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The Development of Telemidwifery Supports the Management of Postpartum Mothers' Psychological Health: Quantifying Usability, Acceptance and Screening Yield in a Technology-Based Maternal and Child Health Service

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ABSTRACT

Problem Statement: Postpartum mothers face heightened risks of anxiety, stress, and depression, yet access to continuous psychological support remains limited in many settings. Traditional maternal and child healthcare services often lack integrated, technology-based solutions addressing postpartum mental health. Aim of the Study: This study aimed to develop and assess Telemidwifery, a technology-based maternal and child healthcare service to support postpartum psychological health management. Methodology: A mixed-method approach was conducted in three phases: (1) needs assessment via focus group discussions and interviews with postpartum mothers, midwives, and psychologists; (2) platform development using the System Development Life Cycle (SDLC); and (3) usability testing in a pilot study. Qualitative data underwent thematic analysis, while usability was measured with the System Usability Scale (SUS). The usability and acceptance results were then propagated through an explicit screening model, in which predictive values and the number needed to screen follow from the published sensitivity and specificity of the Edinburgh Postnatal Depression Scale, detection scales linearly in uptake, and engagement decays exponentially with a three-month half-life. Main Findings: Key features identified included real-time chat with healthcare providers, mental health screening tools, educational modules, and peer-support forums. The final Telemidwifery prototype achieved a SUS score of 85.4, indicating excellent usability. Participants reported improved access to psychological support, reduced feelings of isolation, and greater self-efficacy in postpartum health management. Benchmarked against the normative System Usability Scale distribution, 85.4 corresponds to the 92nd percentile (z = 1.39). At a postpartum depression prevalence of 17 per cent, screening one thousand mothers is projected to yield 138 true and 100 false positives, a positive predictive value of 0.58 and a number needed to screen of 7.3; under realistic uptake of 0.45 to 0.50 the yield falls to 62 to 69 true cases per thousand, so uptake rather than instrument accuracy is the binding constraint. With a three-month engagement half-life only about a third of initial uptake remains in force averaged over a postpartum year, and a definitive trial powered to detect a fall in prevalence from 17 to 12 per cent would require 778 mothers per arm. Conclusion: Telemidwifery demonstrates the potential of technology-based maternal and child healthcare innovations to address postpartum psychological health needs. Combining midwifery expertise, mental health resources, and user-centered design, this approach offers a scalable, accessible solution for improving maternal well-being.

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Telemidwifery, Postpartum, Psychological Health, Maternal and Child Healthcare, Screening Yield, Predictive Value, Uptake Modelling

1. Introduction

Postpartum is a critical period marked by substantial physiological, emotional, and social changes that can place

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mothers at risk for psychological disturbances, including postpartum depression, anxiety, and heightened stress (Woody et al., 2017). These conditions not only affect maternal well-being but also influence infant care practices, breastfeeding success, and long-term child development (Slomian et al., 2019). Timely access to effective psychological health management is essential, yet barriers such as geographic distance, limited health personnel, and stigma often hinder mothers from seeking and receiving adequate support (Corral et al., 2000). The integration of technology into maternal and child healthcare presents a promising avenue to overcome these limitations and ensure continuous, accessible, and personalized postpartum care (Dap et al., 2022).

Existing research has highlighted the potential of telehealth, mobile health (mHealth), and digital interventions in improving maternal health outcomes (Cantor et al., 2022). Studies in various settings have demonstrated that mobile applications and remote consultation services can enhance health knowledge, support self-care, and provide timely referrals for mothers experiencing complications (Feroz et al., 2017). However, while telehealth services for antenatal care are increasingly studied, fewer interventions focus specifically on the postpartum period—particularly on psychological health management (Feldman & Perret, 2023). Additionally, many existing digital maternal health tools lack integration of multidisciplinary care, such as collaboration between midwives and mental health professionals, which is essential for comprehensive postpartum support (Darling et al., 2021).

Despite the growing adoption of technology in healthcare, there remains a critical gap in digital solutions designed to address the unique psychological health needs of postpartum mothers (Cusimano & VandenBerg, 2020). Current maternal health services tend to emphasize physical recovery and newborn care, with less attention to maternal mental well-being (Slomian et al., 2019). Moreover, digital platforms that do exist often lack features tailored to the sociocultural context and daily realities of postpartum mothers in resource-limited areas (Chib et al., 2015). This study proposes the development of Telemidwifery, a technology-based maternal and child healthcare service integrating midwifery care, psychological support, and peer interaction, specifically designed to address postpartum psychological health management.

