported experiencing physical transformations such as weight gain, fatigue, and discomfort, which affected their daily activities and self-image.

  "I did have some kind of depression because that is when my body started changing. I gained weight."

- *Postnatal body changes*: Physical recovery after childbirth, including hormonal shifts, changes in body shape, and postpartum discomfort, affected confidence and well-being.

  "What happens after giving birth is that the whole thing changes. So, I'm actually familiarizing myself with it."

- *Baby needs*: Preparing for and meeting the baby's needs—such as (e.g. feeding, sleep, and medical care), added to the stress and uncertainty.

  "There's depression that comes with having a baby, the thought and the whole care, not being able to sleep well."

- *Co-occurring health conditions*: Some participants faced medical complications such as gestational diabetes or preeclampsia, which added medical concerns and stress.

  "I got preeclampsia, then it was treated. Then, I was told that I'm having gestational diabetes, which might affect the baby and it's risky."

Financial Challenges: Financial challenges were associated with economic concerns, including job security, medical expenses, and childcare costs, all of which impacted access to essential resources.

- *Financial instability*: The financial burden of medical care, reduced income, and childcare costs caused stress.

  "Raising my child on my own, paying bills, and financial aspects could be challenging."

"Getting a second child is going to put me at a financial strain."

- *Professional responsibilities*: Balancing work with pregnancy or postpartum recovery was stressful, while maternity leave brought job security concerns.

  "Employees should be more considerate. Just because it is your first trimester, doesn't mean that you're not going through challenges."

Systemic and Social Barriers to Support: Limited availability and accessibility of healthcare and mental health services created obstacles for participants seeking help.

- *Lack of mental health support*: Participants expressed disappointment when OB-GYNs and healthcare providers prioritized physical health while neglecting discussions on mental well-being.

  "My doctor has never asked about my mental wellness, only my physical health. I haven't had an opportunity to address this side of me."

- *Lack of peer support*: A lack of interaction with others facing similar experiences made it difficult for participants to share concerns and discuss solutions.

  "Having more women who have been pregnant is better because right now I'm dealing with a man and it's hard to explain something because I'm just like, I don't think you get it but it's ok."

- *Lack of family support*: Limited assistance from family members made managing pregnancy and postpartum responsibilities more challenging.

  "I'm in my household alone. The father of the baby is not in the picture, so if something were to change, having his support would matter."

- *Social/Cultural stigma*: Cultural expectations that women should endure pregnancy and childbirth pain without complaints discouraged participants from seeking mental health care.

  "Firstly, women are supposed to be strong, so that's quite hard because sometimes they don't feel strong."

  "Hesitant due to religious belief and also stigma from society. Religion is stopping me from sharing information or from doing certain procedures."

- *Difficulty scheduling appointments*: Participants faced long wait times and limited availability of healthcare providers.

  "Once I booked an appointment but the doctor had an emergency and couldn't attend to me."

  "You have to plan and work with the doctor's schedules. Maybe at that time, you're not in the mood. You're tired. You're depressed. But you have to work with his work plan."

- *Time constraints*: Balancing family responsibilities and childcare needs left participants with limited time to prioritize their own physical and mental well-being.

"Like maybe the child is not feeling well and I had already booked an appointment, so I'm not able to go."

- *Shyness*: Some participants felt hesitant or uncomfortable seeking help, discussing concerns, or attending medical appointments.

  "The most challenging part was that I was not ready to be open and didn't know how people would take it."

- *Rude hospital staff*: Some participants experienced dismissive or unsupportive behavior from hospital staff, which led to dissatisfaction and reluctance to seek further care.

  "They [hospital staff] were kind of rude. That is why I changed my doctor"

RQ2: What factors (both benefits and barriers) promote or hinder their willingness to use remote mental health intervention systems?

Survey

Table 4 presents a quantitative summary of the survey results, along with ANOVA and Chi-square test results, examining the factors that promote or hinder perinatal women's willingness to use remote intervention systems. Respondents in the third trimester reported significantly higher levels of support-seeking behavior compared to those in the first trimester and postpartum period.

The type of support sought also varied significantly across perinatal phases. In-person support was significantly less utilized in the postpartum compared to pregnancy trimesters. Whereas, remote support was significantly more utilized during the second and third trimesters compared to the first trimester and postpartum. Conversely, opting for no support was significantly more frequent during the postpartum period than at any other phase.

Preferences for support modality (in-person, remote, hybrid, or no support) also differed by perinatal phase. In-person and hybrid support was significantly more preferred in the first trimester compared to second, third and postpartum phases. In contrast, remote support was significantly more preferred during the second and third trimesters compared to the first trimester and postpartum.

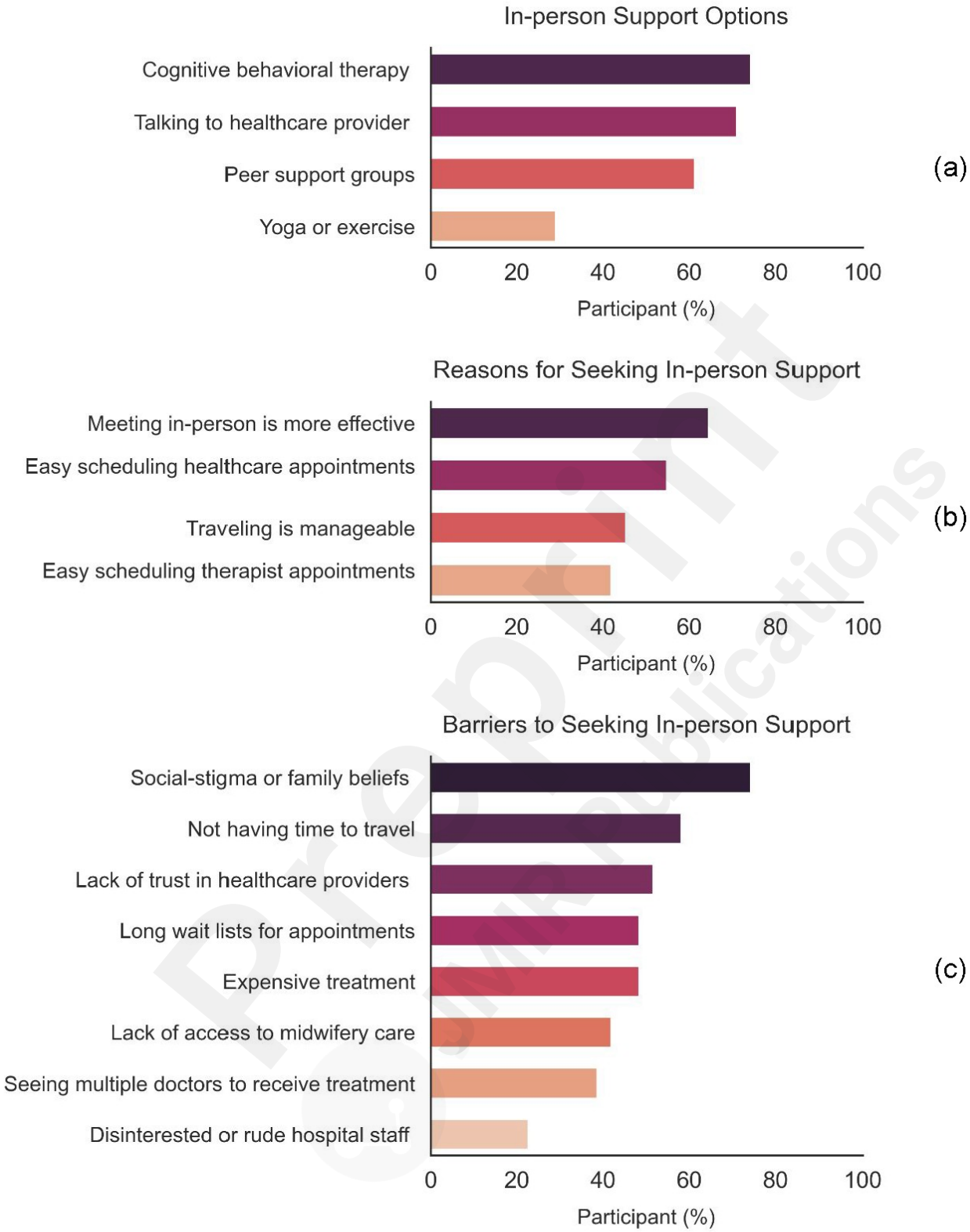
A key barrier to utilizing remote intervention systems was limited time availability. Participants reported that the majority of their daily time was dedicated to family responsibilities (67.7%) and pregnancy-related medical needs (51.6%), while significantly less time was allocated to personal hobbies and interests (29%). Looking ahead to later phases of pregnancy and the postpartum period, 58.1% of participants anticipated that time spent on family and medical obligations would either increase or remain unchanged. In contrast, nearly all participants (96.8%) expected a further decrease in time available for personal interests. Additionally, 74.2% of participants reported spending less time on professional responsibilities, potentially contributing to increased financial stress and compounding the challenges of accessing consistent mental health support.

