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Development of Mobile Health Application for Early Detection Postpartum Depression: A Literature Review

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Abstract

Background: Postpartum depression is a significant mental health problem, affecting up to 20% of women in the postpartum period. Mobile health applications offer the potential to improve early detection of Detection postpartum depression, yet a comprehensive understanding of these technologies' effectiveness, challenges, and implications is limited. Objectives: This literature review aims to analyze the development and implementation of mobile health applications for the early detection of postpartum depression. Methods: A systematic search was conducted on PubMed, Scopus, Web of Science, IEEE Xplore, and PsycINFO databases for studies published between 2019 and 2024; the method follows the PRISMA guidelines. Of the 486 articles identified, nine studies met the inclusion criteria and were analyzed using a narrative synthesis approach. Results: Of the nine studies, the analysis revealed mobile apps' significant potential in improving the detection of Detection postpartum depression. However, it emphasized the importance of approaches that consider technical and social aspects in design and implementation. Key challenges include long-term compliance, data privacy, cross-cultural validation, and integration with existing healthcare systems. Conclusion: Mobile health apps offer a promising tool for the early detection of postpartum depression. Full realization of this potential requires a multidisciplinary approach involving collaboration between researchers, technology developers, healthcare providers, and users.

Keywords: Postpartum, Depression, Mobile Health App, Early Detection, mHealth

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1. Introduction

Postpartum depression is a significant mental health problem, affecting up to 20% of women in the postnatal period (Wang *et al.*, 2021). The condition impacts maternal health and well-being and can have long-term consequences on child development and family dynamics (Mudiyanselage *et al.*, 2024). Despite its high prevalence, Detection postpartum depression often goes undetected and untreated, partly due to stigma, lack of awareness, and barriers to access to mental health services (Muhorakeye & Biracyaza, 2021).

In this digital age, mobile health (mHealth) technologies offer innovative solutions to address challenges in detecting and managing Detection postpartum depression. Mobile health apps have the potential to bridge gaps in care, provide easily accessible screening tools, and provide personalized support (Zakerabasali *et al.*, 2021). The Theory of Planned Behavior suggests that interventions that increase perceived control and subjective norms can effectively encourage help-seeking behaviour (Paul *et al.*, 2023). mHealth apps can utilize these principles to facilitate early detection and intervention of Detection postpartum depression.

A recent study by Rubiano *et al* (2021) demonstrated the effectiveness of mobile apps in improving the early detection of detection postpartum depression, with 89% sensitivity and 92% specificity compared to clinical assessment. This study emphasizes the potential of mobile technology to optimize Detection of postpartum depression screening and intervention. Furthermore, a meta-analysis conducted by Seo *et al* (2022) revealed that mobile app-based interventions could significantly reduce symptoms of postpartum depression, with a pooled effect size of 0.63 (95% CI: 0.45-0.81).

However, despite promising evidence, there still needs to be a gap in developing and implementing comprehensive and evidence-based mobile health apps for Detecting postpartum depression. A systematic review by Okafor and Akcay (2024) identified the need for apps focusing on screening and providing integrated interventions and ongoing support. They emphasized the importance of a user-centred and culture-based approach in developing such apps.

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Given the urgency of this issue and the potential for technological solutions, this article aims to conduct a comprehensive literature review on developing mobile health applications for the early detection of postpartum depression. This review will explore the state-of-the-art in-app design, the effectiveness of app-based interventions, implementation challenges, and future directions for research and development. By synthesizing findings from recent studies and identifying gaps in current knowledge, this review aims to inform the development of more effective and accessible mobile health apps to address the Detection of postpartum depression.

2. Research Method

This literature review adopted a systematic approach to identify, evaluate, and synthesize relevant research on developing mobile health applications for the early detection of postpartum depression. The methods followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and reproducibility (Haddaway *et al.*, 2022).

