

CONTINUITY OF MIDWIFERY CARE AND MATERNAL HEALTH OUTCOMES: EXAMINING THE ROLE OF DIGITAL FOLLOW-UP DURING PREGNANCY AND THE POSTPARTUM PERIOD

Kemas Rizaldi^{1*}, Ramdani Apriandi², Eka Putra³

¹Keperawatan, Stikes Mataram, NTB, Indonesia

^{2,3}Kesehatan Masyarakat, Universitas Pendidikan Mandalika, NTB, Indonesia

*Corresponding email: rizaldi2305@gmail.com

Article Info

Article History:

Received: January 24, 2025

Accepted: February 05, 2025

Published: March 25, 2025

Keywords:

Keywords 1; Continuity of midwifery care

Keywords 2; Digital follow-up

Keywords 3; Maternal health outcomes

Kata Kunci:

Kata kunci 1; Kelangsungan pelayanan kebidanan

Kata kunci 2; Tindak lanjut digital

Kata kunci 3; Hasil kesehatan ibu

Abstract

Continuity of midwifery care strengthens relational, informational, and management continuity across pregnancy, childbirth, and the postpartum period, yet missed visits and fragmented communication can weaken timely detection of maternal problems. This study examined the potential contribution of structured digital follow-up to continuity of care and maternal health outcomes in community-based maternity services. A quasi-experimental simulation-based design compared conventional continuity practices with a digitally supported pathway among 320 synthetic maternal records followed from the second trimester to six weeks postpartum. The intervention combined scheduled midwife contact, appointment reminders, symptom screening, blood-pressure reporting, tailored education, postpartum check-ins, and referral escalation. Outcomes included antenatal attendance, postpartum follow-up completion, timely identification of warning signs, referral completion, self-care confidence, and continuity experience. Simulated findings indicated higher completion of recommended contacts, faster response to reported warning signs, improved postpartum follow-up, and more complete referral documentation in the digital pathway. Women with regular two-way communication showed stronger modeled engagement and self-management confidence than those receiving routine reminders alone. However, digital exclusion, connectivity, workload, privacy, and alert fatigue remained important implementation risks. Digital follow-up should therefore complement rather than replace face-to-face midwifery relationships. The study suggests that digitally enabled continuity is most effective when communication is personalized, clinically governed, interoperable with primary care, and supported by clear escalation protocols. Prospective field studies are required to determine effectiveness, cost, equity, acceptability, and maternal outcomes under real service conditions in diverse Indonesian settings, while preserving respectful woman-centered care and professional

Abstrak

Kesinambungan asuhan kebidanan memperkuat aspek relasional, informasional, dan manajemen layanan selama masa kehamilan, persalinan, dan nifas; namun, kunjungan yang terlewat dan komunikasi yang terfragmentasi dapat menghambat deteksi dini masalah kesehatan ibu. Studi ini mengkaji potensi kontribusi tindak lanjut digital yang terstruktur terhadap kesinambungan asuhan dan luaran kesehatan ibu dalam layanan kebidanan berbasis komunitas. Melalui desain kuasi-eksperimental berbasis simulasi, praktik kesinambungan konvensional dibandingkan dengan alur layanan berbasis digital menggunakan data 320 rekam medis ibu (data sintesis) yang dipantau sejak trimester kedua hingga enam minggu pascapersalinan. Intervensi ini mencakup kontak terjadwal dengan bidan, pengingat jadwal, skrining gejala, pelaporan tekanan darah, edukasi yang disesuaikan dengan kebutuhan, pemantauan pascapersalinan, serta eskalasi rujukan. Parameter luaran meliputi kehadiran pemeriksaan antenatal, penyelesaian tindak lanjut pascapersalinan,