As shown in Figure 3, in-person support mainly included interactions with healthcare providers (71%), cognitive behavioral therapy (74.2%), and peer-support groups (61.3%). The most commonly cited reason for preferring in-person support (Figure 3-b) was the belief that face-to-face interactions are generally more effective than remote ones (64.5%). However, several barriers to accessing in-person care were reported (Figure 3-c), including social stigma or conflicting family beliefs (74.2%), time constraints (58.1%), and a lack of trust in healthcare providers (51.6%). In contrast, the key reasons participants preferred remote support (Figure 3-d) included easier

appointment scheduling with healthcare providers or therapists (90.3%), reduced travel time (90.3%), and lower associated costs (80.6%).

Table 4: Summary of quantitative results *N* (%) and chi-square test outcomes, stratified by perinatal phase (1st, 2nd, and 3rd trimesters, and postpartum) for factors influencing women's decision to use remote intervention systems. Superscript letters indicate significant post hoc pairwise differences (a > b > c > d).

Survey metrics		**First trimester (*N* = 31)**	**Second trimester (*N* = 29)**	**Third trimester (*N* = 24)**	**Postpartum (*N* = 4)**	**Total N (*N* = 88)**	**F/χ^2, *P***
Frequency of Support Sought		2.2 (1.0)[b]	2.8 (0.8)[ab]	3.3 (1.1)[a]	1.5 (0.6)[b]	2.6 (1.1)	7.10, <.001
Type of mental health support sought							
	In-person	7 (23%)[a]	4 (14%)[a]	3 (13%)[a]	0 (0)[b]	14 (15.9%)	21.24, <.001
	Remote	5 (16%)[b]	14 (48%)[a]	8 (33%)[a]	0 (0)[c]	27 (30.7%)	53.82, <.001
	Hybrid	10 (32%)[abc]	7 (24%)[c]	11 (46%)[ab]	2 (50%)[a]	30 (34.1%)	11.31, .01
	No support	9 (29%)[b]	4 (14%)[c]	2 (8%)[c]	2 (50%)[a]	17 (19.3%)	41.35, <.001
Preference for mental health support							
	In-person	4 (13%)[a]	1 (3%)[b]	1 (4%)[b]	0 (0)[b]	6 (6.8%)	17.67, .001
	Remote	8 (26%)[b]	21 (72%)[a]	14 (58%)[a]	2 (50%)[a]	45 (51.1%)	22.19, <.001
	Hybrid	15 (48%)[a]	5 (17%)[b]	6 (25%)[b]	1 (25%)[b]	27 (30.7%)	18.95, <.001
	No support	4 (13%)[ab]	2 (7%)[b]	3 (13%)[b]	1 (25%)[a]	10 (11.4%)	12.18, .007
Pregnancy: Daily routine activity requiring maximum time commitment (*N* = 31)							
	Family responsibilities	21 (67.7%)					-
	Medical needs related to pregnancy	16 (51.6%)					-
	Professional life	8 (25.8%)					-
	Baby bonding activities, such as listening to music	8 (25.8%)					-
	Hobbies/interests	9 (29%)					-
Postpartum: Daily routine activity increase or decrease (*N* = 31)							
	Family responsibilities	Increase (↑) or Stay the Same; 17 (54.8%)					-
	Medical needs related to pregnancy	Increase (↑) or Stay the Same; 18 (58.1%)					-
	Baby bonding activities	Increase (↑) or Stay the Same; 19 (61.3%)					-
	Professional life	Decrease (↓) or Stay the Same; 23 (74.2%)					-
	Hobbies/interests	Decrease (↓) or Stay the Same; 30 (96.8%)					-



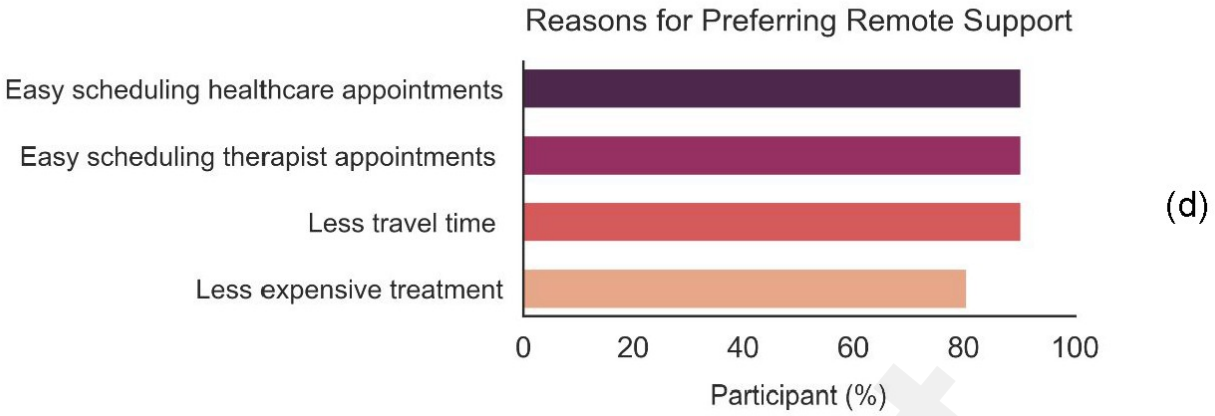


Figure 3. Horizontal bar plots illustrating survey outcomes related to: (a) In-person support options, (b) Reasons for seeking in-person support, (c) Barriers to seeking in-person support, and (d) Reasons for preferring remote support.

Interview

Responses regarding perceived benefits and barriers related to the use of a remote intervention system were identified from the interview (Figure 4). Representative quotes are provided for each theme.

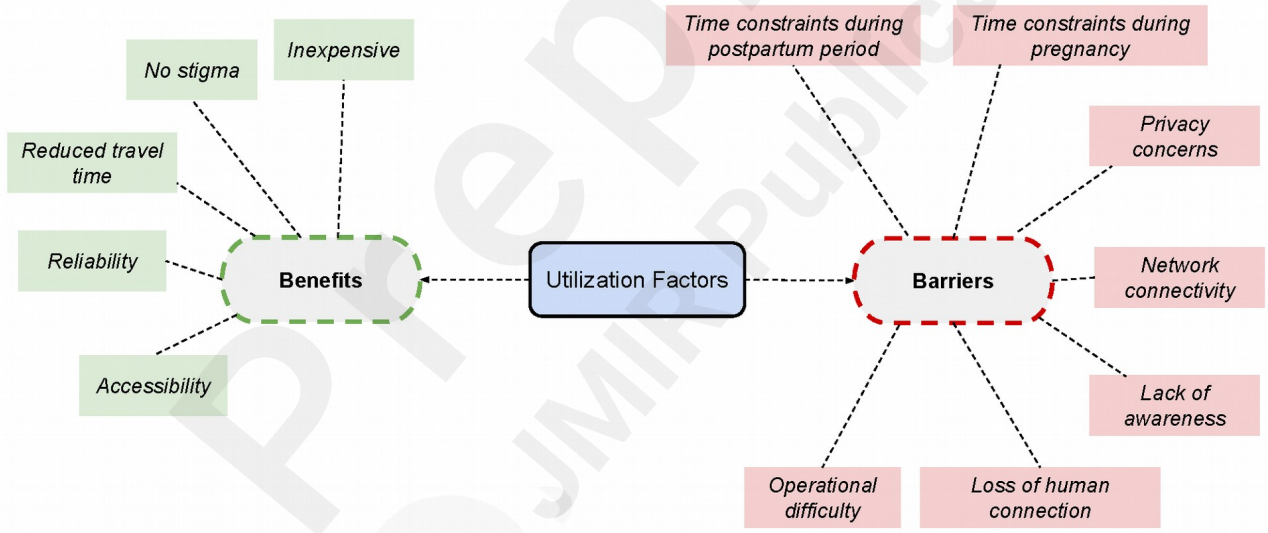


Figure 4. Illustration of second-level themes (rounded boxes with a dotted line), and third-level codes (rectangular boxes) for utilization factors for a remote intervention system.

Benefits: The benefits of using remote intervention systems were identified as follows:

- *Inexpensive*: Financial constraints often restricted participants from accessing in-person healthcare or therapy, making a relatively low-cost remote intervention system a viable solution.

  “Benefits will be I can schedule a call. Maybe it [remote intervention system] is an AI, maybe somebody I don't have to book an appointment with. I think it [remote intervention system] will be very cheap for us.”

- *No stigma*: Using a remote intervention system would help participants avoid societal judgment, making them feel more comfortable discussing and managing their mental health.

  “It [remote intervention system] will help me to be more open to communicating.”

- *Reduced travel time*: Participants mentioned that a remote intervention system would eliminate the need for frequent travel to healthcare facilities.

  “It [remote intervention system] will save me a lot of time and it is less expensive compared to physically going to a healthcare provider. Making my appointments will be easier.”

- *Accessibility and Reliability*: Participants highlighted challenges in accessing support, often citing limited service availability, long wait times, and geographic constraints as key barriers. Many expressed frustration with the unpredictability and inconvenience of in-person support, emphasizing that a remote intervention system could enhance accessibility and reliability. They believed such a system would reduce the disappointments associated with traditional care by offering more flexible and timely support. Some representative comments were:

  “It [remote intervention system] would be convenient, reliable. I would prefer virtual meetings over in-person to avoid disappointments and improve convenience.”