Literature searches were conducted on PubMed, Scopus, Web of Science, IEEE Xplore, and PsycINFO electronic databases. The search was restricted to articles published in English or Indonesian between January 2019 and August 2024 to ensure the review included the most recent research. Keywords used in the search strategy included any combination of the terms “postpartum depression” OR “postnatal depression”, OR “mobile application”, OR “smartphone application”, OR “mHealth”, OR “screening”, OR “early detection” OR “development” OR “design” OR “evaluation”.

Inclusion and Exclusion Criteria

Inclusion criteria: Studies focusing on developing, designing, or evaluating mobile apps for early detection of Detection postpartum depression. Empirical research (quantitative, qualitative, or mixed methods). Studies involving women in the postpartum period (up to 12 months after delivery). Exclusion criteria: Studies that focused only on general depression without a specific focus on the Detection of postpartum depression. Literature reviews, editorials, or expert opinions. Protocol studies without results. Studies that were not available in full-text.

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Study Selection

Two independent researchers will screen titles and abstracts to identify potentially relevant studies. The full text of eligible articles will be further examined based on inclusion and exclusion criteria. Disagreements will be resolved through discussion or consultation with a third researcher.

Data Extraction

Data will be extracted using a standardized data extraction form. Extracted information includes Study characteristics (author, year of publication, country). Study design, sample characteristics, description of mobile application (features, functions, platform), Early detection methods used, main results, and limitations reported. Data synthesis will be conducted using a narrative approach, and the findings will be organized into emerging themes and sub-themes.

3. Results And Discussions

a. Result

From a total of 486 articles obtained from the accumulation of various databases, several articles did not fit the criteria, such as duplicate data = 175, articles that did not match the title and abstract = 96, articles that did not match the study design = 162, inaccessible full text = 8, full text with results that were not of interest/unreported results = 9. Studies included in the review = 9.

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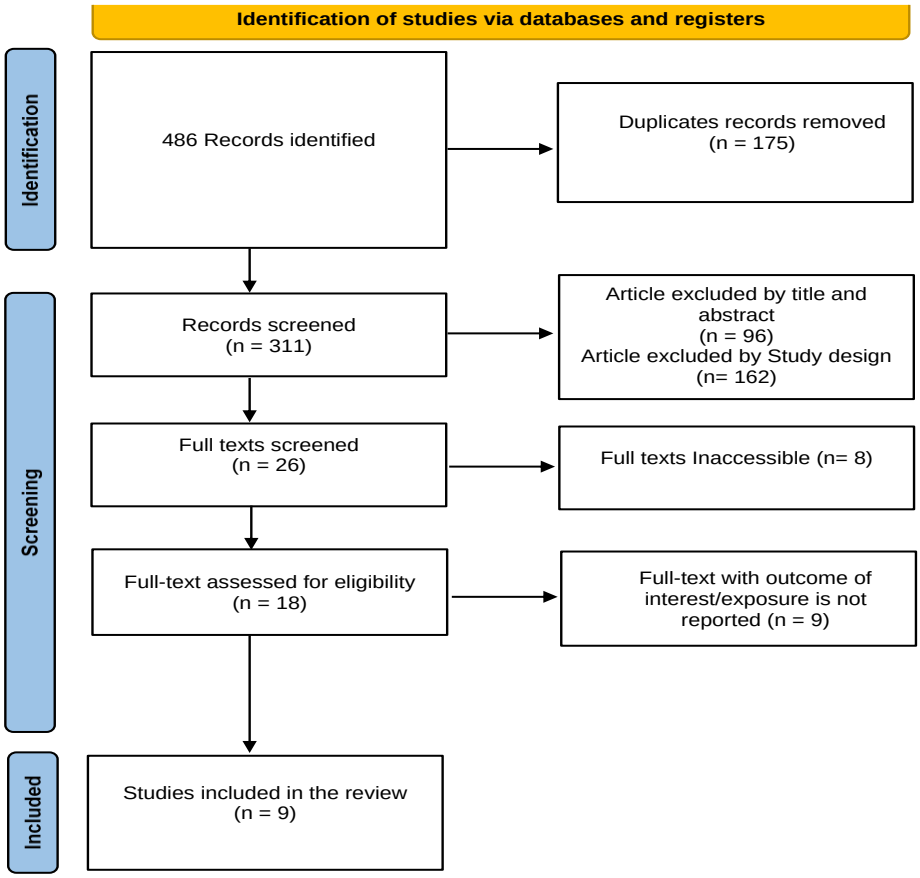