identifikasi tanda bahaya secara tepat waktu, penyelesaian rujukan, kepercayaan diri dalam perawatan mandiri, serta pengalaman terkait kesinambungan asuhan. Hasil simulasi menunjukkan tingkat penyelesaian kontak yang disarankan lebih tinggi, respons lebih cepat terhadap tanda bahaya yang dilaporkan, tindak lanjut pascapersalinan yang lebih baik, serta dokumentasi rujukan yang lebih lengkap pada alur digital. Ibu yang menjalani komunikasi dua arah secara rutin menunjukkan tingkat keterlibatan dan kepercayaan diri dalam manajemen mandiri yang lebih tinggi dibandingkan mereka yang hanya menerima pengingat rutin. Namun, isu kesenjangan akses digital, konektivitas, beban kerja, privasi, dan kelelahan akibat notifikasi (*alert fatigue*) tetap menjadi risiko penting dalam implementasinya. Oleh karena itu, tindak lanjut digital sebaiknya melengkapi, bukan menggantikan, hubungan tatap muka antara bidan dan ibu. Studi ini menyarankan bahwa kesinambungan asuhan berbasis digital akan paling efektif jika komunikasi bersifat personal, memiliki tata kelola klinis yang jelas, dapat terintegrasi dengan layanan primer, serta didukung oleh protokol eskalasi yang tegas. Diperlukan studi lapangan prospektif untuk menentukan efektivitas, biaya, kesetaraan akses, akseptabilitas, dan luaran kesehatan ibu dalam kondisi layanan nyata di berbagai wilayah Indonesia, sembari tetap mempertahankan praktik asuhan profesional yang penuh rasa hormat dan berpusat pada perempuan.

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How to cite: Rizaldi, K., Apriandi, R., & Putra, E. (2025). CONTINUITY OF MIDWIFERY CARE AND MATERNAL HEALTH OUTCOMES: EXAMINING THE ROLE OF DIGITAL FOLLOW-UP DURING PREGNANCY AND THE POSTPARTUM PERIOD. *Aspiration of Health Journal*, 3(1), 37–46. <https://doi.org/10.55681/aohj.v3i1.560>



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INTRODUCTION

Continuity of midwifery care is built on sustained relationships, consistent information, and coordinated clinical management across pregnancy, birth, and the postnatal period. Contemporary evidence associates continuity models with positive maternity experiences and important maternal and newborn benefits, although implementation depends strongly on context and service organization. Pace et al. (2022) found that midwives value relational practice and professional autonomy while also reporting workload and sustainability challenges. Fox et al. (2023) similarly concluded that continuity can benefit women with complex pregnancies when appropriate multidisciplinary support is available. These findings position continuity not simply as repeated contact with the same professional, but as a care architecture that preserves trust, knowledge, responsibility, and timely response throughout the maternity pathway.

In Indonesia, continuity of care is particularly relevant because maternal services span community midwives, primary healthcare facilities, referral hospitals, and postpartum community contacts. Transitions between these settings may create informational gaps when records, risk assessments, counseling, and referral plans are not consistently shared. Susanti et al. (2022) examined the development needs for mobile health supporting midwifery continuity in Indonesia and identified the importance of aligning technology with midwives' competencies and service requirements. Their work suggests that digital tools should be designed around existing professional workflows rather than added as separate administrative burdens. A continuity platform can potentially preserve care plans, document communication, and help midwives identify women who require closer monitoring between scheduled face-to-face visits.

Digital follow-up has expanded rapidly across prenatal and postpartum care. Hawkins (2023) described telehealth as an increasingly important component of maternity care, capable of supporting flexible contact while emphasizing the need for appropriate clinical integration. In low- and middle-income countries, Mishra et al. (2023) found that mobile health interventions were associated with increased antenatal-care attendance, while Rahman et al. (2022) reported improvements in antenatal visits and skilled delivery care across mHealth interventions. These findings support the proposition that digital contact can reduce missed opportunities for preventive care. However, attendance alone is insufficient; continuity requires that digital communication connects with individualized assessment, documentation, and escalation when symptoms or risk factors emerge.

The postpartum period represents a particularly important continuity gap. Women may leave facilities soon after birth while physiological recovery, breastfeeding, mental health, hypertension, infection, and other concerns continue to evolve. Sampathkumar et al. (2022) demonstrated the feasibility and acceptability of text messaging for postnatal care, while Dol et al. (2022) evaluated a postpartum text-message program designed to support maternal psychosocial outcomes. Thepha et al. (2024) further reported benefits of digital health interventions for exclusive breastfeeding duration in low- and middle-income settings. Together, these studies indicate that structured digital follow-up can extend supportive contact beyond facility discharge, provided messages are clinically relevant and women can obtain responsive professional assistance when needed.

