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Nurses' Roles in Digital Perinatal Mental Health Interventions in LMICs: A Systematic Review

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ABSTRACT

Maternal morbidity and mortality are largely driven by perinatal mental health conditions, especially anxiety and depression, particularly in low- and middle-income countries with limited access to care. This review aims to examine the roles of community nurses in implementing digital interventions to enhance perinatal mental health in low- and middle-income countries. Searches for publications between 2020 and 2025 were conducted in the Scopus, ScienceDirect, Dimensions, and ProQuest databases. A total of 21 studies that met the inclusion criteria were included in the final synthesis. According to the findings, there are four primary types of digital therapies: telemedicine and remote counseling, digital cognitive behavioral therapy (CBT) and psychosocial interventions, mobile-based applications, and digital integration based on community health workers (CHW). It has been demonstrated that all of these strategies enhance screening, education, and psychosocial support for expectant and nursing mothers, and they are generally feasible and well-received in several LMIC contexts. Early detection, digital counseling, monitoring, and enabling technology-based services are all areas in which community nurses play a crucial role. Digital interventions decrease gaps in mental health care, improve service continuity, and empower moms and healthcare professionals. To ensure the sustainability and equitable provision of maternal mental health services, primary care systems must integrate policies, enhance digital literacy, and maintain ongoing oversight and monitoring to ensure effective service delivery.

Keywords
Community Nurses
Digital CBT
Digital Interventions
Lmics
Perinatal Mental Health
Telemedicine

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Introduction

Low- and middle-income countries (LMICs) consistently face substantial obstacles in accessing and receiving quality health services, particularly those related to maternal and pediatric health [1]. These challenges are closely linked to limited healthcare infrastructure, shortages of trained personnel, inadequate funding, and unequal access to services between urban and rural populations. Maternal health services in many LMICs are often overburdened, making it difficult to provide comprehensive care that includes physical and psychological support. Perinatal mental health, which covers the period from pregnancy to one year after childbirth, is a primary contributor to pregnancy problems, childbirth complications, and maternal mortality [2]. This period is marked by major biological, emotional, and social changes that can significantly influence the mental wellbeing of mothers. Disorders such as depression, anxiety, and stress affect not just moms but also impact children's emotional and social development [3]. Children born to mothers experiencing untreated psychological distress may experience developmental delays, attachment difficulties, behavioral disorders, and reduced cognitive outcomes. In low-resource areas, perinatal depression (PND) is a significant problem that burdens families and communities [4]. The consequences of PND extend beyond individual mothers and contribute to broader social and economic burdens, including reduced family productivity and increased healthcare expenditures. Globally, 13% of women who have just given birth and 10% of pregnant women suffer from mental diseases, primarily depression. In emerging countries, these statistics are even greater, at 19.8% after childbirth and 15.6% during pregnancy [5]. Even in resource-limited settings, perinatal depression's prevalence is reported as even higher, reaching 25.5% [6]. These data indicate that perinatal mental health problems are not isolated cases but rather widespread public health concerns requiring systematic interventions.

Perinatal mental disorders have a broad impact on the health of mothers and babies. Antenatal depression increases the risk of complications during childbirth, premature birth, low birth weight, and maternal morbidity [7], [8]. In addition to physical complications, mothers with untreated depression may experience poor self-care behaviors, inadequate nutrition, disrupted sleep, and reduced adherence to antenatal care visits. Anxiety during

pregnancy increases fetal cortisol levels, which can trigger behavioral and physiological stress in infants [9]. Persistent exposure to maternal stress hormones during pregnancy may negatively affect fetal brain development and increase vulnerability to future mental health problems in children. Other impacts include an increased risk of neonatal death, congenital disabilities, and impaired emotional bonding between mother and child [10]. Weak mother–infant attachment may also reduce breastfeeding success and negatively influence the child's emotional security and social competence later in life. Therefore, early prevention and intervention for perinatal mental disorders are essential components of maternal and child healthcare services.

Availability of mental health services in LMICs continues to be restricted; geographical, social, and economic barriers, as well as a lack of mental health professionals, make it difficult for communities, especially in rural areas, to obtain adequate services [11]. In many regions, mental health services remain centralized in urban hospitals, leaving remote communities underserved. Social stigma surrounding mental illness further discourages mothers from seeking help. Health professionals in resource-limited areas often face limitations in facilities, cultural values, and issues of privacy and confidentiality [12]. In some communities, cultural beliefs may interpret psychological symptoms as personal weakness or spiritual problems, preventing women from receiving evidence-based treatment. This exacerbates the gap in mental health care for mothers. In this context, advances in information and communication technology offer opportunities. Digital interventions, including mHealth, smartphone applications, SMS, telemedicine, and social media, have been shown to improve monitoring, education, and perinatal healthcare [13], [14]. Digital platforms provide flexible communication channels that can support continuous monitoring and timely interventions without requiring frequent in-person visits. This technology allows mothers and healthcare providers to interact more flexibly and affordably, especially in areas with limited access [15], [16]. Several studies have demonstrated that digital interventions possess the capacity to enhance clinical results, enhance patient engagement, and increase service efficiency [17], [18]. Moreover, digital approaches may help reduce stigma because mothers can access support privately from their homes.

Community nurses play an essential role in supporting perinatal mental health. They are the health workers closest to mothers, conducting regular home visits and playing a role in education, early screening, basic counseling, and referrals [19], [20]. Because of their close relationships with communities, nurses are often trusted sources of healthcare information and emotional support. With digital interventions, nurses can expand the reach of their services, facilitate early detection, and provide psychological support based on task-sharing or telemedicine [21]. Digital tools may also assist nurses in documenting patient progress,

coordinating referrals, and delivering health education more efficiently. However, limitations in digital literacy, cultural adaptation, and privacy aspects remain challenges in implementation in the field [22]. Unequal internet access, limited smartphone ownership, and insufficient training among healthcare workers may reduce the effectiveness of digital programs.