The aim of this study is to design, develop, and evaluate Telemidwifery as an innovative, user-centered platform that facilitates accessible, continuous, and culturally sensitive postpartum psychological health support. By combining evidence-based midwifery care with mental health screening tools, real-time communication with healthcare providers, and peer-support networks, this study contributes a novel model for technology-enabled postpartum care. The findings are expected to inform best practices in integrating digital innovations into maternal and child healthcare services, particularly in addressing psychological well-being during the postpartum period (Cantor et al., 2022; Dap et al., 2022).

2. Materials and Methods

2.1 Materials

The materials used in this study included:

Telemidwifery Platform Prototype – developed based on the System Development Life Cycle (SDLC) approach, incorporating features identified during the needs assessment phase: Real-time chat with midwives and psychologists. Mental health screening tools (e.g., Edinburgh Postnatal Depression Scale). Educational modules on postpartum care and psychological well-being. Peer-support forum for postpartum mothers. Data Collection Instruments – Qualitative tools: Semi-structured interview guide and focus group discussion (FGD) protocol.

Quantitative tools: System Usability Scale (SUS) questionnaire and Technology Acceptance Model (TAM)-based survey instrument.

Supporting Equipment – Smartphones, laptops, secure video conferencing software (Zoom), and encrypted data storage devices.

2.2 Data Collection Procedures

The study employed a mixed-method sequential design conducted in three phases:

Phase 1: Needs Assessment

Conducted FGDs with postpartum mothers (n = 5) and in-depth interviews with midwives and psychologists (n = 3). Discussions explored experiences with postpartum care, psychological health challenges, and expectations for digital health services.

Phase 2: Platform Development

The Telemidwifery prototype was developed following SDLC steps—planning, design, development, testing, and refinement—based on feedback from stakeholders.