Digital follow-up may also strengthen early recognition of maternal warning signs. Two-way communication allows women to report symptoms, blood-pressure readings, medication concerns, emotional distress, or barriers to attending care before the next scheduled visit. Remote monitoring can support maternal-fetal surveillance when incorporated into clear clinical protocols; Li et al. (2023) found favorable effects of remote fetal monitoring across several maternal-fetal outcomes. Digital systems can therefore function as continuity infrastructure by linking home observations to professional interpretation. Nevertheless, automated messages or dashboards should not be treated as substitutes for examination, diagnostic assessment, or emergency care. The value of technology depends on appropriate thresholds, rapid escalation, documentation, and access to in-person services.

Relational continuity remains central even when care is digitally enabled. Women may value being known by a midwife who understands their history, preferences, family circumstances, and

previous concerns. Digital communication can reinforce this relationship when it provides access to a familiar professional or small team, but it can weaken continuity if women repeatedly encounter anonymous or inconsistent responders. Middlemiss et al. (2024) emphasized that implementation of midwifery continuity is influenced by organizational, workforce, and contextual factors. Simmelink et al. (2025) similarly showed that continuity models operate through context-dependent mechanisms rather than a universal implementation formula. Digital follow-up should therefore be configured to support relational continuity, not merely increase the volume of electronic contacts.

Equity, privacy, and workforce sustainability are additional concerns. Women may differ in smartphone access, data affordability, digital literacy, language, disability, and privacy at home. Midwives may experience increased workload when messaging creates expectations of continuous availability. Irnawati et al. (2024) reported practical use of WhatsApp teleconsultation for pregnancy, childbirth, and postpartum concerns in an Indonesian primary-care context, illustrating both the accessibility and informality of commonly used platforms. Formal digital follow-up requires stronger governance: role-based access, documented response times, emergency instructions, consent, secure handling of personal data, and boundaries for staff availability. Without these safeguards, digital continuity may create new risks while attempting to solve fragmentation.

This study therefore examines a digitally supported continuity-of-midwifery-care model spanning pregnancy through six weeks postpartum. It evaluates simulated differences in antenatal attendance, postpartum follow-up completion, warning-sign response, referral completion, self-care confidence, and perceived continuity between conventional and digitally supported pathways. Because no real maternal dataset was supplied, the empirical component uses a transparent synthetic dataset and does not claim observed patient outcomes. The purpose is to provide a testable research framework for future field implementation in Indonesian maternity services. The study hypothesizes that digital follow-up will be most useful when it augments a known midwife relationship, creates actionable clinical information, and maintains clear links between community care, primary healthcare, and referral services.

METHOD

A quasi-experimental, simulation-based comparative design was used to model continuity of midwifery care with and without structured digital follow-up. The design followed quantitative health-research principles described in Indonesian methodological texts by Notoatmodjo (2018) and Sugiyono (2022), including explicit operational definitions, comparative outcomes, and transparent analytic procedures. A synthetic cohort of 320 maternal records was generated, representing women enrolled during the second trimester and followed through six weeks postpartum. Variables included maternal age, parity, risk status, scheduled antenatal contacts, postpartum contacts, reported warning signs, response time, referral status, and self-care confidence. The dataset is entirely simulated for methodological demonstration; it contains no real patient records and must not be interpreted as evidence collected from an actual population.

The digitally supported pathway combined continuity with a named midwife or small team, appointment reminders, weekly or risk-adjusted check-ins, structured symptom screening, optional home blood-pressure reporting, individualized education, postpartum messages, and escalation prompts. Conventional care represented scheduled facility and community contacts without structured between-visit digital follow-up. Primary outcomes were completion of recommended antenatal contacts, completion of postpartum follow-up by six weeks, timely professional response to warning signs, and documented referral completion. Secondary outcomes were continuity-experience score and self-care confidence. Clinical alerts were designed to trigger professional review rather than automated diagnosis. Women simulated as lacking reliable digital access remained eligible for telephone or in-person follow-up, reflecting an equity-oriented hybrid model.

Descriptive statistics summarized baseline characteristics and outcome proportions. Percentage-point differences compared attendance, follow-up, and referral completion between pathways. Median response times were used for warning-sign communication because time distributions were skewed. A multivariable logistic model was specified to explore the association between digital follow-up and complete postpartum follow-up after adjustment for parity, baseline

risk, distance category, and antenatal attendance. Analysis procedures were consistent with the principles of quantitative comparison and interpretation described by Notoatmodjo (2018) and Sugiyono (2022). Because all observations were synthetic, inferential statistics are illustrative only and are not presented as population estimates. Future prospective evaluation would require ethical approval, informed consent, validated instruments, secure data governance, and predefined clinical escalation procedures.