However, despite growing evidence on digital interventions, there has been no comprehensive synthesis examining how community nurses implement or support digital mental health services for pregnant women in low- and middle-income nations (LMICs). Despite the increasing clinical evidence supporting the efficacy of digital therapies, research related to implementation aspects, particularly the role of community nurses in the context of LMICs, is still minimal [23], [24]. In fact, the involvement of community nurses has excellent potential to improve accessibility, continuity of services, and empowerment of mothers in the perinatal period. Understanding how nurses integrate digital technologies into routine maternal healthcare is important for identifying best practices, barriers, and policy implications. The objective of the literature review is to determine the role of community nurses in implementing digital interventions to enhance services for perinatal mental health in low- and middle-income countries.

Literature Review

This study is based on several theories, including Organizational Behavior Theory, Donabedian's Quality of Care Model, and the Total Quality Management (TQM) approach. It examines how transformational leadership affects patient safety incident reporting through the role of patient safety culture. At the individual level, nurses' views and motivation to report incidents depend on organizational support and psychosocial factors [5],[6]. Donabedian's model highlights the essential role of structure and process in achieving good outcomes, with incident reporting being a vital part of quality care delivery [7]. In this context, TQM encourages ongoing improvement by involving all members of the organization in efforts to improve healthcare quality and patient safety, with support from leadership and active participation [8].

Transformational leadership is key in building a culture of safety through its main elements: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration [2].A positive patient safety culture includes open communication, a non-punitive approach to errors, and supportive reporting systems that promote learning and teamwork [9], [10]. Nurses, who work directly with patients, play a crucial role in identifying and reporting risks early; however, their actions often depend on how much managerial support and a positive organizational climate they perceive [3], [11]. Therefore, this framework emphasizes the connection between leadership, system quality, and

organizational culture, showing that incident reporting is not just a procedure but is part of complex social and institutional dynamics.

Material and Methods

A. Research Design

This study employs a literature review methodology to examine the role of nurses in executing digital perinatal mental health interventions in low- and middle-income countries to mitigate the burden of perinatal mental health conditions and address the existing gap in access to services for mothers during pregnancy and postpartum.

B. Search Method

Literature searches were conducted in several major electronic databases, such as ScienceDirect, Scopus, Dimensions, and ProQuest. The data sources in this study were scientific articles published in national and international journals over the last five years (2020–2025). The search strategy uses Boolean Operators (AND and OR) with the keywords community nurse OR Visiting Nurse OR home health nurses AND Telemedicine OR digital health OR mHealth OR mobile health OR telehealth OR eHealth AND perinatal OR maternal OR postpartum OR antenatal AND mental health OR mental hygiene AND Low- and middle-income countries OR developing countries OR LMICs. The search is confined to English-language items published within the past five years (2020-2025) and in the form of original articles. Country income classification was determined based on the World Bank country income classification at the time of study publication. Only studies conducted in countries classified as low- and middle-income by the World Bank were eligible for inclusion. Studies conducted in high-income countries were excluded during the full-text screening stage to ensure consistency with the study objectives.

C. Inclusion and exclusion criteria

Articles were selected based on predefined inclusion and exclusion criteria. All primary empirical study designs were eligible for inclusion. Protocol studies were included only when they provided empirical data on feasibility, implementation processes, or intervention design relevant to community nursing roles. Randomized controlled trials (RCTs) were not mandatory but were included where available alongside other quantitative, qualitative, and mixed-methods designs. The inclusion criteria were (a) Low- and Middle-Income Countries, (b) Digital health interventions, (c) community nurses, (d) perinatal mental health, (e) Feasibility, (f) randomized controlled trials, (g) Qualitative design, (h) provider-patient mental health full-text Studies, (i) Exploration design, (j) Cross- sectional study, (k) Mixed-methods, (l) Cohort studies, (m) original articles in English. The exclusion criteria were (a) High-Income Countries (HICs), (b) non-digital interventions, (c) not involving community nurses, (d) not perinatal mental health, (e) not reporting feasibility or impact, (f) protocol studies, (g) systematic

reviews, or narrative reviews, and scoping reviews. Accordingly, studies conducted in high-income countries, including Canada and Singapore, were excluded from the final analysis.

D. Screening of articles

All articles found in the search results were entered into Mendeley to facilitate the screening process and remove duplicates. One independent reviewer evaluated the titles and abstracts of all papers identified according to the established inclusion and exclusion criteria. The mental health documents that satisfied the qualifying requirements were further examined in greater detail to ensure their suitability for inclusion in the final synthesis. No other automated tools were used, except for Mendeley's duplication detection feature. The initial search results found 1,479 articles. After screening, 21 studies were selected for further analysis. This study uses secondary data, so it does not involve human subjects. Researchers still adhere to ethical principles by ensuring that all sources of information are properly cited to respect intellectual property rights.

E. Quality appraisal

The methodological quality of included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, with the appropriate checklist selected based on each study design. Each study was independently appraised across relevant domains, including study design, sampling, measurement validity, and outcome reporting. Studies were not excluded based on quality appraisal results. However, study quality was considered during data synthesis and interpretation of findings, with greater emphasis placed on evidence derived from studies with moderate to high methodological quality.

The results of the quality appraisal are presented in Appendix A. Overall, most included studies were rated as having moderate to high methodological quality. Common methodological limitations included small sample sizes, lack of blinding, and reliance on self-reported outcome measures.

F. Data extraction

Outcome data were extracted using a standardized data extraction template developed by the authors. Extracted outcomes included measures of perinatal mental health such as depression, anxiety, stress, or psychological well-being, as reported in the included studies. Where available, quantitative outcome data were extracted, including sample size, mean differences, odds ratios, and confidence intervals. For qualitative studies, outcome-related themes and implementation-relevant findings were extracted narratively. The following data were extracted from each study: (a) Authors & Country; (b) Study design; (c) Sample sizes and participant characteristics; (d) Intervention components and duration; (e) Outcome measures; and (f) Key Findings. All extracted data were synthesized and reported in an expanded study

characteristics table (Table 2 in the Appendix) to ensure standardized and transparent reporting across studies.

Where standardized screening instruments were used, the sources of each instrument were identified and cited. Information on whether validated local language versions were employed was extracted when reported by the original studies. Instruments commonly used across included studies included the Patient Health Questionnaire-9 (PHQ-9) [25], Generalized Anxiety Disorder-7 (GAD-7) [26], Edinburgh Postnatal Depression Scale (EPDS) [27], and Depression Anxiety Stress Scales (DASS-21) [28]. Validated local translations were reported in some studies, while others did not specify translation or validation procedures.