  “Having a remote service provision would be beneficial because it can be difficult to physically visit the healthcare provider while pregnant.”

  “It [remote intervention system] will give me the services that I need at my convenience. Having such a system may be able to discover more things. If I'm developing a problem that requires urgent treatment, it [remote intervention system] will be accessible at the right time. It will improve the availability. It will improve my mental health. I won't be absorbing so much stress.”

  “With maternal responsibilities, I think everything should be more accessible when you're at home, you feel like you have a lot of time in your hands.”

  “You can stay at home if you use it [remote intervention system] and also lessen the expenses.

Barriers: The barriers of using remote intervention systems were identified as follows:

- *Time constraints during postpartum period*: While some participants did not experience time constraints during pregnancy, they found that the demands of caring for a newborn left little room for self-care. As a result, engaging with a remote intervention system became challenging. Participants shared their experiences:

  “During my pregnancy, I don't think there will be any challenges, but after delivery, I might not attend all the sessions because when I'm free, I might be too tired and just want to rest. From what I've seen and heard from friends and relatives, kids need attention, and sleep periods are shorter.”

  “Using it [remote intervention system] depends on the needs of the baby. You can't predict

when your child will be awake or asleep, so I feel like we should have room for flexibility. It [remote intervention system] should be of the same duration but a flexible time. Some days 15 minutes, some days 2 hours, it depends on the needs of the baby."

"During my first pregnancy, I didn't get maternity leave earlier. During postpartum, I got the time to bond with my baby but my self care routine was almost non-existent because most of the time was consumed in taking care of my baby."

- *Time constraints during pregnancy*: Busy schedules during pregnancy can make it difficult for participants to prioritize mental health care and engage with a remote intervention system.

  "There will be an issue with time difference during pregnancy, sometimes I want to do my things."

- *Privacy concerns*: Participants worried about confidentiality and data security when using a remote intervention system.

  "I can use it [remote intervention system] provided my identity is not disclosed."

- *Network connectivity*: Unreliable internet access was a barrier for participants, affecting their ability to use a remote intervention system effectively.

  "Challenges will be, is this system online? Is it [remote intervention system] something that can work without even a network? Sometimes if it's [remote intervention system] on a network, maybe use it [remote intervention system] in some place where you can't access Wi-Fi or data, so you can really connect and report on things or be reminded of things to do."

- *Lack of awareness*: Participants expressed concerns on being unaware of available remote mental health intervention systems and their importance, limiting their ability to seek help. Some example quotes were:

  "Educating women about the need to check on their mental health and put effort into it is important because some people tend to ignore it."

  "Creating more awareness about the availability of such systems and providing a platform where women can learn from each other's experiences would be beneficial."

  "There can be a lack of education on how to use them [remote intervention systems] and also awareness."

- *Loss of human connection*: Some participants felt that remote interventions lacked the personal connection and emotional support that can be provided by face-to-face interactions.

  "Limitation is maybe not having that one-on-one conversation with anyone. So it [remote intervention systems] should be like a session, maybe like a Zoom where people are interacting."

- *Operational difficulty*: Participants expressed concerns about the complexity of using remote intervention systems, particularly for those unfamiliar with digital tools. Some representative comments were:

"Issue with not knowing how to operate it [remote intervention system]."

"I think adapting to it [remote intervention system] will be challenging. Once you get used to it, it will be OK, but the process of adapting to it will be quite a challenge. It depends on how simplified it is. We have those apps which are very complex. It should be user-friendly."

RQ3: What key design features and considerations are essential for an effective, inclusive remote mental health intervention system?

Survey

Table 5 presents the ANOVA test results examining key features to consider when designing remote intervention systems for perinatal women. Findings indicate that the demand for certain remote support options varied significantly across perinatal phases. Symptom monitoring (e.g. heart rate tracking) and psychotherapy with counselors were significantly more utilized in the third trimester compared to the first trimester. Participation in peer support groups was significantly lower during the first trimester compared to the second and third trimesters. However, no significant differences were observed between types of support options across the perinatal phases.

In terms of preferred timing for intervention, during pregnancy, 54.8% respondents expressed a preference for flexible scheduling, while the remaining favored fixed morning sessions between 9 AM and 12 PM (Figure 5-a). For the postpartum period, a higher preference for flexible scheduling was reported (90.3%). Regarding session duration, 77.4% respondents recommended that each intervention session last between 15minutes and one hour (Figure 5-b).

Other high-priority features from the participants included communication with healthcare providers, counseling services with the psychiatrist like cognitive behavioral therapy, monitoring of medical signs like heart rate, calming music, and positive quotes (see Appendix 5, Figure a for a full list). For general feedback on the remote intervention system (see Appendix 5, Figure b), most participants preferred using a customizable smartphone-based intervention system that was easy to use and required minimal time. They were willing to use the system if recommended by healthcare providers or other perinatal women, and were comfortable sharing data with healthcare providers or researchers for educational purposes. However, concerns existed about the system's reliability in predicting anxiety and depression. Overall, participants indicated they would recommend the system to other perinatal women if proven effective.

Table 5: Summary of ANOVA test outcomes, stratified by perinatal phase (1st, 2nd, and 3rd trimesters, and postpartum) for key features for developing remote intervention systems. Superscript letters indicate significant post hoc pairwise differences (a > b > c > d).

Types of remote mental health support sought	First trimester (*N* = 31)	Second trimester (*N* = 29)	Third trimester (*N* = 24)	Postpartum (*N* = 4)	Total N (*N* = 88)	F, *P*
Mindfulness-based cognitive therapy	2.1 (1.0)	2.7 (1.1)	2.8 (1.2)	2.3 (1.3)	2.5 (1.1)	2.12, .103
Medication reminders	2.2 (1.2)	2.4 (1.0)	2.7 (1.2)	2.5 (1.9)	2.4 (1.1)	.92, .422
Applications for exercise-yoga	2.0 (0.9)	2.5 (1.0)	2.1 (1.2)	1.5 (1.0)	2.2 (1.0)	1.76, .162
Symptom monitoring (e.g. Heart rate)	1.7 (1.2)[b]	2.4 (1.4)[ab]	2.8 (1.4)[a]	2.0 (1.2)[ab]	2.3 (1.4)	3.37, .022
Talking with healthcare provider	2.1 (1.3)	2.9 (1.2)	2.6 (1.3)	1.5 (1.0)	2.5 (1.3)	3.0, .035
Psychotherapy with	2.0 (1.1)[b]	2.7 (1.2)[ab]	2.9 (1.2)[a]	2.5 (1.0)[ab]	2.5 (1.2)	3.21, .027

counselor						
Peer Support Groups	1.5 (1.1)[b]	2.4 (1.0)[a]	2.4 (1.5)[a]	2.8 (1.3)[ab]	2.1 (1.3)	3.84, .013

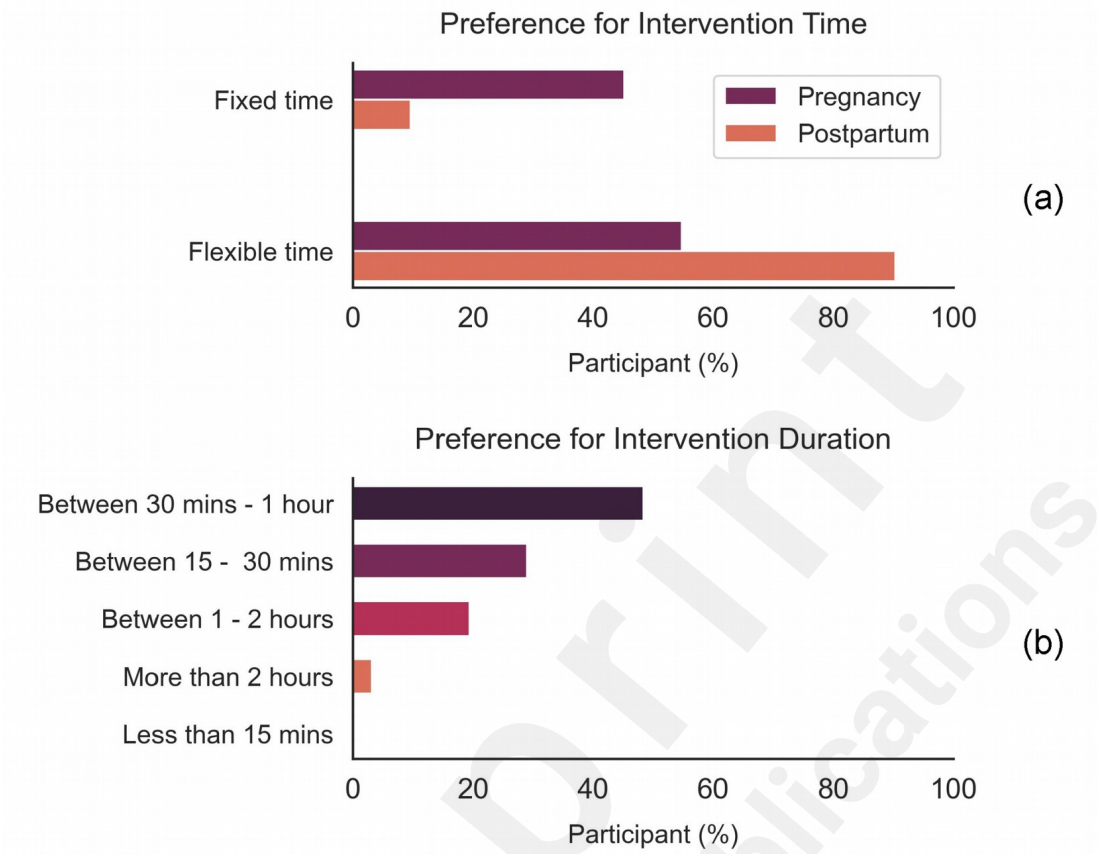


Figure 5. Horizontal bar plots illustrate survey outcomes related to: (a) Time preference for providing remote intervention system (fixed vs. flexible), and (b) Preference for the duration of remote intervention system.

