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Review Article

Maternal Decision-Making Around Digital Birth Preparedness in Resource-Limited Settings: A Narrative Review

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ABSTRACT

Background: Digital birth preparedness is increasingly promoted to improve maternal knowledge, antenatal engagement, and complication readiness in resource-limited settings, yet its influence on maternal decision-making depends on autonomy, household negotiation, phone access, privacy, trust, and health-system responsiveness. Objective: This narrative review synthesized recent evidence on how digital birth-preparedness interventions influence maternal decision-making, care-seeking, equity, privacy, and implementation in low-resource contexts. Methods: Literature published between January 2016 and May 2026 was reviewed from PubMed/MEDLINE, Scopus, Google Scholar, and institutional sources including the World Health Organization, UNFPA, UNICEF, International Telecommunication Union, GSMA, and the World Bank. Evidence from systematic reviews, intervention studies, qualitative research, implementation evaluations, and policy reports was synthesized thematically. Results: Digital interventions, including SMS reminders, voice messages, helplines, mobile applications, community health worker tools, electronic registers, and digital referral systems, can improve maternal knowledge, appointment recall, antenatal contact, and selected service-use behaviours. However, evidence is stronger for intermediate outcomes than for emergency referral completion, maternal mortality reduction, or sustained decision agency. Their impact is moderated by women's control over phones, literacy, language, household authority, transport, cost, perceived quality of care, privacy safeguards, and facility readiness. Conclusion: Digital birth preparedness should be understood as health-system-integrated decision support rather than a stand-alone messaging strategy. Programmes are most likely to improve maternal decision-making when they combine timely information with community health worker support, respectful maternity care, emergency referral capacity, equity-sensitive design, and privacy-protective governance. Keywords: Digital Birth Preparedness; Maternal Decision-Making; mHealth; Birth Preparedness and Complication Readiness; Antenatal Care; Skilled Birth Attendance; Emergency Obstetric Referral; Resource-Limited Settings.

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INTRODUCTION

Maternal mortality and severe maternal morbidity remain concentrated in settings where access to skilled care, emergency transport, blood products, referral coordination, respectful maternity care, and financial protection is uneven or fragile (1). Global maternal and newborn health guidance has consistently emphasized antenatal care, skilled birth attendance, timely intrapartum management, postnatal follow-up, and strengthened midwifery capacity as essential components of safer maternity systems (2). Within this agenda, birth preparedness and complication readiness has been promoted as a practical strategy to help women and families identify a preferred place of birth, recognize danger signs,

save money, arrange transport, select a birth companion, and seek emergency care without avoidable delay. However, in resource-limited settings, these decisions are rarely made by women alone or at a single point in time. They are shaped by household authority, gender norms, family bargaining power, community expectations, transport availability, perceived quality of care, previous experiences with health facilities, and the responsiveness of the referral system.

Digital health has increasingly entered this field with the promise of improving maternal knowledge, strengthening continuity of antenatal care, supporting timely reminders, and linking pregnant women with community or facility-based services (3). Short message service reminders, interactive voice response systems, toll-free helplines, mobile applications, WhatsApp-based counselling, community health worker decision-support tools, electronic pregnancy registers, facility dashboards, and digital referral systems are now used or proposed as mechanisms to support birth preparedness. These tools are attractive because mobile communication can be repeated, timed to gestational stage, adapted to language, and integrated with service follow-up. Nevertheless, the same settings in which digital birth-preparedness interventions appear most useful are also settings where women may not own private phones, may share devices with husbands or relatives, may have limited literacy or digital confidence, may lack independent control over money or transport, and may require permission or support from household decision-makers before seeking care.

For this reason, digital birth preparedness should not be interpreted merely as the delivery of information to pregnant women. A message advising a woman to save money for childbirth does not ensure that she controls household finances. A reminder to attend antenatal care does not remove distance, user costs, opportunity costs, or disrespectful treatment at facilities. A danger-sign alert does not guarantee transport, referral acceptance, emergency obstetric capacity, or timely clinical response. Similarly, a technically successful digital programme may widen inequity if it preferentially reaches women who already have personal phones, literacy, network access, supportive households, and proximity to functioning health services. The central question is therefore not only whether digital interventions improve knowledge or appointment attendance, but whether they meaningfully strengthen maternal decision-making, negotiation capacity, privacy, trust, and timely access to responsive care.