G. Data synthesis

A narrative synthesis was conducted due to substantial heterogeneity across included studies in terms of study design, intervention modalities, outcome measures, and follow-up periods. Quantitative findings were synthesized descriptively by summarizing reported outcomes and effect directions, while qualitative and mixed-methods studies were synthesized thematically to capture implementation processes, contextual factors, and nurses' roles. Findings from different study designs were integrated narratively to provide a comprehensive understanding of both effectiveness and implementation aspects of digital perinatal mental health interventions.

The diversity of mental health instruments, reporting formats, and implementation contexts precluded meaningful quantitative pooling or meta-analysis, even among studies with similar outcomes. Effect sizes were not calculated de novo for this review. Where effect estimates such as mean differences, odds ratios, or confidence intervals were reported in the original studies, these were extracted and summarized descriptively. During synthesis, greater interpretive weight was given to findings from studies rated as moderate to high quality, while results from lower-quality studies were interpreted with caution.

Results

A. Study selection

The preliminary search produced 1,479 articles from four electronic databases: Scopus (380), ProQuest (516), Dimensions (500), and ScienceDirect (83). After removing 43 duplicates, 1,436 records were available for title and abstract screening. As a consequence of this procedure, 1304 records were excluded due to their irrelevance to perinatal mental health, non-digital interventions, the general population (excluding perinatal), literature reviews, inappropriate settings (non-low-resource contexts), non-primary study designs, absence of community nurse involvement, lack of conduct in low- and middle-income countries (LMICs), or failure to assess the impacts or feasibility of the outcomes.

A total of 132 full-text papers were evaluated for eligibility. One hundred and eleven studies were discarded for the following reasons: not digital interventions (n = 29), not pertain to the role of community nurses (n = 24), not focused on perinatal mental health (n = 32), not primary research (n = 10), or not conducted in low- and middle-income countries (n = 16). This literature review ultimately included 21 studies that met the inclusion criteria. Detailed characteristics of the included studies, including intervention components, comparators, outcome measures, and follow-up periods, are summarized in Table 2. Figure 1 presents the PRISMA flow diagram.

B. Study characteristics

A total of 21 studies were conducted in several low- and middle-income countries. The included studies were conducted across eight low- and middle-income countries as classified by the World Bank at the time of study publication, namely Bangladesh (n = 4), Pakistan (n = 6), India (n = 3), Malaysia (n = 3), Iran (n = 1), Indonesia (n = 2), Thailand (n = 1), and Vietnam (n = 1). Overall, most included studies demonstrated moderate methodological quality. Protocol studies were included only when they provided empirical data on feasibility, implementation processes, or intervention design, and were not considered primary sources of effectiveness outcomes. Studies rated as high quality generally demonstrated clearer outcome reporting and more rigorous study designs, while moderate-quality studies commonly exhibited risks of bias related to sample size, blinding, and outcome measurement.

C. Types of digital perinatal mental health interventions

This study examines digital interventions focusing on perinatal mental health. Simulation-based digital training has been reported to improve CHWs' skills in screening and supporting anxiety, depression, and psychological health among pregnant and postpartum women. The included interventions comprised mobile application-based digital interventions for education, screening, and self-therapy, including multilingual digital self-assessment applications (PHQ-9, GAD-7), MoodMission app, Parentbot mobile application featuring an AI chatbot, Mommy-Be mobile app focusing on breastfeeding and maternal mental health, KhunLook mobile app, mMOM intervention, LoVE4MUM, SMART intervention, mHealth app, and the i-PartnerPulse framework for digital application design [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39]. Telemedicine and remote counseling facilitate long-distance communication between healthcare professionals and perinatal mothers, including midwife-led telemedicine that encompasses prenatal, postnatal, and gender-based violence (GBV) screening. mPareshan app-facilitated therapy by Female Health Workers. Behavioral activation is offered via telemedicine (both by professionals and nonspecialists), with Kushal Maa WhatsApp-facilitated group audio/video support sessions, and government-established Wellbeing Centers providing video-based mental health treatment [21], [40], [41], [42], [43]. Digital Cognitive Behavioral

Therapy (CBT) and psychosocial interventions utilizing CBT or psychoeducational modules in a digital format, including CBT-based interventions. Happy Mother Healthy Baby, Technology-assisted WHO Thinking Healthy Program (THP-TAP), Healthy Mother Healthy Baby psychosocial program, Happy Mother Healthy Baby (CBT intervention), SM-ART Intervention [44], [45], [46], [47]. CHW-based digital integration, A program that integrates digital interventions with community-based or home-based care methodologies, including: CHW-delivered behavioral activation (home-based), tablet-based mHealth for nutritional counseling, the SISFORNUTRIMIL web application, and a community-based mental health care package incorporated into maternal services [48], [49], [50], [51], [52].

D. Implementation roles of nurses

Across the included studies, community nurses played a central role in the implementation of digital perinatal mental health interventions. Their responsibilities included conducting initial mental health screening using digital tools, facilitating access to mobile applications and telemedicine platforms, providing psychoeducation, and delivering basic counseling through task-sharing models. In several studies, nurses acted as intermediaries between mothers and specialist services by coordinating teleconsultation, monitoring symptoms, and supporting follow-up care. Community nurses were also involved in guiding mothers in the use of digital platforms, addressing technical barriers, and promoting engagement with digital interventions, particularly in low-resource and rural settings.

E. Contextual factors influencing implementation

Several contextual factors were reported to influence the implementation and effectiveness of digital perinatal mental health interventions. Common facilitators included high acceptability among mothers, perceived privacy benefits, and support from community nurses. Reported barriers included limited digital literacy, unstable internet connectivity, device availability, and variations in health system capacity. Cultural considerations, language adaptation, and trust in healthcare providers were also identified as important factors affecting engagement and sustained use of digital interventions across different low-and middle-income country settings.

To enhance clarity and facilitate comparison across studies, Table 1 summarizes the relationships between digital intervention types, reported mental health outcomes, and key implementation facilitators and barriers identified across included studies.