Interview

The major themes that emerged from participants regarding effective features for a remote intervention system included physical health management, information, emotional well-being, and other personalized preferences. The percentages next to each feature indicate the proportion of interview participants who mentioned that feature. These themes highlight key areas that should be prioritized in designing a system that effectively supports perinatal women, which are described in Figure 6.

- **Physical Health Management**: Physical health management features were highlighted as essential in supporting perinatal women experiencing depression and anxiety by promoting holistic well-being. Key recommendations included *medication reminders* (50%), *exercise reminders* (18.8%), *sleep tracking* (18.8%), *tracking the baby's growth* (6.3%), *maintaining pregnancy progress* records (6.3%), and *appointment scheduling with healthcare providers* (25%).
- **Access to Information**: Participants emphasized the need for *educational content tailored to pregnant women* (37.5%), *guidance on exercise* (43.8%), *nutrition* (25%), and *meditation practices* (6.3%).
- **Emotional Well-being**: Suggested features included *motivational quotes* (18.8%), *journaling* (12.5%), *mood and anxiety symptom analysis* (50%), a *personalized real-time virtual assistant* (6.3%), *leisure activities* (12.5%), *peer support groups* (43.8%), and *postpartum*

support (6.3%).

- **Other Preferences**: Some other preferences focused on usability and accessibility. Participants emphasized that the system should be *user-friendly* (37.5%), incorporate *time-management tools* such as integrated calendars (6.3%), offer a 24/7 *emergency contact helpline* (18.8%), and include some level of *family involvement* (6.3%).

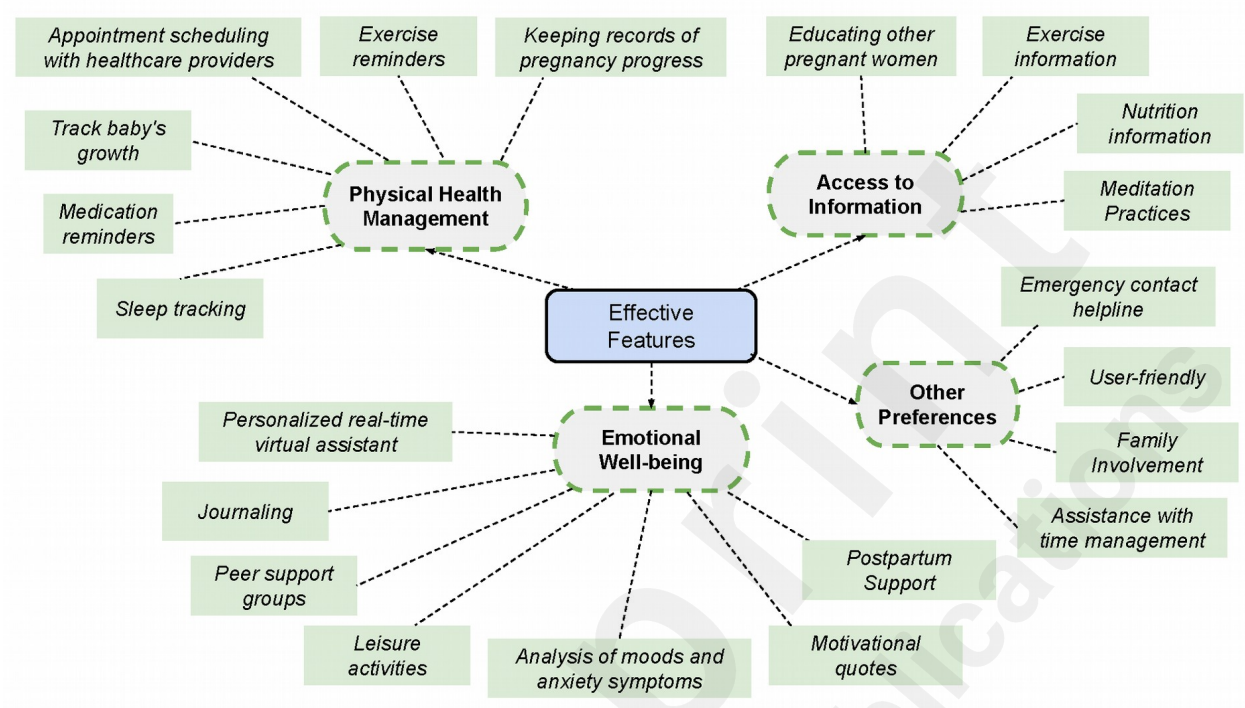


Figure 6. Illustration of second-level themes (rounded boxes with a dotted line), and third-level codes (rectangular boxes) for key features for developing remote intervention systems.

4. Discussion

We conducted a mixed-methods study using both surveys and interviews to investigate the challenges faced by Black or African American perinatal women with perinatal mood and anxiety disorders (PMAD), the factors promoting or hindering their willingness to use remote mental health intervention systems, and the features essential for developing remote intervention systems. Below, we detail the findings corresponding to each research question.

RQ1: What are the specific challenges and unmet needs experienced by Black or African American women experiencing PMAD?

We found that Black or African American women with PMAD faced four primary challenges: emotional, physical, financial, and systemic and social barriers to support. Below, we detail the findings corresponding to each research question.

Emotional Challenges

Unlike prior studies documenting medical and racial discrimination in the treatment of PMAD[9,12,32], our participants did not explicitly describe emotional challenges tied to racial discrimination in either the survey or interview responses.. Rather, participants in our study frequently experienced mood swings, persistent sadness, frequent crying, restlessness, and irritability —symptoms that substantially disrupted daily life. Previous studies with women of color[32] similarly

identified stigma, isolation, and trauma as critical issues in navigating perinatal mental health challenges. Participants also reported feelings of anxiety and uncertainty related to labor, childbirth and postpartum adjustment in agreement with findings from studies[32–34]. For example, Thayer et al.[33] found that 62% of pregnant Black women reported a high level of childbirth fear. Participants further reported inconsistent postpartum care, which left them feeling neglected and unsupported. Previous studies suggest racial disparities, with Black and Latina women receiving less consistent follow-up care than White counterparts[14]. Thus, the majority of the emotional challenges mentioned by participants are in agreement with the previous studies, and these may be intensified for Black or African American women, especially when the other resources (e.g., financial or social support) are limited.

Physical Challenges

Hormonal changes during pregnancy were cited by 80.6% of participants as a major contributor to PMAD, which was acknowledged in prior study[32] but not as a primary contributor. Consistent with prior studies[32,35], other physical challenges included pregnancy-related body changes such as weight gain, fatigue, and bodily discomfort, which negatively impacted self-esteem and body image. Given that isolation was already a prominent emotional challenge for participants, low self-esteem could further hinder help-seeking behaviors and social connection.

In agreement with Dagher et al.[36], postpartum-related body changes, particularly after C-sections or conditions such as preeclampsia, added to participants' physical distress. It is crucial to address this physical challenge as it can elevate the risk of post-traumatic stress disorders (PTSD)[37]. Participants further reported that infant-related needs, such as sleep difficulties—also noted by Dagher et al.[36], contributed to significant exhaustion. Overall, these physical challenges align with findings from previous studies, with no notable racial differences observed; they were commonly experienced by all women.

Financial Challenges

Financial stress was a significant contributor to participants' mental health difficulties. Over 77.4% of survey respondents reported concerns about medical expenses, childcare costs, and loss of income, in agreement with prior studies[14,38]. Several described unsupportive work environments and increased pressure during the perinatal period, heightening anxiety about job security and financial instability. Similar themes were found in prior research on marginalized women, which described the emotional burden of choosing between staying home (and losing income) or working (and incurring high childcare costs)[39].

Systemic and Social Barriers to Support

Participants reported substantial barriers to accessing mental health services, primarily due to difficulty scheduling appointments and the scarcity of available providers—a theme echoed in prior research[40,41,38]. This barrier experienced by participants could be exacerbated due to racial disparity, as noted in prior studies[32,40].