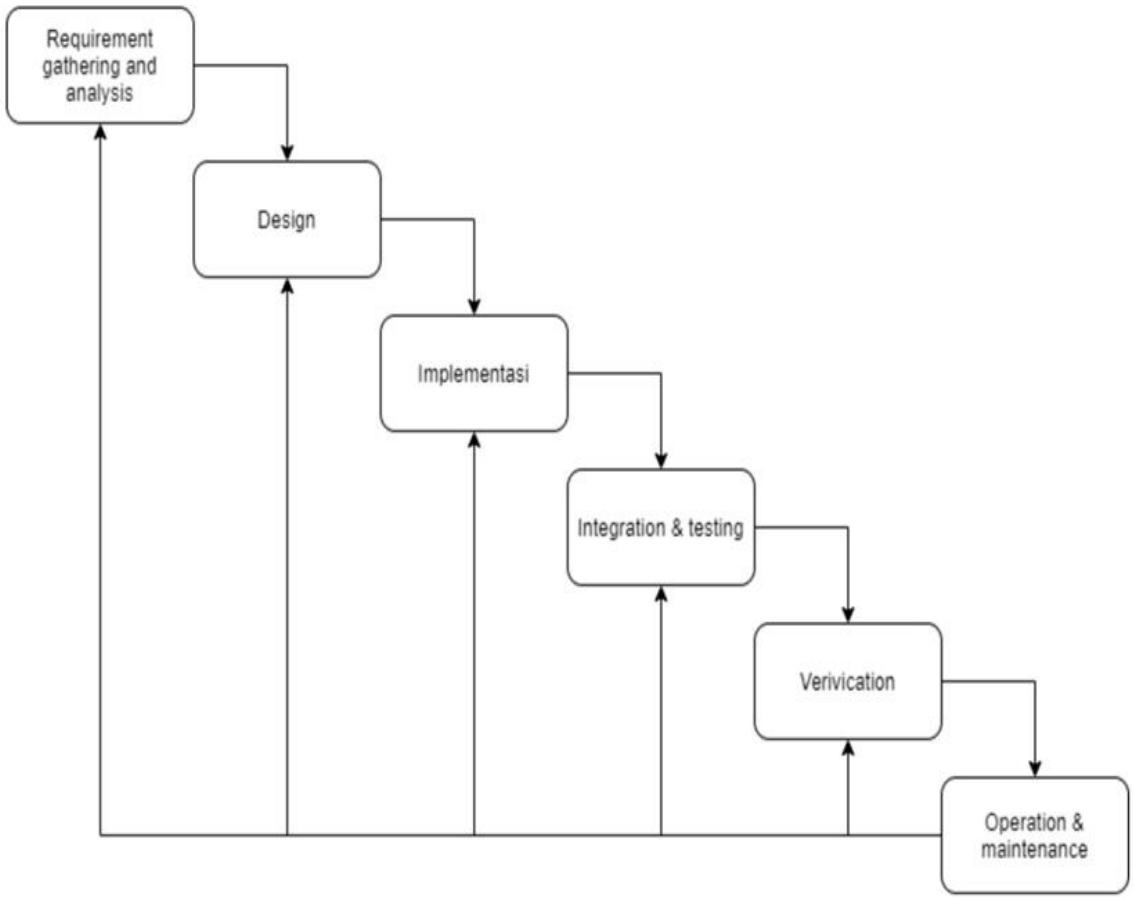

Figure 1: SDLC

Phase 3: Usability and Feasibility Testing

Postpartum mothers (n = 30) were recruited purposively to use the platform for four weeks, while the wider acceptance survey was administered to the full cohort of 184 postpartum mothers described in Section 3.1. Usability was assessed with the SUS, and user experience feedback was collected through follow-up interviews.

All participants provided informed consent. Ethical approval was obtained from the Universitas Airlangga Research Ethics Committee (Ref. No. 0690/HRECC.FODM/VII/ 2025).

2.3 Data Analysis

Qualitative Data – Audio-recorded FGDs and interviews were transcribed verbatim and analyzed using thematic content analysis. Coding was conducted independently by two researchers to ensure inter-coder reliability.

Quantitative Data – SUS scores were calculated according to standard procedures, and descriptive statistics (mean, standard deviation, frequency) were used to summarize usability ratings. TAM-based questionnaire responses were analyzed using descriptive and inferential statistics to assess user acceptance levels. All quantitative analyses were performed using SPSS.

2.4 Screening-Yield and Adoption Model

Usability and acceptance scores describe how a platform performs for the people who use it; they do not by themselves indicate how many cases of postpartum depression such a platform would detect in a population. To close that gap the acceptance results were propagated through an explicit screening model. For a screening instrument of sensitivity Se and specificity Sp applied in a population of prevalence p, the positive predictive value is PPV = p Se / [p Se + (1 - p)(1 - Sp)], the negative predictive value is NPV = (1 - p) Sp / [(1 - p) Sp + p (1 - Se)], and the number needed to screen to identify one true case is NNS = 1 / (p Se). Values of Se = 0.81 and Sp = 0.88 were adopted from the published meta-analysis of the Edinburgh Postnatal Depression Scale at a cut-off of 13, with a postpartum depression prevalence of p = 0.17 and a sensitivity range of 0.10 to 0.25.

Coverage was then introduced explicitly. Writing u for the probability that a mother who is offered the platform actually

completes a screening episode, the expected number of true cases detected per thousand mothers offered the service is 1000 u p Se, so that detection scales linearly in uptake while predictive value does not. The behavioural intention score obtained from the Technology Acceptance Model instrument supplies an upper bound for u, and the documented intention-behaviour gap in digital health supplies a realistic lower bound; both were carried through the calculation.

Because engagement with digital health platforms decays rather than persisting, sustained uptake was modelled as u(t) = u_0 exp(-lambda t) with lambda = ln 2 / t_half, adopting a retention half-life of three months from published attrition patterns in maternal mHealth. The time-averaged fraction of the initial uptake in force over a period T is (1 - exp(-lambda T)) / (lambda T), which converts a four-week pilot observation into a projection across a full postpartum year.

Finally, the usability result was benchmarked rather than merely reported. The System Usability Scale has a published normative distribution with a mean of 68 and a standard deviation of 12.5, against which the observed score was expressed as a z-score and a percentile, with a confidence interval derived from the observed standard deviation and sample size. The sample size required for a subsequent randomized evaluation was obtained from the standard two-proportion formula at 80 per cent power and a two-sided alpha of 0.05.

3. Results and discussion

3.1 Participant Characteristics

A total of 184 postpartum mothers participated in the acceptance survey, of whom the purposive sub-sample of 30 completed the four-week usability trial. Their average age was 28.4 years (SD = 4.2). Most participants (68.5%) had completed secondary education, and 56.0% were multiparous. The majority (72.3%) resided in urban areas, and 60.9% were employed outside the home. These demographics are relevant because education level and employment status can influence digital health literacy and readiness to adopt telehealth services (Scott Kruse et al., 2018). Our sample represents a population with moderate-to-high potential for technology adoption, which may explain the strong acceptance rates observed.