F. Comparative analysis across intervention types and outcomes

Across the included studies, differences were observed in the consistency and strength of evidence across intervention types. Digital cognitive behavioral therapy (CBT) based and structured psychosocial interventions, particularly those evaluated using randomized controlled trials, demonstrated more consistent reductions in depression and anxiety

outcomes compared with mobile application-only interventions, which primarily reported improvements in acceptability, usability, and screening uptake. Telemedicine and remote counseling interventions showed variable effectiveness across settings but consistently improved access to care and service continuity, especially in rural and underserved contexts. CHW-integrated digital interventions demonstrated moderate but contextually meaningful effects, particularly in enhancing engagement and task-sharing, although outcome measures and follow-up periods varied substantially across studies.

Across the included studies, 14 out of 21 studies reported statistically significant reductions in depressive and/or anxiety symptoms among pregnant or postpartum women. Among randomized controlled trials (n = 12), 9 studies demonstrated statistically significant improvements in primary mental health outcomes, particularly depression and anxiety scores measured using validated instruments such as PHQ-9, GAD-7, EPDS, and DASS-21. Where effect estimates were reported, reductions were generally of moderate magnitude and considered clinically meaningful within the context of low-resource settings. Mobile application-only interventions more frequently reported improvement in screening uptake, acceptability, and user engagement rather than significant symptom reduction, whereas CBT-based and task-shared psychosocial interventions showed more consistent symptom improvement across studies. However, heterogeneity in outcome measures, follow-up duration, and reporting formats limited direct quantitative comparison across studies.

Table 1 illustrates the mapping of digital intervention types, reported outcomes, and the facilitators and barriers identified during implementation. The table categorizes various forms of digital interventions applied in the reviewed studies and highlights their corresponding impacts on targeted outcomes.

Table 1. Mapping of Digital Intervention Types, Reported Outcomes, and Implementation Facilitators and Barriers

Intervention type	Primary outcomes	Direction/consistency of effect	Key facilitators	Key barriers
Mobile app-based interventions	Depression, anxiety, screening uptake	Moderate, mixed consistency	High acceptability, privacy, flexibility	Digital literacy, engagement drop-off
Telemedicine & remote counseling	Depression, anxiety, and service access	Consistent improvement in access, mixed symptom reduction	Nurse facilitation, task-sharing	Connectivity, scheduling
Digital CBT & psychosocial interventions	Depression, anxiety, stress	More consistent symptom reduction	Structured guidance, supervision	Training demands
CHW-based digital integration	Engagement, depression, care continuity	Contextually meaningful effects	Community trust, task-sharing	Resource constraints

Fig. 1 presents the PRISMA flow diagram illustrating the process of study selection conducted in this review. The diagram outlines the stages of identification, screening, eligibility assessment, and inclusion of studies based on the PRISMA guidelines. Initially, records were identified from multiple databases and registers, followed by the removal of duplicate records. The remaining studies were screened through title and abstract evaluation, resulting in the exclusion of articles that did not meet the inclusion criteria. Full-text articles were subsequently assessed for eligibility using predefined criteria and JBI appraisal standards. Finally, a total of 21 studies were included in the review. The figure provides a transparent overview of the selection process and demonstrates the systematic approach used to ensure the relevance and quality of the included studies.

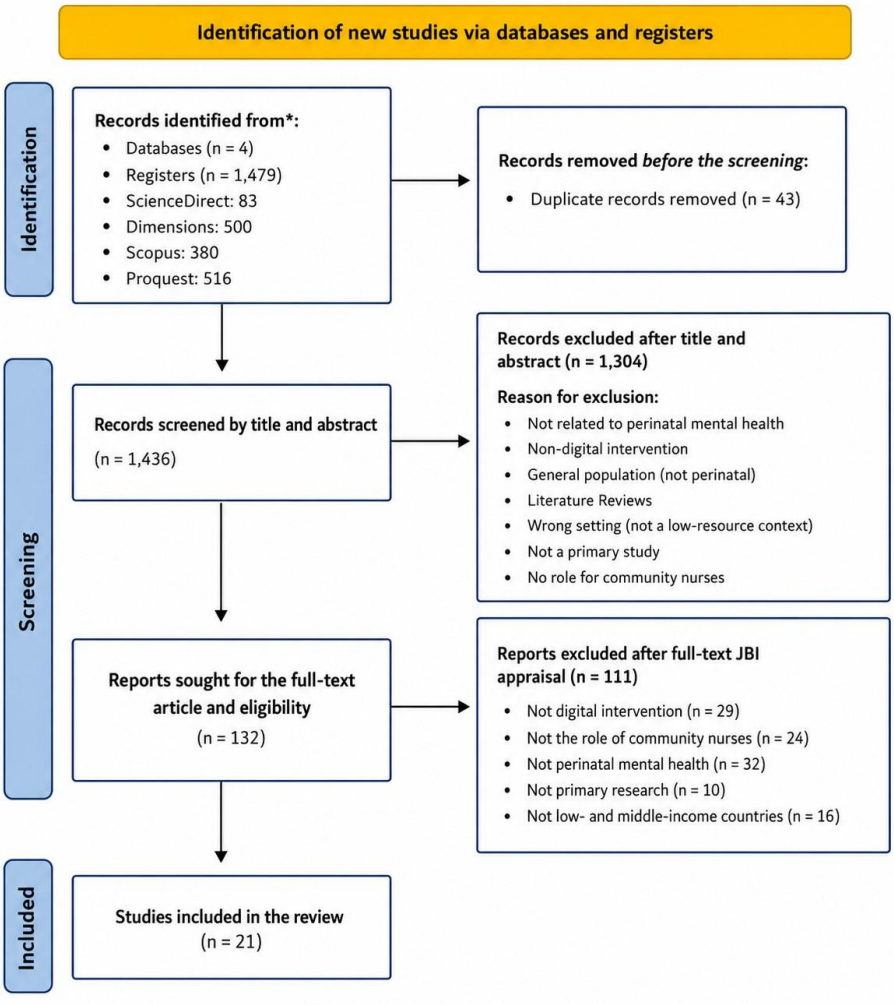


Fig. 1. PRISMA flow diagram of study selection

Discussions

A. Mobile App-Based Digital Interventions

Furthermore, previous studies demonstrated that digital interventions for postpartum depression significantly impact the overall health and well-being of mothers and their children