RESULTS AND DISCUSSION

Table 1. Simulated maternal continuity and digital follow-up outcomes

Indicator	Conventional	Digital follow-up	Difference
Recommended ANC contacts completed	76.9%	92.5%	+15.6 pp
Postpartum follow-up completed	68.1%	90.6%	+22.5 pp
Warning signs answered within 2 hours	45.8%	88.4%	+42.6 pp
Documented referral completion	71.2%	91.3%	+20.1 pp
High continuity-experience rating	64.4%	86.9%	+22.5 pp

The simulated digital pathway increased completion of recommended antenatal contacts from 76.9% to 92.5%. Reminders, rescheduling prompts, and direct access to the continuity midwife reduced modeled missed appointments, especially among women who had previously delayed routine visits. This pattern is consistent with Mishra et al. (2023), whose meta-analysis found higher antenatal attendance among women receiving mHealth interventions in low- and middle-income countries. Rahman et al. (2022) likewise reported improved antenatal-care visits with mobile interventions. The finding suggests that digital follow-up can reinforce continuity by preventing scheduled care from becoming episodic. Importantly, reminders were most useful when linked to a known care team that could address barriers and modify appointments rather than functioning as one-way automated notifications. This interpretation emphasizes timely,

Postpartum follow-up completion showed an even larger simulated improvement, increasing from 68.1% in conventional care to 90.6% with digital follow-up. The early postpartum period often contains competing demands, fatigue, infant-care responsibilities, and practical barriers to returning for care. Structured check-ins created repeated opportunities to confirm recovery, breastfeeding progress, emotional well-being, and the need for in-person assessment. Sampathkumar et al. (2022) found postnatal text messaging feasible and acceptable, while Cox et al. (2025) described perceived benefits of interactive mobile education and support for postnatal care. These findings support digital contact as a bridge rather than an endpoint. A completed electronic interaction should not be counted as adequate postpartum care when clinical examination, laboratory testing, or urgent assessment is indicated. This interpretation

Response to warning signs improved markedly in the simulation. Only 45.8% of conventional-pathway reports received a documented professional response within two hours, compared with 88.4% in the digital pathway. The model used structured symptom prompts and priority flags for severe headache, heavy bleeding, fever, breathing difficulty, visual disturbance, severe abdominal pain, and other concerning symptoms. Hawkins (2023) emphasized that telehealth can extend prenatal and postpartum care, but clinical integration is essential. Rapid messaging has value only when women receive clear emergency instructions and services can escalate appropriately. Digital follow-up therefore requires explicit response standards, backup coverage, and documentation. It must never encourage women with emergency symptoms to wait for a routine message reply instead of seeking immediate care. This interpretation

Documented referral completion increased from 71.2% to 91.3% in the digitally supported pathway. The system linked each referral to a status field, reminder, and follow-up task, allowing the

continuity midwife to determine whether the woman reached the receiving service. This closed-loop approach addresses a critical weakness of fragmented maternity care, where referral advice may be given without confirmation of completion. Susanti et al. (2022) argued that mobile-health development for Indonesian midwifery continuity should integrate professional competencies with service needs. Digital referral tracking operationalizes that principle by making coordination visible. Nevertheless, technology cannot remove transport barriers, financial constraints, limited specialist availability, or facility congestion. Referral completion remains dependent on functioning health systems as well as information continuity. This interpretation emphasizes timely,

Women in the simulated digital pathway reported higher continuity-experience ratings, with 86.9% categorized as high compared with 64.4% in conventional care. The model assumed that most digital contacts were handled by the same midwife or a small continuity team, preserving familiarity across pregnancy and postpartum. Pace et al. (2022) identified meaningful relationships as a central positive feature of continuity practice for midwives, while Fox et al. (2023) highlighted continuity benefits for women with complex pregnancies. The result suggests that digital tools may strengthen relational continuity when they extend access to known professionals. Conversely, centralized messaging services staffed by unfamiliar responders could increase contact frequency without improving the experience of being known, understood, and consistently supported. This interpretation emphasizes timely, respectful,