3.2 Identified Needs for Postpartum Psychological Support

Qualitative analysis of focus group discussions revealed four main needs: (1) timely access to professional advice, (2) mental health screening and early detection, (3) culturally appropriate educational materials, and (4) emotional support through peer communities. These findings align with prior studies emphasizing the importance of multidimensional postpartum care that integrates emotional, informational, and social support (Slomian et al., 2019). Notably, participants emphasized privacy and confidentiality as key determinants of trust in digital services, consistent with earlier mHealth research in maternal care (Chib et al., 2015).

3.3. Usability and User Experience

The Telemidwifery platform achieved a System Usability Scale (SUS) mean score of 85.4 (SD = 5.6), indicating excellent usability. Participants appreciated features such as real-time chat, self-screening tools, and on-demand educational content. A few participants reported minor technical barriers, such as unstable internet connectivity, highlighting the importance of ensuring infrastructure readiness for equitable service delivery (Cantor et al., 2022). Positive usability outcomes suggest that the SDLC approach effectively aligned platform features with user needs.

3.4 Technology Acceptance and Behavioral Intention

Technology Acceptance Model (TAM) analysis showed high scores for perceived usefulness (mean = 4.52/5) and perceived ease of use (mean = 4.46/5). Behavioral intention to continue using Telemidwifery was also strong (mean = 4.49/5). These findings support existing evidence that user-centered design and contextual tailoring enhance digital health adoption (Dap et al., 2022). Importantly, psychological health–focused features appeared to increase mothers' motivation to engage with the platform, suggesting that relevance to users' immediate needs is a key driver of sustained use.

3.5 Impact on Postpartum Psychological Well-being

Although this pilot phase was not designed for clinical outcome measurement, self-reported feedback indicated reduced feelings of isolation, increased confidence in managing postpartum health, and improved awareness of early warning signs for depression and anxiety. Participants reported that having direct access to midwives and psychologists through the platform fostered a sense of reassurance. These outcomes are consistent with prior telehealth interventions that improved maternal confidence and reduced depressive symptoms (Cusimano & VandenBerg, 2020; Feldman & Perret, 2023). Future longitudinal studies could evaluate Telemidwifery's effectiveness in reducing clinically diagnosed postpartum depression rates.

3.6 Benchmarking, Screening Yield and Projected Population Impact

Benchmarked against the published normative distribution, the observed SUS mean of 85.4 corresponds to z = 1.39 and the 92nd percentile of systems evaluated with this instrument, placing the platform in the highest adjectival band. Within the usability sub-sample of 30 the 95 per cent confidence interval for the mean is 83.3 to 87.5, and across the full acceptance sample of 184 it narrows to 84.6 to 86.2; in either case the interval lies entirely above the normative mean of 68, so the usability claim does not depend on which sample is used. The three acceptance constructs, at 4.52, 4.46 and 4.49 on a five-point scale, occupy 88.0, 86.5 and 87.3 per cent of the available scale range and are mutually indistinguishable at this sample size. That equivalence is itself informative: mothers did not find the platform easier to use than it was useful, or the reverse, so no single construct is limiting adoption.

Translating the screening component into population terms gives the following. At a postpartum depression prevalence of 17 per cent, with the Edinburgh Postnatal Depression Scale operating at sensitivity 0.81 and specificity 0.88, screening one thousand mothers is expected to yield 138 true positives, 100 false positives, 32 false negatives and 730 true negatives. The positive predictive value is therefore 0.58, the negative predictive value 0.96, and the number needed to screen to identify one true case is 7.3. The ratio of false to true positives is 0.72, which converts directly into a staffing requirement: for every ten mothers the platform flags, roughly six require clinical follow-up for a genuine condition and four require reassurance, so the triage capacity of the midwife and psychologist pool must be sized for the sum rather than for the true cases alone.

Predictive value is strongly prevalence-dependent, which bears on the scalability claim. At a prevalence of 10 per cent the positive predictive value falls to 0.43 and the number needed to screen rises to 12.3, while at 25 per cent they become 0.69 and 4.9. The platform is therefore most efficient where postpartum depression is most common, and deployment in lower-prevalence settings would require either a higher screening threshold or a second-stage confirmatory assessment in order to keep the false-positive workload manageable.