[53]. Perinatal mood anxiety disorders (PMAD) substantially impair a mother's ability to operate, nurture, and establish a connection with her newborn during pregnancy and the postpartum phase, thereby influencing the child's socio-emotional development trajectory [54]. Mobile health (mHealth) applications demonstrate significant potential in delivering prompt and personalized assistance to persons with diverse medical disorders, including anxiety, depression, and hypertension [55]. A literature review indicates that mobile application-based therapies provide educational, socio-emotional, and psychological support to parents throughout the perinatal period, largely due to their flexibility and on-demand accessibility [56]. Likewise, previous studies discovered that mobile applications serve as effective and readily available instruments for providing evidence-based psychological interventions to support perinatal mental health [57]. These digital interventions have also been reported to show high levels of feasibility and acceptability, particularly among populations with limited access to conventional mental health services [58].

Several studies further indicate that digital mental health tools demonstrate moderate to high effectiveness in reducing symptoms of anxiety and depression among pregnant and postpartum women in low- and middle-income countries [59]. The rapid expansion of mobile applications designed for perinatal populations reflects their perceived value as cost-effective, private, and adaptable options tailored to the specific needs of new mothers [60]. Furthermore, demonstrated that digital interventions for postpartum depression, such as mobile applications, telemedicine, and websites, yielded higher effect sizes than traditional face-to-face interventions [61]. Moreover, mHealth applications have been shown to alleviate specific challenges experienced by pregnant and postpartum women, including psychological stress, limited social support, and delays in help-seeking behavior [62].

In addition to psychological support, mobile application-based interventions also contribute to strengthening maternal self-management and health literacy during pregnancy and the postpartum period. Many digital platforms provide structured information regarding emotional regulation, infant care, breastfeeding, sleep management, and coping strategies for stress and anxiety. Such features enable mothers to access reliable health information independently and repeatedly according to their needs. The convenience of mobile-based interventions is particularly important for women living in low-resource settings where access to mental health professionals and maternal healthcare services remains limited. In these contexts, digital tools may reduce geographical and financial barriers while maintaining continuity of care.

Another important aspect highlighted in recent literature is the personalized nature of mHealth interventions. Several applications incorporate reminders, mood-tracking systems, symptom-monitoring features, and interactive counseling support that allow mothers to

monitor their emotional conditions in real time. These functions may encourage early recognition of depressive symptoms and facilitate timely referral to healthcare providers when necessary. Furthermore, anonymity and privacy within mobile applications may increase user confidence and reduce stigma associated with seeking mental health support, particularly in communities where mental health issues are still highly stigmatized.

The scalability of mobile app-based interventions also represents a major advantage for public health systems in low- and middle-income countries. Compared with conventional face-to-face counseling programs, mobile interventions require fewer physical resources and may reach larger populations in a shorter period. This flexibility became especially relevant during public health emergencies such as the COVID-19 pandemic, where digital communication became essential for maintaining maternal healthcare access. Consequently, mobile app-based interventions can be viewed not only as complementary strategies but also as sustainable alternatives for improving maternal mental health outcomes and strengthening community-based healthcare systems.

B. Telemedicine and Remote Counseling

This study confirms that telemedicine and remote counseling are significant advancements in strengthening communication between healthcare professionals and pregnant women, particularly in remote and underserved regions. The Telehealth MOM model demonstrated improvements in postpartum visit attendance, early identification of maternal health concerns, and maternal satisfaction through structured online monitoring [63]. Similarly, the Moms IMPACTT initiative was shown to enhance access to perinatal mental health services through digital psychiatric consultations and coordinated telehealth care [64].

Recent international evidence further supports these findings. The integration of telehealth into prenatal care has been reported to improve midwife-mother communication by facilitating real-time monitoring of maternal conditions and facilitating timely clinical decision-making [65]. Digital-based behavioral activation therapy delivered through telemedicine has also been shown to increase patient engagement while reducing stress and symptoms of perinatal depression [9]. Additionally, telehealth integration within obstetric practice has been associated with improved interprofessional collaboration and continuity of care, allowing sustained remote contact between mothers and healthcare providers [66].

In line with these findings, the results reinforced the idea of task-sharing by confirming that behavioral therapy delivered by midwives and nurses via telemedicine achieves outcomes comparable to those offered by specialized mental health professionals [67]. Online and video-based counseling interventions have also been found to improve maternal mental health while reducing stigma associated with seeking psychological support [68].

Telemedicine-based interventions also offer important practical benefits for healthcare systems facing workforce shortages and unequal service distribution. In many low- and middle-income countries, mental health specialists are concentrated in urban areas, leaving rural populations with limited access to professional care. Through telemedicine, nurses, midwives, and community healthcare workers can collaborate with specialists remotely to provide more comprehensive maternal mental health services. This collaborative approach strengthens referral systems, improves treatment coordination, and enhances the capacity of frontline healthcare providers to manage psychological conditions during pregnancy and postpartum periods.

Another significant contribution of remote counseling lies in its flexibility and patient-centered nature. Pregnant and postpartum women often experience challenges attending in-person consultations due to transportation barriers, childcare responsibilities, financial limitations, or social stigma. Remote counseling enables mothers to receive psychological support within their own homes, thereby increasing comfort and participation in treatment programs. The use of video calls, instant messaging, and digital monitoring systems also facilitates continuous emotional support and follow-up care, which are essential in preventing the worsening of depressive and anxiety symptoms.

Overall, the evidence indicates that telemedicine and remote counseling approaches offer effective, inclusive, and patient-centered strategies for supporting perinatal mental health by strengthening service continuity and provider-patient communication across diverse care settings. In addition, these approaches demonstrate strong potential for integration into national maternal healthcare programs, particularly in low-resource settings where digital health technologies can bridge service gaps and improve equitable access to mental healthcare services.