Several participants mentioned that providers prioritized physical health over emotional well-being. Dismissive or unempathetic attitudes from hospital staff, discouraged some from seeking further help, in agreement with Webb et al.[6], Martinez[32]. Social and cultural stigma, along with family attitudes that normalized PMAD symptoms, contributed to women hiding their emotional struggles, consistent with prior studies[32,39,42]. As reported by the survey, when family support was available, it was mostly directed toward financial (58.1%) or physical needs (54.8%), with significantly lower emotional support (41.9%). Maxwell et al.[39] described similar patterns among marginalized North American women who "kept it to themselves" due to family cultures that minimized mental health issues. Martinez[32] similarly recounted one Black mother's reflection on

internalizing the ideal of being a "strong maternal figure," which contributed to self-silencing. Survey responses additionally revealed that participants relied more heavily on friends for emotional support. Interestingly, this finding contrasts with Maxwell et al.[39], who noted that both family and friends often impose high expectations on perinatal women, making it challenging for them to express their struggles.

Time constraints due to family and childcare responsibilities further prevented participants from prioritizing their own well-being, in agreement with Webb et al.[6]. Overall, many expressed a sense of inadequate support from family, healthcare providers and peers—a theme consistently echoed in prior studies with women of color[32].

RQ2: What factors (both benefits and barriers) promote or hinder their willingness to use remote mental health intervention systems?

Our findings revealed several factors influencing perinatal women's willingness to use remote mental health intervention systems. While many participants acknowledged distinct benefits, they also cited critical barriers that may affect the adoption and effectiveness of these systems.

Benefits

Many participants believed that remote systems could enhance mental health more effectively than in-person services, reflecting strong user acceptance. One of the most frequently cited benefits of remote interventions was their ability to reduce traditional access barriers such as long wait times for scheduling appointments and high costs. Approximately 90.3% of survey respondents found remote systems helpful for easier appointment scheduling and reduced travel time, while 80.6% noted that these systems were more affordable. These findings align with a prior review[2], which highlighted the scalability and cost-efficiency of mHealth tools. For example, artificial intelligence chatbots delivering CBT via SMS[43] have been shown to provide 24/7 access to mental health resources, bypassing transportation and scheduling challenges while still allowing escalation to human providers for higher-risk cases such as self-harm.

Participants valued the reduced stigma of remote care, which made them more willing to adopt it by reducing the risk of judgment from family members or healthcare providers. Prior research has consistently shown that stigma is a major barrier to accessing mental health support, particularly among racial and ethnic minorities[38,39]. Given that difficulty scheduling appointments, social and cultural stigma, and financial constraints, were among the top concerns identified in RQ1, these benefits suggest that remote intervention systems could offer a meaningful solution for expanding access to care.

Barriers

Despite these benefits, participants identified several barriers that may limit engagement with remote mental health systems. One major concern was the absence of face-to-face interaction, with 64.5% of participants believing that in-person care was more effective, consistent with findings from prior studies[18,44]. To address this, some participants suggested integrating features such as live video conferencing[23] to replicate the engagement of traditional care models.

Another critical barrier was limited awareness of available remote services, emphasizing how recognition of symptoms and treatment relevance is essential for help-seeking behavior. Therefore, educating perinatal women on both the risks of untreated PMAD and the availability of accessible digital interventions is crucial. These outreach efforts could be enhanced through online platforms and social media campaigns.

Operational complexity also presented a challenge, especially for individuals with limited experience using digital tools. A review by Webb et al.[6] identified technology-related usability issues

as a barrier to mental health service design and delivery. Ensuring that remote systems are intuitive and user-friendly will be essential for encouraging broader adoption.

Consistent with Rai et al.[44], privacy and data security were additional concerns in adopting remote systems, particularly given the heightened stigma surrounding mental health within their communities. These findings reinforce the importance of implementing robust data protection protocols to preserve user anonymity and build trust—particularly among minority women who may already feel vulnerable. Network connectivity and device access posed logistical issues, especially for participants without reliable internet. To address this, interventions could be made available as downloadable mobile apps. Some apps can function offline once installed, reducing dependence on continuous internet access[45].

Lastly, time constraints were a substantial barrier. Approximately 67.7% of participants reported that family responsibilities consumed most of their time, while 51.6% were preoccupied with medical appointments. 96.8% participants expected reduced time for personal interests, suggesting that this projected decline in discretionary time may limit their ability to prioritize mental health and engage with remote intervention tools. Participants anticipated even greater time limitations in the postpartum period (58.1%). These findings are consistent with prior studies[6,46,47]. The unpredictable demands of childcare call for interventions that are flexible, brief, and easy to integrate into daily routines.

RQ3: What key design features and considerations are essential for an effective, inclusive remote mental health intervention system?

We found several key features and design considerations necessary for creating an effective remote mental health intervention system, with particular attention to the needs of Black or African American women—who are disproportionately affected by barriers in access and continuity of care. In this section, we summarize them as a list of recommendations for the designers of remote intervention systems.

From the survey, the recommendations and top rated features were as provided below:

- **Phase-Specific Information**: Remote intervention systems should be accessible across all perinatal phases, with a particular focus on the second and third trimesters. Regardless of prior usage, a majority of participants preferred receiving remote support during the second and third trimesters, compared to pregnancy and postpartum, emphasizing these as critical phases. This trend emerged despite PMAD symptom levels being relatively consistent across perinatal periods. These high needs during the second and third trimesters could coincide with maternity leave, financial stress, and increasing physical discomfort—suggesting that support-seeking behavior may be influenced more by life circumstances than symptom severity alone.
- **Direct communication with healthcare providers**: The strong preference for communication features with healthcare providers reflects the substantial scheduling barriers (58%) and lack of trust (52%), particularly among Black or African American women. To address the barrier of limited face-to-face interaction identified in RQ2, incorporating live video conferencing may be an effective solution, in agreement with Ghimire et al.[48]. Notably, OB Nest[49], a remote intervention for prenatal women that included virtual visits alongside on-site clinic appointments, showed promising results. However, participants in that study were primarily pregnant Caucasian women. Findings from our study suggest that such a virtual care model can also be beneficial for Black or African American perinatal women. Furthermore, hybrid models that combine AI with human interaction may also be valuable.
- **Mindfulness-based CBT**: Despite high interest in psychotherapy, few tools currently deliver structured psychological therapies, such as CBT as noted by prior study[2]. Notable exceptions

include an AI-powered chatbot delivering CBT via SMS[43], and Motherly[50], a smartphone app that provides CBT for pregnant women. Similarly, Latendresse et al.[23] developed a group video conferencing intervention using mindfulness-based CBT based on the UPLIFT program[51], that reduced depression scores among perinatal women. This suggests that digitally facilitated group therapy could help address loneliness (a theme discussed in RQ1).

- **Symptom monitoring**: Monitoring signs for anxiety and depression (e.g. heart rate) was also highly valued. A prior study by Hantsoo et al.[18] demonstrated the effectiveness of a mood tracking app for vulnerable pregnant women, which helped alert healthcare providers when symptoms worsened and significantly improved women's perceived health management capacity. However, participants expressed concerns in the survey regarding accuracy in the prediction of anxiety and depression levels. This indicates a need for evidence-based assessments and advanced machine-learning models[52] to enhance diagnostic accuracy.
- **Calming music and Positive quotes**: Participants preference for calming music aligns with findings from Sun et al.[53], who noted its efficacy in reducing cortisol and endorphin levels. Positive quotes were also frequently mentioned, although most existing programs emphasize alternative positive psychology techniques[54]. For example, Mamma Mia[55] promotes visioning exercises, and Gratitude diary[56] encourages daily reflections to reduce stress. However, participants in our study preferred receiving motivational quotes rather than writing exercises, suggesting a need for simplified, passive forms of positive reinforcement.

Although a few features were not top-rated in the survey, they were positively discussed in interviews.

- **Physical health monitoring**: Features such as medication or exercise reminders, baby growth tracking were useful for enhancing overall physical and psychological health (e.g. Mums on the Run[47] home-based treadmill intervention program).
- **Peer support**: Remote intervention systems may help facilitate easier access to peer support, a challenge identified in RQ1. For example, 7Cups[57], an online peer-support platform with trained volunteers, received favorable responses from 88% of postpartum users, particularly when provider availability was limited.
- **Information-related features**: Psychoeducation informational features (e.g., psychoeducation on pregnancy, nutrition) are known to be effective for women with mild to moderate PMAD[2]. For example, health education chatbots like Rosie[58] offer promising functionality. Designed for perinatal women of color, Rosie provides guidance on pregnancy, parenting, and infant development and can alert clinic workers in emergencies. Such tools offer a scalable solution to address the lack of mental health awareness and support among underserved populations.

Other preferences from the survey included:

- **Flexible scheduling**: Flexible scheduling was strongly preferred during the postpartum period (90.3%) compared to pregnancy (54.8%), due to the unpredictable nature of infant care, disrupted sleep, and varied feeding routines, in agreement with prior studies[6,38]. Viverios et al.[38] emphasized that many services prioritize infant needs while neglecting maternal mental health—an issue felt even more frequently among women of color. This underscores the necessity for on-demand or adaptable scheduling options. Additionally, 77.4% of participants recommended that intervention sessions last between 15 minutes to one hour, indicating the need for brief, accessible interventions that accommodate shifting maternal routines.
- **System interface**: Participants strongly preferred smartphone-based systems compared to wearable smartwatch-based systems, echoing prior studies (e.g., Baumel et al.[57], where 90% of participants preferred smartphone use). The high rating for ease of use and minimal time

commitment highlights the need for low-burden interfaces that minimize cognitive load.