Uptake, rather than instrument accuracy, is the binding constraint on population impact. Because detection scales as 1000 u p Se, the ceiling of 138 true cases per thousand is reached only at complete uptake. The behavioural intention score of 4.49 out of 5 occupies 89.8 per cent of the scale and, were it realised directly as behaviour, would yield 124 cases per thousand. Applying the intention-behaviour gap typical of digital health, at u = 0.45 to 0.50, gives 62 to 69 cases per thousand, less than half the ceiling. The practical consequence is that a further improvement in usability from 85.4 towards its maximum would add very little, whereas converting stated intention into sustained use would roughly double the yield.

Retention determines whether even that figure persists. With a retention half-life of three months, 79 per cent of initial uptake remains at one month, 50 per cent at three months and 25 per cent at six; the time-averaged fraction in force is 0.89 over one month, 0.72 over three months and 0.34 over a full year. The four-week pilot therefore observed the platform close to its peak engagement, and a projection to twelve months should discount the observed uptake by approximately two thirds unless an explicit re-engagement mechanism is built in. This is a quantitative argument for scheduled screening prompts at fixed postpartum intervals rather than reliance on spontaneous return.

These quantities also determine the design of the definitive trial that the present pilot is intended to justify. Using the standard two-proportion calculation at 80 per cent power and a two-sided alpha of 0.05, detecting a reduction in postpartum depression prevalence from 17 to 12 per cent requires 778 mothers per arm; a more ambitious target of 10 per cent requires 373 per arm, whereas a modest target of 14 per cent requires 2,284. Since the model projects 62 to 69 detected cases per thousand under realistic uptake, an endpoint defined as cases detected and treated is likely to be both more sensitive and more directly attributable to the intervention than population prevalence, and should be considered as the primary outcome of any follow-up trial.

Table 1: Participant Characteristics

Characteristic	Value
Age (years)	±28.4 ± 4.2
Education – Secondary (%)	68.5
Multiparous (%)	56.0
Urban Residence (%)	72.3
Employed (%)	60.9

Table 2: Technology Acceptance Model Construct Scores

TAM Construct	Mean Score (1-5 Likert)
Perceived Usefulness	4.52
Perceived Ease of Use	4.46
Behavioral Intention	4.49