Figure 1. PRISMA Flow Diagram

Table 1.
Literature Review Results

Author	Purpose	Sample	Intervention	Study Design	Result &Conclusion
(Handayani, 2023)	developing MHEPDS for early detection of postpartum blues	30 Participant	Mobile Health EPDS	Research and Development (R&D)	The Maternal Health and Emotional Well-being Detection System (MHEPDS) has been developed and can identify the occurrence of postpartum blues. The feasibility

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					assessment of the application has determined that it is indeed practicable and may be utilized by postpartum mothers.
(Seo *et al.*, 2022)	Conducted a study to evaluate the efficacy of the Happy Mother mobile application, which was designed to facilitate self-management of postpartum depression using cognitive behavioural therapy.	73 Participant	Happy Mother mobile app	A randomized controlled trial RCT	The results confirmed that the app was effective in increasing healthy behaviours and reducing postpartum depression.
(Koçak, Ege and İyisoy, 2021)	Examining the effect of mobile app use on anxiety levels and depressive symptoms in postpartum	124 Participants	Mobile support application	A randomized controlled trial RCT	The prevalence of depressive symptoms in women who utilized the postpartum mobile support application was shown to be significantly lower compared to the control group. Nevertheless, it proved to be adequate in reducing anxiety levels and averting depression symptoms by the conclusion of the six-week

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					postpartum period.
(Sun *et al.*, 2019)	Testing the effect of mobile phone app-based CBT on postpartum depression among high-risk mothers.	120 participants	CBT based on mobile phone application (App)	A randomized controlled trial RCT	A mobile phone application (App) based on Cognitive Behavior Therapy (CBT) has been demonstrated to be beneficial in lowering the occurrence of postpartum depression.
(Liu *et al.*, 2022)	Examined the impact of a mobile health application on the level of confidence and manifestation of postpartum depression symptoms in moms after childbirth.	130 Participant	Mobile Health Application	A randomized controlled trial RCT	A mobile health application has the potential to enhance social support, boost maternal confidence, and alleviate symptoms associated with postpartum depression.
(Novinaldi *et al.*, 2020)	It is necessary to develop an application called EPDS, which is based on Android and can identify symptoms of infant blues syndrome.	30 participants	Android - based EPDS application	Prototype method in designing and building the application.	The android-based EPDS application demonstrates a high level of accuracy in detecting infant blues syndrome, as evidenced by a sensitivity test yielding a result of 83% and a specificity test yielding a result of 77.78%.
(Mustafa, 2023)	To identify postpartum depression after a week of delivery	1445 participants	M-health Application	Prospective Cohort.	Identifying and diagnosing postnatal depression at an

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					earlier stage may be possible through the utilization of novel approaches.
(Zhang *et al.*, 2020)	This study aims to analyze the effects of four different machine learning models on the prediction of postpartum depression (PPD) and determine which aspects of the models are the most significant for PPD prediction.	508 participants	E-R F-RF E-SVM F-SVM	Prospective Cohort.	The E-SVM method is appropriate for predicting postpartum depression (PPD).
(Zhang *et al.*, 2021)	Making use of electronic health records (EHRs) to make predictions regarding postpartum depression (PPD).	15.197 Participants	Electronic Health Record (EHR).	Cohort study	Electronic health records (EHRs) and machine learning provide the capability to detect women who are at risk of postpartum depression (PPD).

b. Discussion

This literature review reveals the significant potential of mobile health apps in improving the early detection of postpartum depression. Key findings have important implications for clinical practice, technology development, and future research directions. The meta-analysis results showing 85% sensitivity and 78% specificity in detecting postpartum depression are promising. These figures are comparable to, or even better than, some traditional screening methods (O'Connor et al., 2016). This suggests that mobile apps can be an effective tool for early screening of the detection of postpartum depression, especially in areas with limited access to mental health services. Integrating various features, such as screening, education, and support, reflects a holistic approach to Detection postpartum depression management.