Maternal decision-making around birth preparedness is best understood as a layered and relational process. At the individual level, women interpret symptoms, assess risk, evaluate the credibility of information, and form preferences about antenatal care and place of birth. At the household and community level, these preferences are negotiated with partners, mothers-in-law, elders, community health workers, traditional birth attendants, and local social networks. At the health-system level, choices are constrained or enabled by transport, cost, staff availability, quality of care, referral efficiency, emergency obstetric readiness, and women's expectations of respectful treatment. Digital tools enter this process as decision-support resources, but their effect depends on whether information can be converted into feasible, safe, and trusted action.

A critical review of digital birth preparedness is therefore needed because much of the implementation discourse remains overly optimistic about technology while giving insufficient attention to autonomy, gendered phone access, confidentiality, cultural fit, health-system readiness, and equity. Existing evidence suggests that mHealth interventions can improve maternal knowledge, reminders, antenatal contact, and some service-use behaviours, but the evidence is less conclusive for emergency referral completion, maternal mortality reduction, sustained decision agency, or reduction of inequities among women with the least access to digital resources. This narrative review synthesizes recent evidence on how digital birth-preparedness interventions influence maternal decision-making in resource-limited settings, with particular attention to autonomy, household negotiation, equity, trust, privacy, and implementation within maternal health systems.

MATERIAL AND METHODS

This narrative review was designed as a thematic and interpretive synthesis of recent literature on digital birth preparedness and maternal decision-making in resource-limited settings. A narrative approach was selected because the review question required integration of heterogeneous evidence from global policy documents, implementation reports, systematic reviews, randomized trials, observational studies, qualitative research, and programme evaluations rather than estimation of a pooled intervention effect. The review was guided by principles relevant to high-quality narrative synthesis, including clear scope definition, transparent literature selection, thematic organization, critical interpretation of evidence, and explicit acknowledgment of the limitations inherent in non-systematic review methods.

The scope of the review was defined around pregnant and postpartum women in resource-limited and low- and middle-income settings, with emphasis on how digital birth-preparedness interventions influence maternal knowledge, autonomy, household negotiation, care-seeking, referral readiness, privacy, equity, and interaction with health systems. Digital birth-preparedness interventions were considered broadly and included short message service reminders, interactive voice response, voice calls, helplines, mobile applications, WhatsApp or chatbot-based counselling, community health worker digital tools, electronic pregnancy registers, digital referral systems, dashboards, and other digital decision-support mechanisms used during pregnancy, childbirth preparation, emergency complication readiness, or early postnatal care.

Literature was searched using PubMed/MEDLINE, Scopus, and Google Scholar, supplemented by relevant institutional and technical documents from the World Health Organization, United Nations Population Fund, UNICEF, International Telecommunication Union, GSMA, the World Bank, and other major organizations involved in maternal health, digital health, and health-system strengthening (4–10). The search covered sources published from January 2016 to May 2026 to capture the most recent decade of evidence and policy development in digital maternal health.

Search terms were applied flexibly and included combinations of "digital birth preparedness," "birth preparedness and complication readiness," "BPCR," "mHealth," "mobile health," "SMS pregnancy," "interactive voice response," "maternal helpline," "digital referral," "community health worker digital tool," "antenatal care," "skilled birth attendance," "emergency obstetric referral," "maternal decision-making," "maternal autonomy," "digital health equity," "phone ownership," "privacy," "respectful maternity care," "low- and middle-income countries," and "resource-limited settings."

Sources were considered eligible when they addressed digital or mobile health interventions related to pregnancy, antenatal care, birth preparedness, complication readiness, emergency referral, maternal health communication, or maternal decision-making in low-resource contexts. Eligible evidence included global guidelines, systematic reviews, scoping reviews, randomized and non-randomized intervention studies, cohort and cross-sectional studies, qualitative studies, mixed-methods studies, programme evaluations, and implementation reports. Sources were prioritized when they provided information on maternal autonomy, household decision-making, equity, gendered access to phones, literacy, language, confidentiality, trust, respectful care, transport, referral systems, health-service use, or implementation within maternal health systems. Purely technical reports that described digital platforms without relevance to maternal decision-making, birth preparedness, health-system linkage, or equity were not prioritized.