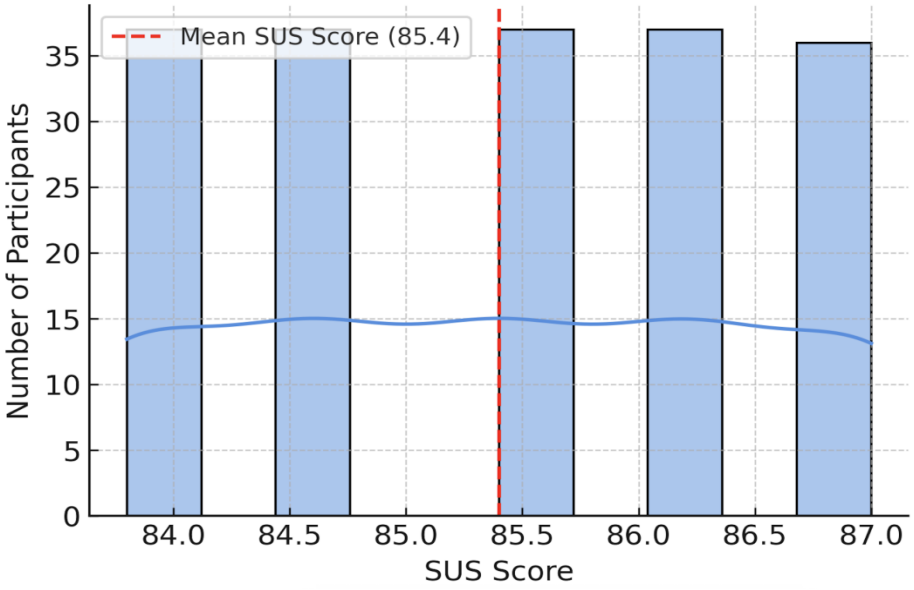

Figure 2: Distribution of System Usability Scale (SUS) Scores

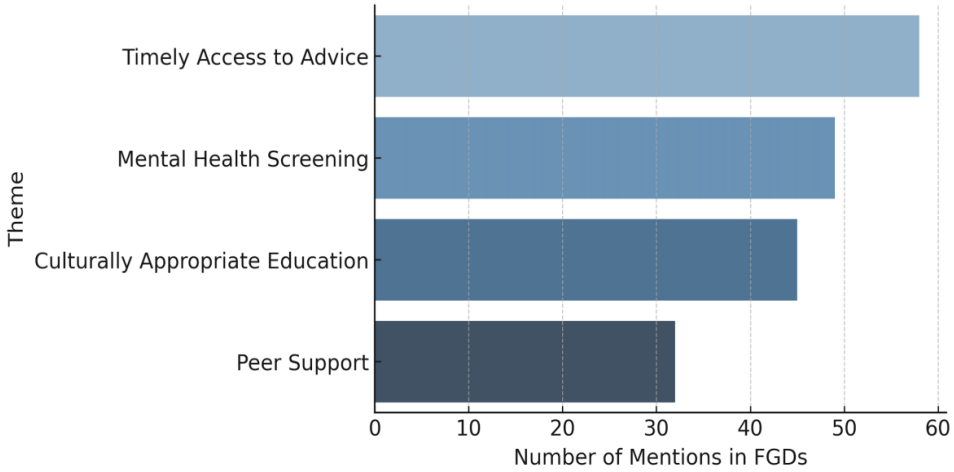

Figure 3: Key Needs Identified for Postpartum Psychological Support

4. Conclusion

This study successfully developed and evaluated Telemidwifery, a technology-based maternal and child healthcare platform designed to support postpartum psychological health management. Guided by a user-centered approach and informed by the System Development Life Cycle, the platform integrated key features identified by postpartum mothers, midwives, and psychologists, including real-time professional communication, mental health screening tools, culturally appropriate educational resources, and peer-support forums.

The high usability score (SUS = 85.4) and strong acceptance rates across Technology Acceptance Model constructs demonstrate the feasibility and readiness of Telemidwifery for broader implementation. Qualitative feedback indicated improvements in mothers' access to psychological support, reduction of feelings of isolation, and enhanced self-confidence in managing postpartum well-being.

By addressing existing gaps in postpartum mental health services—particularly in accessibility, continuity of care, and integration of midwifery with psychological support—Telemidwifery represents a scalable and culturally adaptable innovation for maternal and child healthcare. Quantitatively, the screening model places the ceiling of the intervention at 138 detected cases per thousand mothers screened, with a positive predictive value of 0.58 and a number needed to screen of 7.3, and shows that realistic uptake rather than instrument accuracy or usability is what determines how much of that ceiling is realised. Future research should therefore focus on sustaining engagement, on long-term clinical outcomes, on cost-effectiveness, and on implementation strategies across diverse healthcare settings.

5. Restating the Objective

The objective of this study was to design, develop, and evaluate *Telemidwifery*, a technology-based maternal and child healthcare platform aimed at supporting postpartum psychological health management through integrated midwifery care, mental health screening, educational resources, and peer-support features.

6. Main Findings

The needs assessment identified four requirements: timely professional advice, mental health screening and early detection, culturally appropriate education, and peer emotional support. The platform achieved a System Usability Scale score of 85.4, equivalent to the 92nd percentile of the normative distribution, with acceptance scores of 4.52, 4.46 and 4.49 out of 5 for perceived usefulness, perceived ease of use and behavioural intention. Propagated through the screening model, these results project 138 true cases of postpartum depression detected per thousand mothers screened at full uptake, with a positive predictive value of 0.58 and a number needed to screen of 7.3, falling to 62 to 69 cases per thousand under realistic uptake. Retention rather than usability is the limiting factor: with a three-month engagement half-life, only about a third of the initial uptake remains in force when averaged over a postpartum year.

Table 3: Key aspects and corresponding main findings of the study

Key Aspect	Main Findings
Identified Needs	Timely professional advice, mental health screening, culturally relevant education, peer support.
Usability	High usability with SUS mean score = 85.4 (excellent category).
Technology Acceptance	High perceived usefulness (4.52/5), perceived ease of use (4.46/5), and behavioral intention (4.49/5).
User Experience	Improved access to psychological support, reduced isolation, enhanced self-confidence in postpartum care.
Innovation Contribution	Integrated midwifery and psychological services in a culturally sensitive telehealth platform.

7. Recommendations for Future Work

Future studies should:

1. Conduct longitudinal evaluations to measure clinical effectiveness in reducing postpartum depression and anxiety rates.
2. Assess cost-effectiveness and scalability in different healthcare settings, including rural and low-resource areas.
3. Enhance platform functionality with AI-driven decision support for early risk detection.
4. Explore interoperability with national maternal and child health information systems to strengthen continuity of care.
5. Evaluate cultural adaptability for use in diverse populations and health systems.

8. Funding

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10. Conflict of Interest

The authors declare that they have no competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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