Overall, both the interview responses and survey findings emphasize the need for a holistic remote intervention system that integrates physical health tools, emotional support features, and information-related features. To achieve this goal, existing applications such as Rosie[59], specifically designed for perinatal women of color, can be expanded to incorporate additional interventions, including CBT, motivational quotes and calming music. Participants can then experiment with each feature and select those they find most beneficial and pertinent to their needs.

Strengths and Limitations

This mixed-methods study provides a comprehensive evaluation of the mental health challenges and potential solutions experienced by Black or African American women with PMAD. By integrating both survey and interview data, the study provides an in-depth understanding of emotional, physical, and financial, and systematic barriers these women face, alongside the features they prefer in remote intervention systems. To our knowledge, this is the first study to compile and synthesize such a detailed list of challenges and design considerations specifically tailored to Black or African American perinatal women. A key strength of this study lies in its focus on a historically underrepresented population, offering culturally relevant insights that are often missing from the broader perinatal mental health literature. The detailed feature analysis also serves as a practical foundation for designing inclusive, responsive remote intervention tools that address both individual and systemic barriers to care.

However, several limitations must be acknowledged. First, the study focused exclusively on Black or African American women and did not include perspectives from other racial or ethnic groups, such as Latinx/Hispanic, Asian/Pacific Islander, and Middle Eastern women. Including these voices in future work would allow for more inclusive and generalizable understanding of perinatal mental health needs and intervention design among minority women. Second, the sample was not evenly distributed across perinatal phases, with fewer participants represented in the postpartum period. This imbalance may limit the generalizability of findings, particularly regarding postpartum mental health challenges and intervention preferences. Future research should aim to recruit more balanced samples across all perinatal phases to ensure broader applicability. Third, the limited sample size in this study posed challenges in examining other potential factors influencing PMAD (e.g. income level)[9,14]. Future studies should assess these variables across different perinatal phases. Finally, this study captured participants' experiences at a single point in time. Participants reflected on both past and current perinatal phases, which could have introduced recall bias[60]. Longitudinal research tracking the same cohort throughout the perinatal journey could offer valuable insights into how mental health needs, barriers, and intervention preferences evolve over time. Such designs would be particularly valuable for understanding the dynamic nature of support-seeking behaviors and system usability throughout pregnancy and postpartum.

Conclusion

This study highlights the critical challenges faced by Black or African American perinatal women experiencing PMAD and the key factors influencing their decision to engage with remote mental health intervention systems. Emotional, physical, financial, and accessibility-related barriers were found to significantly impact participants' mental well-being. Although PMAD symptom severity did not significantly differ across perinatal phases, support-seeking behavior peaked during the second and third trimesters—emphasizing the importance of delivering timely and phase-specific

interventions. While remote systems offer improved accessibility, flexibility, and affordability, barriers such as limited awareness, technological difficulties, and privacy concerns must be addressed to enhance usability and adoption. Findings suggest that an effective system should integrate direct communication with healthcare providers, CBT-based counseling services, symptom monitoring for anxiety or depression, calming music, positive affirmations or motivational quotes, and educational resources, while supporting flexible scheduling, particularly for postpartum women facing time constraints. Intervention durations ranging from 15 minutes to 1 hour were preferred. By addressing these user-identified needs and preferences, it is possible to develop a comprehensive, culturally responsive, and accessible remote mental health intervention system aimed at mitigating PMAD in Black or African American perinatal women. Future work will focus on designing and evaluating a prototype that integrates these features, with the ultimate goal of improving mental health outcomes for underserved perinatal populations.

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Conflicts of Interest

None declared.

Abbreviations

ANOVA: Analysis of Variance

CBT: Cognitive Behavioral Therapy

EPDS: Edinburgh Postnatal Depression Scale

LLM: Large Language Model

PMAD: Perinatal Mood and Anxiety Disorders

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Supplementary Files

Figures

Horizontal bar plots illustrating survey outcomes related to: (a) primary reasons for PMAD, (b) assistance received from family, and (c) assistance received from friends. PMAD = Perinatal mood and anxiety Disorders.

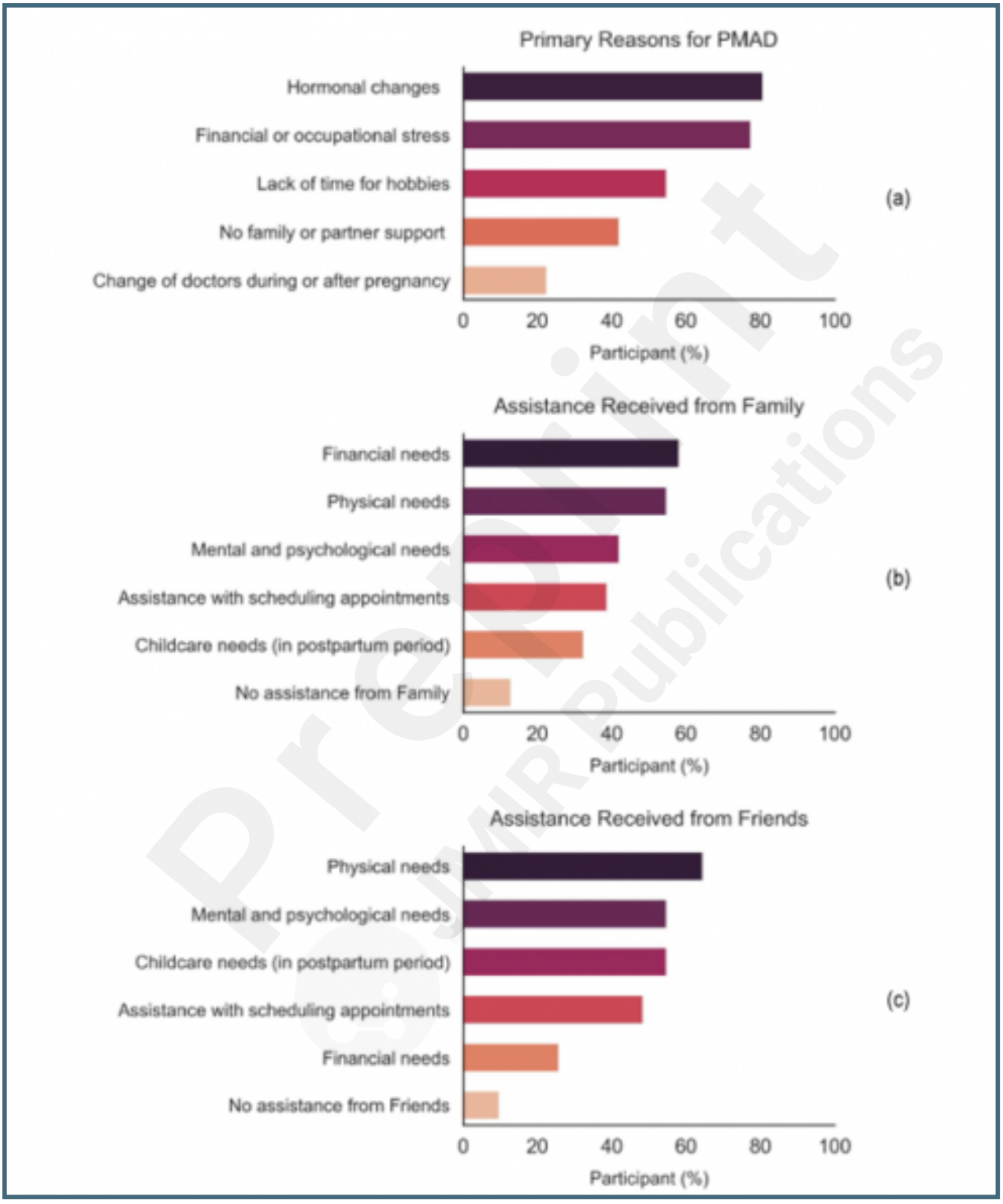
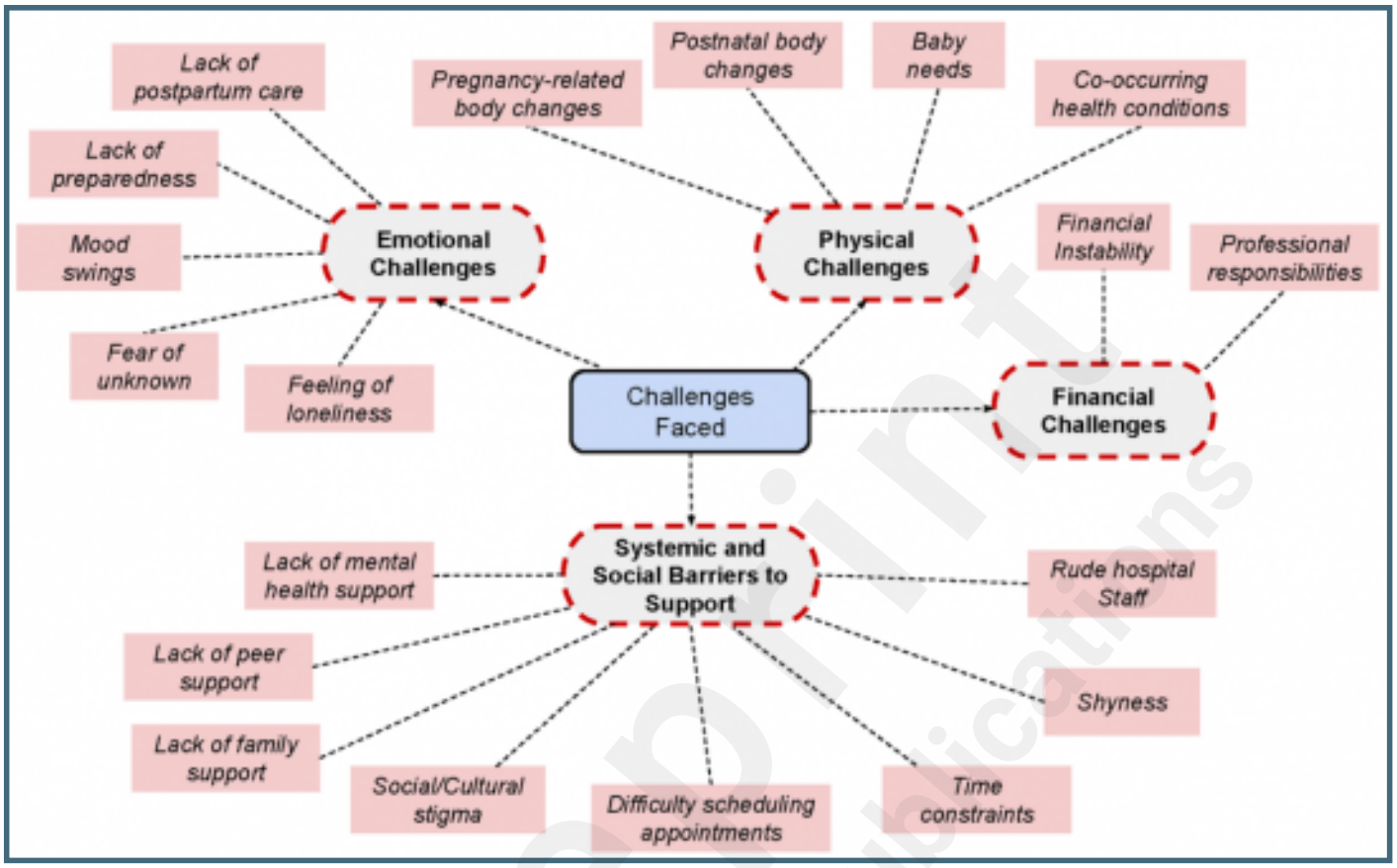