C. Digital CBT and Psychosocial Interventions

Numerous studies have demonstrated the efficacy and accessibility of digital cognitive behavioral therapy (CBT) and psychosocial interventions in improving the mental health of pregnant and postpartum women. App-based CBT programs delivering cognitive exercises and emotion regulation strategies with flexible access have been shown to reduce the risk of prenatal depression [69]. A systematic review reported that digital cognitive behavioral therapy interventions during pregnancy have encouraging outcomes, particularly when delivered through guided formats that enhance intervention adherence and participant engagement [70]. These findings are supported by a meta-analysis indicating that perinatal cognitive behavioral therapy interventions significantly reduce symptoms of depression, anxiety, and stress, while also improving perceived social support [71]. In addition, psychosocial interventions incorporating psychoeducational components have demonstrated

particular benefits for vulnerable populations, including adolescent mothers [72]. These findings suggest that integrating psychoeducation with digital cognitive behavioral therapy may contribute to the prevention of postpartum emotional disorders.

Digital cognitive behavioral therapy and psychosocial interventions further offer advantages related to scalability and adaptability within resource-limited settings. Evidence indicates that digitally delivered mental health treatments are especially effective when structured guidance and interactive support mechanisms are incorporated into intervention design [73]. Programs such as the Technology-Assisted Thinking Healthy Program (THP-TAP) demonstrate how digital platforms can extend the delivery of cognitive behavioral therapy-based interventions in low- and middle-income countries [74]. Studies have shown that e-training for nurses yields outcomes comparable to face-to-face training and that interventions delivered by nonspecialists remain effective when supported by adequate supervision [75].

Hybrid intervention models combining peer support with digital cognitive behavioral therapy are also increasingly reported in the literature. Mobile health applications that integrate peer interaction features have been associated with improved user engagement, higher satisfaction, and reductions in depressive symptoms among mothers [8]. These approaches demonstrate how digital technology, social support, and evidence-based psychological interventions can be integrated to enhance perinatal mental health.

D. CHW-based digital integration

Integrating digital technology into services delivered by community health workers (CHWs) represents an innovative approach to strengthening maternal and mental health care across diverse settings, particularly in resource-limited contexts. Within this model, CHWs function as key intermediaries linking digital tools with community-based care to deliver more structured, responsive, and accessible services [76]. Evidence indicates that tablet-based mHealth systems used during CHW home visits can improve maternal health knowledge and overall well-being among pregnant and postpartum women [77].

Additional studies support the effectiveness of incorporating digital tools into community-based health programs. Digital platforms such as MomConnect have been shown to expand access to health information and enhance social support among women living in rural communities [16]. Research conducted in Malawi demonstrated that CHW-led mHealth interventions increased the utilization of maternal and neonatal health services [78]. Similarly, the CHV-NEO interactive messaging system implemented in Kenya was effective in improving newborn care practices through community-level digital engagement [79].

Beyond service delivery, digital technologies also contribute to strengthening CHW capacity and workforce development. Simulation-based digital training has been reported to improve CHWs' skills in prenatal depression screening and early identification of mental

health concerns [80]. System-level implementation frameworks, such as the Technology-Assisted Thinking Healthy Program (THP-TAP), emphasize the importance of integrating digital interventions into the primary care system to support sustainability and scale up [81]. Evidence further suggests that digital interventions delivered by trained CHWs and peer counselors can achieve outcomes comparable to traditional service delivery models, highlighting their potential for broader implementation in low-resource settings [46].

Conclusion

This review suggests that digital perinatal mental health interventions may help address service gaps in low-and middle-income countries by supporting screening, education, and psychosocial care through mobile applications, telemedicine, digital cognitive behavioral therapy, and CHW-integrated approaches. Community nurses play a central role in facilitating these interventions through task-sharing, digital screening, counseling support, and care coordination.

However, the effectiveness, feasibility, and scalability of digital interventions are highly context-dependent. Key challenges identified across included studies include limited digital literacy, unstable internet connectivity, and health system capacity constraints, workforce training needs, and equity affecting rural and socioeconomically disadvantaged populations. These findings indicate that digital interventions should be implemented as complementary strategies within strengthened health systems rather than as standalone solutions.

Future implementation efforts should prioritize equity-sensitive approaches, health system integration, and capacity-building for community nurses to ensure sustainable and contextually appropriate delivery of digital perinatal mental health services.

Conflict of Interest

The authors declare no conflict of interest.

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Appendix A. Quality appraisal of included studies using Joanna Briggs Institute (JBI) tools

Study Design	JBI tools	Yes	No	Unclear	Overall quality	Ref.
Mixed-methods	JBI Qualitative Checklist & Quasi-experimental Checklist	15	2	2	Moderate	[42]
Mixed-methods	JBI Qualitative Checklist & Quasi-experimental Checklist	14	2	3	Moderate	[43]
Mixed-methods	JBI Qualitative Checklist & Analytical Cross-Sectional Checklist	13	3	2	Moderate	[34]
RCT	JBI RCT Checklist	9	3	1	Moderate	[38]
Mixed-methods	JBI Qualitative Checklist & Analytical Cross-Sectional Checklist	13	3	2	Moderate	[36]
RCT	JBI RCT Checklist	11	1	1	High	[45]
Qualitative	JBI Qualitative Checklist	10	0	0	High	[37]
RCT	JBI RCT Checklist	11	2	0	High	[29]
Qualitative	JBI Qualitative Checklist	8	1	1	Moderate	[30]
RCT	JBI RCT Checklist	11	2	0	High	[46]
Mixed-methods	JBI Qualitative Checklist & Quasi-experimental Checklist	15	3	1	Moderate	[52]
Mixed-methods	JBI Qualitative Checklist	8	0	2	Moderate	[35]
Mixed-methods	JBI Qualitative Checklist & Analytical Cross-Sectional Checklist	13	3	2	Moderate	[50]
RCT	JBI RCT Checklist	9	2	2	Moderate	[51]
RCT	JBI RCT Checklist	9	1	3	Moderate	[33]
RCT	JBI RCT Checklist	11	2	0	High	[44]
RCT	JBI RCT Checklist	12	1	0	High	[49]
RCT	JBI RCT Checklist	9	2	2	Moderate	[40]
RCT	JBI RCT Checklist	11	2	0	High	[47]
RCT	JBI RCT Checklist	11	2	0	High	[31]
Mixed-methods	JBI Qualitative Checklist & Analytical Cross-Sectional Checklist	16	0	2	Moderate	[41]