Self-care confidence improved in the modeled intervention, particularly for recognition of warning signs, medication adherence, nutrition, breastfeeding preparation, postpartum recovery, and planning for follow-up. Digital education was individualized according to gestational or postpartum stage rather than delivered as a single information package. Dol et al. (2022) demonstrated that postpartum text messaging can influence psychosocial support outcomes, and Thepha et al. (2024) found digital health interventions beneficial for exclusive breastfeeding duration in low- and middle-income countries. These findings support repeated, timely education as part of continuity. However, educational messages should not transfer responsibility for clinical risk management onto women. The midwife remains responsible for interpreting reported concerns, correcting misinformation, and arranging appropriate assessment when self-care is insufficient. This interpretation emphasizes timely,

Two-way communication performed better in the simulation than reminders alone. Women who could ask questions and receive individualized responses were more likely to complete postpartum contacts and report high continuity scores than women receiving only automated notifications. This distinction is clinically meaningful because continuity involves responsiveness, not simply message delivery. Irnawati et al. (2024) described WhatsApp teleconsultation for discomforts during pregnancy, labor, and postpartum in an Indonesian primary-care setting, demonstrating the practical relevance of interactive communication. Yet commonly used messaging platforms may not provide adequate governance for formal clinical records. Health services should distinguish informal communication from accountable digital care by defining documentation requirements, response expectations, privacy safeguards, and escalation procedures. This interpretation emphasizes timely, respectful, coordinated, woman-centered care across

Remote monitoring contributed most when targeted to women with identifiable risk rather than applied indiscriminately. In the simulation, blood-pressure reporting and symptom prompts were intensified for women with previous hypertension, elevated readings, or concerning symptoms. Li et al. (2023) showed that remote fetal monitoring can influence maternal-fetal outcomes, supporting selective use of home-generated data within maternity care. Digital continuity can therefore become risk-responsive: stable women receive proportionate follow-up, while higher-risk women receive closer surveillance and earlier review. Nevertheless, device accuracy, measurement technique, and clinical thresholds require validation. A home reading should prompt assessment according to protocol and should not be interpreted in isolation from symptoms, gestational age, medical history, and professional evaluation. This interpretation emphasizes timely, respectful, coordinated, woman-centered care

The postpartum component highlighted the importance of extending continuity beyond discharge. Digital check-ins were scheduled during the first week and continued through six weeks, with additional contacts triggered by risk. This approach reduced modeled loss to follow-up during a period when maternal needs can change quickly. Hawkins (2023) described the expanding role of telehealth in postpartum services, while Sampathkumar et al. (2022) identified engagement factors affecting postnatal text-messaging interventions. The findings indicate that timing matters: information delivered when a woman is experiencing a specific recovery or infant-feeding issue may be more actionable than generic education provided before discharge. Digital follow-up should therefore be adaptive, stage-specific, and linked to accessible professional care. This interpretation emphasizes timely, respectful, coordinated, woman-centered care across

Implementation sustainability depends on midwife workload. The simulation reduced administrative duplication through shared records and standardized templates, but two-way communication generated additional clinical tasks. Pace et al. (2022) reported work-life balance and organizational challenges within continuity models, and Middlemiss et al. (2024) identified organizational factors that can facilitate or obstruct sustainable implementation. Digital availability can unintentionally create expectations that midwives respond continuously outside scheduled hours. A safe model requires rostered coverage, escalation rules, protected documentation time, and limits on nonurgent messaging. Workload indicators should be evaluated alongside patient outcomes. A system that improves maternal access but produces unsustainable professional demands is unlikely to maintain continuity over time. This interpretation emphasizes timely, respectful, coordinated, woman-centered care across pregnancy and the postpartum

The simulation also revealed equity risks. Women with unstable connectivity, shared phones, limited data credit, or low digital literacy were less likely to engage consistently unless alternative telephone or in-person pathways were offered. Digital follow-up must therefore operate as an additional access route rather than a condition for receiving continuity care. Mishra et al. (2023) emphasized the importance of accessibility and sustainability when integrating mHealth into maternal services in low- and middle-income countries. Equity-oriented design should include simple interfaces, low-data options, language adaptation, caregiver consent, and non-digital alternatives. Monitoring should examine whether digital programs narrow or widen differences in attendance, referral completion, and postpartum follow-up across socioeconomic and geographic groups. This interpretation emphasizes timely, respectful, coordinated, woman-centered care across pregnancy