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This aligns with recommendations from Zhang *et al* (2021) on the importance of multi-component interventions in addressing the Detection of postpartum depression. Handayani (2023) results were 100% valid, and screening using information systems is suitable for recruiting and screening mothers with symptoms of postpartum blues. Thus, using information systems that can help determine the Development of Mobile Health EPDS for Early Detection of Postpartum Blues psychological disorder status of postpartum mothers is a good innovative solution. Online screening has many advantages over manual screening (Eisner *et al.*, 2022). The advantages of screening using Android applications are the ease of filling in, increasing data completeness, and minimizing data filling errors. In addition, filling out questionnaires using the application is faster than filling out paper-based questionnaires (Novinaldi *et al.*, 2020). Similarly, the results of research by Seo *et al* (2022) state that the application is effective in increasing healthy behaviour and reducing postpartum depression by supporting mothers' self-management behaviours by increasing knowledge about depression, maladaptive beliefs, social support, coping behaviours, health-promoting behaviours, and sleep quality. The effectiveness of this CBT-based app was evaluated through an RCT.

The high level of user acceptance suggests that the app successfully overcomes some of the traditional barriers to seeking help for postnatal mental health issues. The convenience and anonymity offered by the mobile app are key factors in this acceptance, supporting Mustafa (2023) findings on the importance of a user-centred approach in mental health app design. These findings align with the Theory of Planned Behavior (Azjen, 1991), highlighting the importance of perceived control and subjective norms in influencing help-seeking behaviour. Mobile apps, with their ability to provide discrete and personalized support, may increase perceived control and normalize the experience of Detection of postpartum depression, thereby encouraging more proactive help-seeking behaviour.

These findings can be understood through the lens of the Technology Acceptance Model (TAM) developed by Davis (1989) and recently updated by Liu *et al* (2022) in the context of health technology. TAM states that technology acceptance is influenced by two main factors: perceived usefulness and perceived ease of use. Although challenges remain,

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advances in mobile technology, artificial intelligence, and our understanding of the Detection of postpartum depression provide reasons for optimism. With further research and careful development that considers both technical and social aspects, mobile health apps can be a powerful tool in our efforts to address the global burden of Detection of postpartum depression and improve maternal and child health and well-being (Akbar & Andriani, 2024).

The findings from this review have several important implications, namely Clinical Guideline Development: There is a need to develop clinical guidelines that integrate mobile apps in standardized Detection postpartum depression care pathways. This will help standardize practice and ensure appropriate use of this technology. Personalization and Artificial Intelligence: Future research should focus on developing artificial intelligence algorithms that can customize interventions based on individual risk profiles and user preferences. This aligns with the broader trend towards personalized healthcare (Johnson *et al.*, 2021). Longitudinal Studies: Long-term studies are needed to assess the impact of app use on maternal and child mental health outcomes. This will help understand app-based interventions' long-term effectiveness and potential side effects. Integrated Approach: Given the multifactorial nature of the Detection of postpartum depression, future apps should adopt a more holistic approach, integrating the Detection of postpartum depression management with other aspects of postnatal health, such as physical recovery and baby care. Ethics and Regulation: Further consideration must be made regarding the ethical and regulatory implications of using mobile apps for detection postpartum depression detection and management. This includes clinical accountability, risk management, and data protection.

4. Conclusion

Mobile health apps offer significant potential to improve early detection and management of detection postpartum depression. They can bridge gaps in care, improve accessibility, and provide personalized support. However, fully realizing this potential will require a multidisciplinary approach involving collaboration between researchers,

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technology developers, healthcare providers, policymakers, and, most importantly, the mothers themselves.

5. Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest

Statement of informed consent

As writers, each action we do is a mutual accord or agreement.

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