Appendix Table 2. Selected Articles

Ref., Country	Design	Sample sizes and population characteristics	Intervention components, duration, and comparator	Outcome measures	Follow-up time and key effect estimates
[42]	Mixed-methods	Sample size: 6,917 pregnant and postpartum women screened for GBV, program data from 36 hospitals.	Intervention components: Midwife-led telemedicine delivering remote ANC and PNC integrated with GBV screening, counseling, and referral.	Maternal health service utilization (ANC, PNC, facility births) and GBV screening indicators.	Follow-up time: monthly service utilization data assessed before and after intervention implementation (2019-2022).
Bangladesh		Population characteristics: pregnant and postpartum women using secondary-level maternal health services,	Duration: implemented from December 2020, with approximately one year of implementation. Comparator: pre-intervention service utilization trends.		Key effect estimates: increased utilization of ANC/PNC and GBV screening over time.
[43]	Mixed-methods	Sample size: 366 adults surveyed at baseline, 98 eligible, 92 completed intervention.	Intervention components: home-based digital mental health counselling (mPareshan app) adapted from WHO mhGAP, delivered by trained and supervised lady health workers (LHWs) during routine household visits.	Anxiety and depression symptom severity were measured using validated screening instruments: Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7). Outcomes assessed as	Follow-up time: six months between baseline and endline assessments.
Pakistan		Population characteristics: adult men and women in rural Sindh with mild-moderate anxiety and depression.	Duration: six counseling sessions delivered over six months. Comparator: baseline (pre-intervention) assessment compared with endline (post-intervention) assessment, no control group.		Key effect estimates: anxiety and depression scores decreased after intervention.
[34]	Mixed-methods	Sample size: 234 perinatal women (101 pregnant and 133 postpartum), 138 completed follow-up.	Intervention components: multilingual tablet-based digital self-assessment for perinatal mental health.	Anxiety and depression screening (PHQ-9 and GAD-7), feasibility, and acceptability indicators.	Follow-up time: 24 hour post assessment telephone follow-up for acceptability and feasibility evaluation.
India		Population characteristics: adult pregnant and postpartum women attending urban obstetric and paediatric clinics in Bengaluru.	Duration: single-session self-assessment conducted during clinic visits.		Key effect estimates: high acceptability, identification of mild to moderate anxiety and depression.

Ref., Country	Design	Sample sizes and population characteristics	Intervention components, duration, and comparator	Outcome measures	Follow-up time and key effect estimates
			Comparator: no comparator, descriptive feasibility and acceptability assessment.		
[38] **Malaysia**	Randomized controlled trial	Sample size: 48 psychiatric outpatients (24 intervention, 24 control). Population characteristics: adult psychiatric outpatients (≥ 18 years) with mild-moderate depression and anxiety attending psychiatric outpatient clinics.	Intervention components: smartphone-based mental health application (MoodMission) providing evidence CBT based coping strategies, delivered in addition to treatment as usual (TAU). Duration: 4-week intervention period. Comparator: treatment as usual (TAU) alone.	Depressive and anxiety symptom severity (PHQ-9) and generalized anxiety disorder-7 (GAD-7) were assessed at baseline and 4 weeks.	Follow-up time: 4 weeks after baseline assessment. Key effect estimates: depressive symptoms decreased in the intervention group, no significant between-group difference for anxiety.
[36] **Iran**	Mixed-methods	Sample size: 15 experts (CVI/CVR), a delphi panel, literature review of 34 articles, and 3 guidelines. Population characteristics: perinatal women (conceptual), experts in health informatics and mental health.	Intervention components: identification and validation of mHealth app requirements. Duration: none Comparator: none	Functional and non-functional app requirements.	Follow-up time: multi-stage validation. Key effect estimates: finalized 75 requirements across 13 domains.
[45] **Pakistan**	Randomized controlled trial	Sample size: 720 women completed postpartum assessment. Population characteristics: pregnant women with prenatal anxiety.	Intervention components: Happy mother, healthy baby (HMHB) CBT-based intervention. Duration: six-session CBT-based intervention delivered during pregnancy. Comparator: enhanced usual care.	Breastfeeding outcomes and anxiety levels.	Follow-up time: 6 weeks postpartum. Key effect estimates: marginal improvement in early breastfeeding, stronger effects among intervention completers.
[37]	Qualitative research design	Sample size: 6 first-time breastfeeding mothers.	Intervention components: Mommy-Be breastfeeding support app.	User experience, technology acceptance	Follow-up time: during the app use period.

Ref., Country	Design	Sample sizes and population characteristics	Intervention components, duration, and comparator	Outcome measures	Follow-up time and key effect estimates
Indonesia		Population characteristics: postpartum women using the Mommy-Be app.	Duration: app use during breastfeeding period, no fixed intervention duration specified. Comparator: none	(TAM), and perceived usefulness.	Key effect estimates: positive acceptance, usability benefits with noted technical barriers.
[29] **Thailand**	Randomized controlled trial	Sample size: 358 parents of children <3 years (182 intervention, 176 control) completed both visits. Population characteristics: parents attending well-child clinics, smartphone users, and those using the maternal and child health handbook (MCHH).	Intervention components: Mobile app Khunlook, maternal and child health handbook (MCHH), standard care. Duration: maternal and child health handbook (MCHH) and standard care only. Comparator: 2 visits, 2-6 months apart.	Parental health literacy (Thailand health literacy scale), accuracy of child health assessment, and convenience of use.	Follow-up time: immediate (visit 1) and intermediate (visit 2). Key effect estimates: significant improvement in health literacy and assessment accuracy in the app group vs control ($p<0.05$).
[30] **Malaysia**	Qualitative research design	Sample size: 20 perinatal women, 15 spouses, and 10 experts. Population characteristics: perinatal women with depression/anxiety symptoms, spouses, and multidisciplinary experts.	Intervention components: development of spouse inclusive digital self-care framework (i-PartnerPulse). Duration: none Comparator: none	Framework components (functions, content, approaches) and content validity.	Follow-up time: two-phase validation. Key effect estimates: high content validity (average CVI = 0.88).
[46] **Pakistan**	Randomized controlled trial	Sample size: 980 women with perinatal depression. Population characteristics: rural perinatal women in primary care.	Intervention components: technology-assisted peer-delivered CBT (THP-TAP) Duration: antenatal to postnatal period, primary outcome assessed at 3 months postpartum. Comparator: standard WHO-THP.	Depression remission.	Follow-up time: 3 and 6 months postnatal. Key effect estimates: THP-TAP non-inferior to WHO-THP, higher remission rates.
[52] **India**	Mixed-methods	Sample size: 26 postpartum women with positive EPDS screening. Population characteristics: rural postpartum women.	Intervention components: ASHA-delivered behavioral activation (BA). Duration: A 5-week community health worker delivered a behavioral activation intervention.	Depression severity (EPDS), feasibility, and acceptability.	Follow-up time: post-intervention (5 weeks). Key effect estimates: significant reduction in EPDS scores ($p<0.001$).