Illustration of second-level themes (rounded boxes with a dotted line), and third-level codes (rectangular boxes) for challenges faced by women during the perinatal period.



Horizontal bar plots illustrating survey outcomes related to: (a) in-person support options, (b) reasons for seeking in-person support, (c) barriers to seeking in-person support, and (d) reasons for preferring remote support.

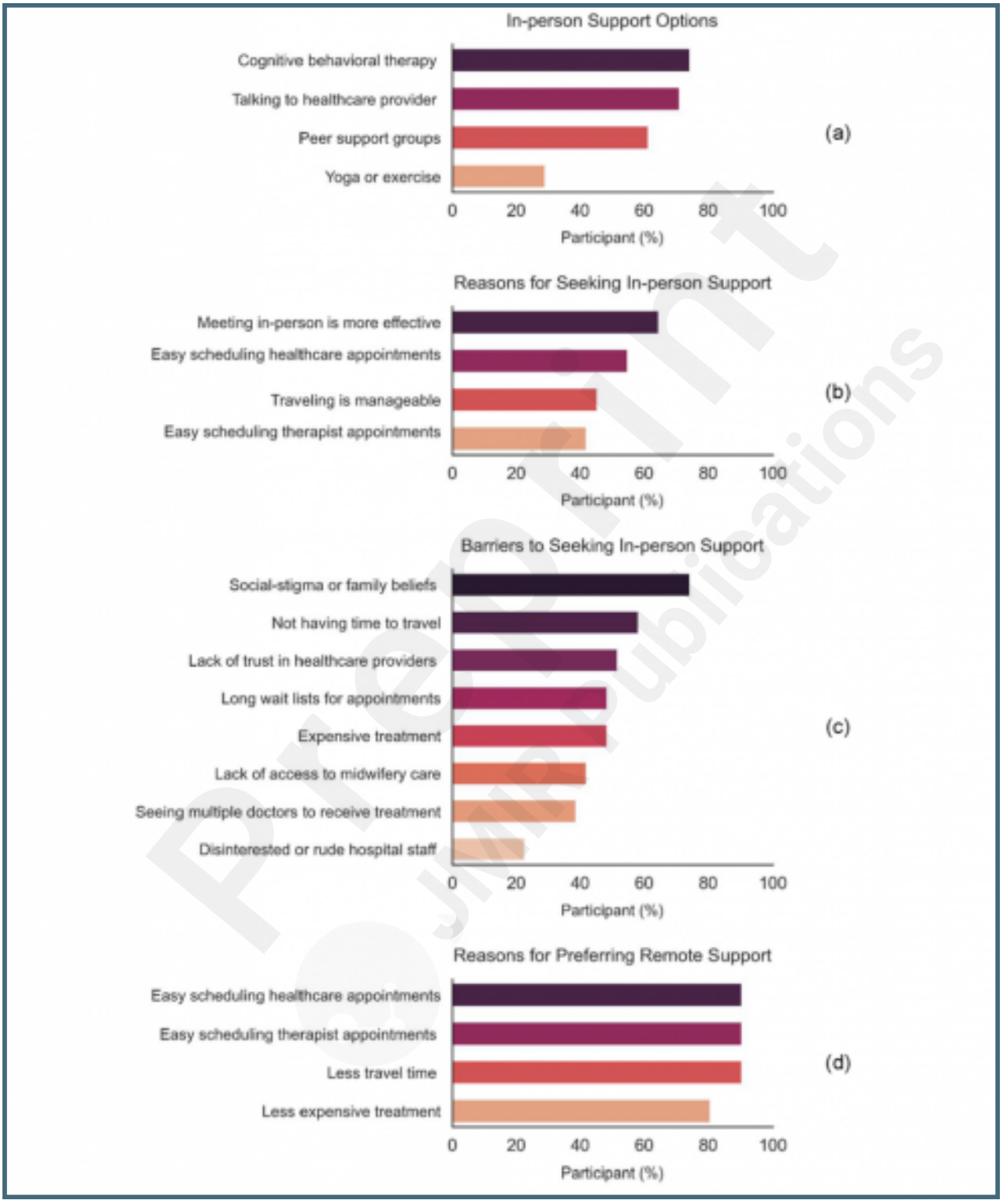
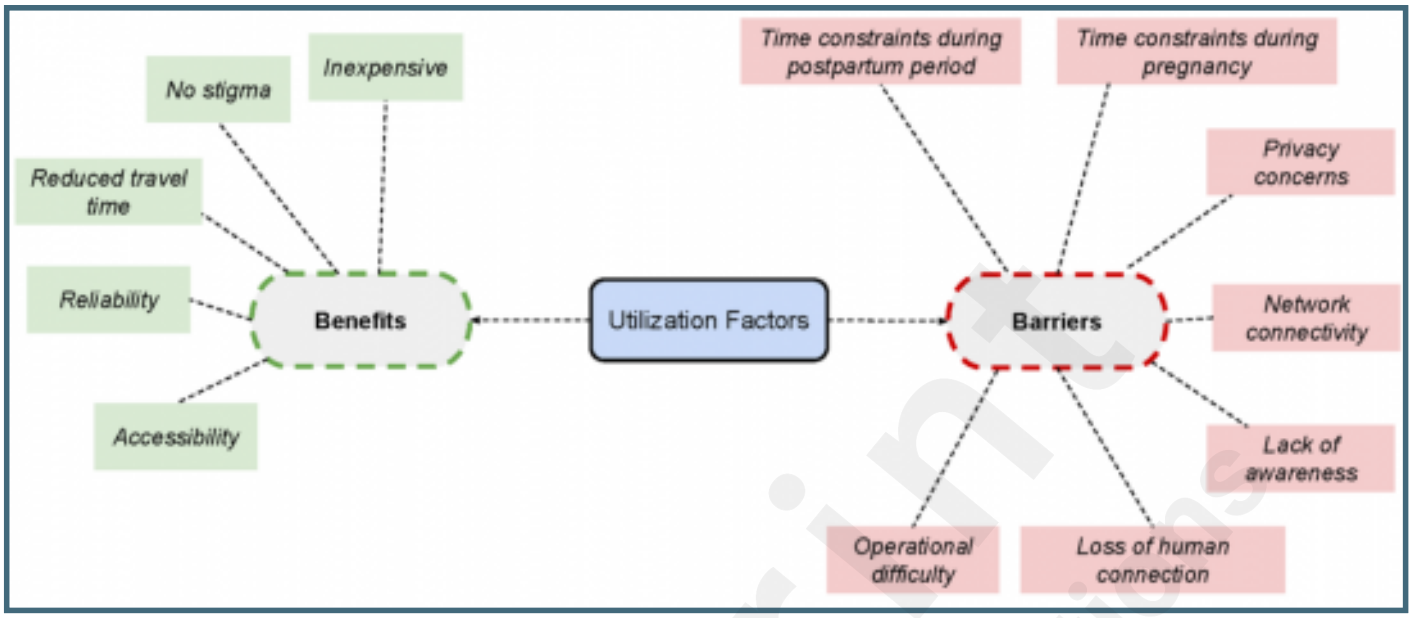


Illustration of second-level themes (rounded boxes with a dotted line), and third-level codes (rectangular boxes) for utilization factors for a remote intervention system.