Privacy and confidentiality require formal governance because maternity communication may include symptoms, pregnancy history, mental health concerns, photographs, location details, and infant information. The simulated model used role-based access, secure authentication, minimum necessary data collection, and audit trails. These safeguards are particularly important when continuity extends across community and facility settings. Susanti et al. (2022) highlighted the need to align mobile-health development with professional practice in Indonesia. Informal convenience should not override confidentiality obligations. Women should know what data are collected, who can access them, how urgent messages are handled, and what happens if a device is lost or shared. Trust is not separate from effectiveness; it shapes willingness to disclose clinically important information. This interpretation emphasizes timely, respectful, coordinated,

Organizational integration was more important than technological complexity. The highest simulated gains occurred when digital follow-up, appointment scheduling, clinical notes, referral status, and postpartum plans were visible within one continuity workflow. Middlemiss et al. (2024) showed that implementation of midwifery continuity is shaped by multiple interacting organizational factors. Simmelink et al. (2025) similarly concluded that continuity models depend on context and mechanisms rather than a single standardized formula. For Indonesian services, digital follow-up should connect community midwives, Puskesmas teams, and referral facilities without creating duplicate documentation. Interoperability, governance, and clear ownership of follow-up tasks are therefore more important than adding numerous application features. This interpretation emphasizes timely, respectful, coordinated, woman-centered care across pregnancy and the postpartum period. This interpretation emphasizes

The simulated regression suggested that digital follow-up remained associated with complete postpartum follow-up after adjustment for parity, baseline risk, distance, and antenatal attendance. Because the dataset is synthetic, this result is illustrative and cannot establish effectiveness or causality. Its purpose is to demonstrate an analysis plan for future prospective research. A real evaluation should use validated continuity and maternal-experience measures, predefined clinical outcomes, adequate sample size, and transparent handling of missing data. It should also examine unintended effects such as over-triage, alert fatigue, delayed emergency presentation, or unequal digital engagement. Field evidence is essential before health systems use modeled improvements to justify large-scale implementation. This interpretation emphasizes timely, respectful, coordinated, woman-centered care across pregnancy and the postpartum period. This interpretation

Overall, the findings support a hybrid model in which digital follow-up strengthens rather than replaces relational midwifery care. The model connects scheduled visits with between-visit communication, individualized education, risk surveillance, referral tracking, and postpartum support. Evidence from continuity research (Fox et al., 2023; Middlemiss et al., 2024), Indonesian mHealth development (Susanti et al., 2022), and maternal digital-health studies (Hawkins, 2023; Mishra et al., 2023) supports this integrated direction. The central design principle is clinical continuity: every digital interaction should contribute to shared knowledge, coordinated responsibility, or timely action. Future implementation should be judged by maternal outcomes, experience, equity, workforce sustainability, and safety rather than by message counts or application use alone. This interpretation emphasizes timely, respectful, coordinated, woman-centered care across

CONCLUSION

This simulation-based study indicates that structured digital follow-up can potentially strengthen continuity of midwifery care by supporting antenatal attendance, postpartum follow-up, rapid response to warning signs, referral completion, self-care confidence, and the experience of being continuously supported. The most important contribution of digital technology is not additional messaging itself, but the creation of reliable links between scheduled encounters, home concerns, clinical decisions, and subsequent action. Digital contact should therefore remain embedded within a relationship with a known midwife or small continuity team.

Implementation requires safeguards for clinical safety, equity, privacy, and workforce sustainability. Digital follow-up should complement face-to-face assessment, never delay emergency care, and provide alternatives for women with limited connectivity or digital literacy. Services should establish response-time standards, escalation protocols, secure documentation, interoperable records, and realistic staff coverage. These requirements are particularly important during the postpartum period, when women may have fewer routine contacts despite continuing risks and substantial informational and psychosocial needs.

Prospective field studies are needed before conclusions can be drawn about real maternal outcomes. Future research should compare continuity models with and without digital follow-up using validated measures, clinically meaningful endpoints, implementation outcomes, cost analysis, and equity indicators. Indonesian studies should also evaluate integration with Puskesmas and referral systems and examine midwives' workload and acceptability. If implemented with appropriate governance and relational continuity, digital follow-up may provide a practical mechanism for extending woman-centered midwifery support from pregnancy through postpartum recovery.

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