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			Comparator: none.		
[35] **Vietnam**	Mixed-methods	Sample size: not yet reported (protocol) Population characteristics: ethnic minority pregnant women.	Intervention components: dMOM (SMS, app, and AI chatbot). Duration: may 2022-june 2025 (multi-phase). Comparator: SMS vs app modalities.	MNCH outcomes, acceptability, and equity.	Follow-up time: across pregnancy to postpartum. Key effect estimates: not yet available.
[50] **Bangladesh**	Mixed-methods	Sample size: community mother-child dyads (coverage data across clusters). Population characteristics: pregnant women & mothers in the first 1000 days.	Intervention components: CHW delivered nutrition counseling supported by the mHealth job aid. Duration: 17 scheduled visits per dyad across pregnancy to early childhood. Comparator: routine services.	Feasibility, coverage, and CHW usability.	Follow-up time: across scheduled visits. Key effect estimates: high visit coverage (>90%) except for the perinatal window.
[51] **Indonesia**	Randomized controlled trial	Sample size: 112 pregnant women (56 app users, 56 controls). Population characteristics: second-trimester primigravida women.	Intervention components: SISFORNUTRIMIL web-based nutrition app. Duration: 12 weeks. Comparator: non-users (usual care).	Dietary diversity, nutrient intake, and maternal weight gain.	Follow-up time: pre- and post 12 weeks. Key effect estimates: improved dietary diversity and healthy weight gain.
[33] **Malaysia**	Randomized controlled trial	Sample size: planned 72 postpartum mothers. Population characteristics: postnatal women in a hospital setting.	Intervention components: self-guided LoVE4MUM CBT-based app. Duration: postpartum period (up to 3 months). Comparator: treatment as usual.	Postpartum depression, mental health literacy.	Follow-up time: outcomes were assessed at baseline and at the end of the intervention period. Key effect estimates: result pending.
[44]	Randomized controlled trial	Sample size: 1200 pregnant women randomized (HMHB vs EUC).	Intervention components: CBT-based healthy mother, healthy baby (HMHB).	Anxiety and depression severity (HADS), mediators (social support, stress).	Follow-up time: assessments were conducted at baseline, during the third trimester of pregnancy,

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					and at 6 weeks postpartum.
Pakistan		Population characteristics: pregnant women with perinatal anxiety.	Duration: pregnancy period (antenatal sessions), outcomes assessed postpartum.		Key effect estimates: significant reductions in anxiety and depression, mediation via social support.
			Comparator: enhanced usual care (EUC).		
[49]	Randomized controlled trial	Sample size: 1215 perinatal women (605 intervention, 610 control).	Intervention components: community-based mental health care (CBMHC) package and routine care.	Depression, anxiety, stress (DASS-21), quality of life (EQ-5D-3L).	Follow-up time: outcomes were measured at baseline and at endline.
Bangladesh		Population characteristics: rural perinatal women.	Duration: 2017-2018 implementation period.		Key effect estimates: greater reduction in stress and improved QoL in the intervention group.
			Comparator: routine maternal care.		
[40]	Randomized controlled trial	Sample size: planned 2100 pregnant women.	Intervention components: Kushal maa group-based mHealth education & support.	PPD, breastfeeding, and family planning.	Follow-up time: 6 weeks, 3 months, 6 months postpartum.
India		Population characteristics: pregnant women (30-33 weeks of gestation).	Duration: 4 prenatal and 24 weekly postpartum sessions (6 months).		Key effect estimates: pending.
			Comparator: standard care.		
[47]	Randomized controlled trial	Sample size: 796 pregnant women.	Intervention components: HMHB CBT-based intervention.	Birth outcomes (LBW, PTB, SGA).	Follow-up time: at delivery.
Pakistan		Population characteristics: women with antenatal anxiety.	Duration: during pregnancy (2019-2022), ≥5 sessions for completers.		Key effect estimates: no ITT effect, significant reductions in LBW & SGA among completers.
			Comparator: enhanced usual care.		
[31]	Randomized controlled trial	Sample size: 200 pregnant women.	Intervention components: SM-ART resilience training program.	Resilience, depression, and pregnancy-related anxiety.	Follow-up time: baseline and at 6 weeks post intervention.
Pakistan		Population characteristics: pregnant women in Karachi.	Duration: 6 weekly sessions (60-90 min each).		Key effect estimates: resilience scores increased, while

Ref., Country	Design	Sample sizes and population characteristics	Intervention components, duration, and comparator	Outcome measures	Follow-up time and key effect estimates
					depressive symptoms scores decreased.
			Comparator: usual care.		
[41]	Mixed-methods	Sample size: 911 antepartum and postpartum women, 168 health care providers across 6 facilities.	Intervention components: telemental health services at wellbeing centers (videoconference-based counseling by psychologists/psychiatrists).	Depression (PHQ-9), anxiety (GAD-7), and implementation outcomes (acceptability, feasibility, accessibility).	Follow-up time: between counseling sessions during service use.
Bangladesh		Population characteristics: pregnant and postpartum women receiving care at a public hospital (well-being centers).	Duration: January 2023 - August 2024 (implementation period), ≥2 counseling sessions per woman.		Key effect estimates: decreasing mean PHQ-9 and GAD-7 scores between sessions, high acceptability (>99%).
			Comparator: none		