Horizontal bar plots illustrate survey outcomes related to: (a) time preference for providing remote intervention system (fixed vs. flexible), and (b) preference for the duration of remote intervention system.

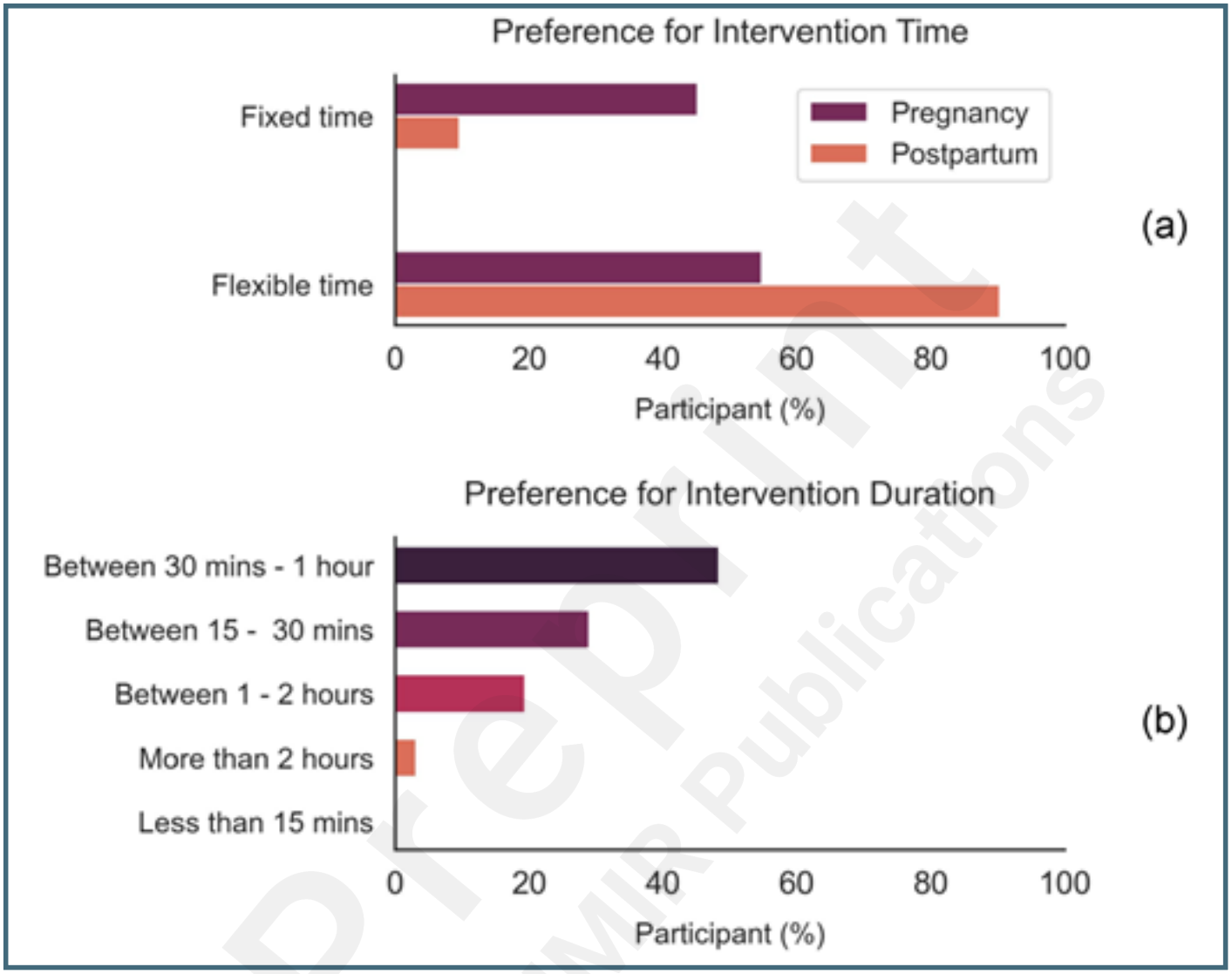
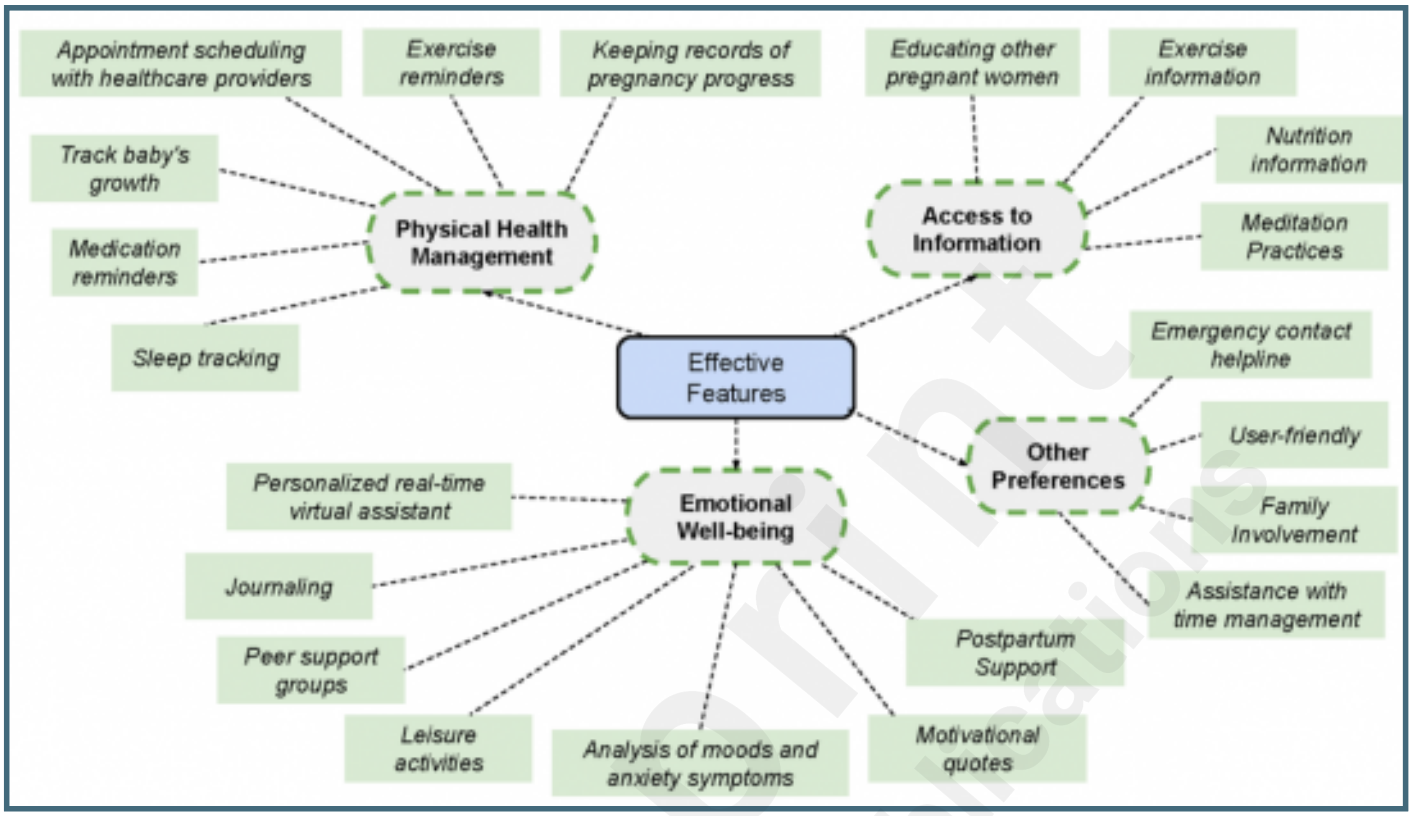


Illustration of second-level themes (rounded boxes with a dotted line), and third-level codes (rectangular boxes) for key features for developing remote intervention systems.



Multimedia Appendixes

Survey questions.
URL: http://asset.jmir.pub/assets/d0dae1b56e5d5d04a9e191ff284142b0.docx

Interview questions.
URL: http://asset.jmir.pub/assets/133f1fad41caadb6f2fdf95a702029cf.docx

LLM Prompt for thematic analysis.
URL: http://asset.jmir.pub/assets/ec74890f3781566166041b4d760f7152.docx

Representative quotes for the category named “challenges faced during the perinatal period".
URL: http://asset.jmir.pub/assets/989eed4d0aae21436ad8594ee2f25457.docx

Boxplots for RQ3 survey.
URL: http://asset.jmir.pub/assets/946e9a40c3174b5a8a0c789613026b06.docx