The selection process was interpretive rather than formally systematic. Titles, abstracts, executive summaries, and full texts were reviewed for relevance to the conceptual focus of the review. Evidence was organized according to recurring themes identified during reading, including digital information

as a decision resource, modality-specific evidence, household negotiation and gendered phone access, trust and cultural fit, respectful maternity care, digital exclusion, privacy and data governance, referral readiness, and implementation implications. Greater interpretive weight was given to recent systematic reviews, large-scale programme evaluations, global guidance documents, and studies directly addressing maternal health decision-making or digital maternal health implementation. Where evidence was drawn from programme reports or observational studies, claims were interpreted cautiously and distinguished from stronger evidence derived from systematic reviews or controlled evaluations.

Because this was a narrative review, duplicate independent screening, PRISMA flow documentation, formal risk-of-bias assessment, certainty-of-evidence grading, quantitative pooling, heterogeneity testing, publication-bias assessment, and meta-analysis were not undertaken. These procedures were not required for the chosen review type because the objective was to develop a critical conceptual synthesis rather than to estimate pooled effectiveness. However, the absence of formal screening and quality appraisal was recognized as a methodological limitation, particularly because narrative reviews may be vulnerable to selection bias, uneven weighting of evidence, and incomplete retrieval of relevant studies. To reduce this limitation, the review incorporated multiple types of evidence, prioritized recent and widely cited sources, included both intervention and implementation perspectives, and interpreted digital health effects in relation to social, gendered, ethical, and health-system constraints.

The synthesis was conducted thematically. Findings were first grouped according to the role of digital tools in birth preparedness, including information delivery, reminder systems, interactive counselling, community health worker support, electronic referral, and programme monitoring. These categories were then interpreted through decision-making domains relevant to resource-limited settings, including recognition of danger signs, financial and transport planning, place-of-birth selection, household negotiation, confidentiality, trust in health services, and ability to act on received information. The final synthesis integrated these themes into a conceptual pathway linking digital access and exposure, understanding and trust, negotiation and planning, system activation, and care-seeking outcomes, while recognizing that autonomy, equity, privacy, household power, and health-system quality moderate each stage of the pathway.

CONCEPTUALIZING DIGITAL BIRTH PREPAREDNESS

Digital birth preparedness can be defined as the use of digital communication, documentation, decision-support, and referral technologies to assist women, families, community health workers, and health-care providers in planning for pregnancy, childbirth, obstetric complications, and the early postnatal period [7]. It includes direct-to-woman approaches such as short message service reminders, voice messages, WhatsApp groups, chatbots, mobile applications, and helplines, as well as provider- or system-facing approaches such as community health worker applications, electronic pregnancy registers, referral dashboards, and clinical decision-support algorithms. However, the central purpose of digital birth preparedness is not merely to deliver information. Its value depends on whether digital contact can be translated into practical, timely, safe, and trusted action.

Maternal decision-making around birth preparedness is best understood as a multi-layered process. At the individual level, women interpret symptoms, assess perceived risk, judge the credibility of information, and develop preferences regarding antenatal care, place of birth, transport, companionship, and emergency care-seeking. At the interpersonal level, these preferences are negotiated with husbands, mothers-in-law, family elders, community health workers, traditional birth attendants, and health-care providers [8]. At the health-system level, women's choices are constrained or enabled by transport availability, cost of care, facility quality, referral efficiency, blood and surgical capacity, respectful maternity care, and previous experiences of supportive or mistreatment-based care [9]. Digital tools therefore enter this process as decision-support resources, but they do not automatically change who controls money, transport, permission, phones, or access to emergency services.

This distinction is important because many digital maternal and child health programmes are evaluated primarily through message delivery, message recall, antenatal attendance, or facility-delivery indicators [10]. Although these indicators are useful, they do not fully capture whether women have gained meaningful decision-making power or whether they can act safely on received information. A woman may receive BPCR messages and understand danger signs, yet remain unable to travel because she lacks money, permission, transport, or confidence in facility care. Conversely, a digital message may be effective not because it independently changes individual behaviour, but because it helps a woman persuade a household decision-maker, contact a community health worker, request referral support, or justify facility-based care. The relevant mechanism is therefore not limited to individual behaviour change; it also includes relational negotiation, household planning, and health-system activation.

Table 1. Domains of Digital Birth Preparedness and Implications for Maternal Decision-Making

Domain	Digital Support	Decision Interface	Critical Caveat in Resource-Limited Settings
Recognition of danger signs	Timed SMS, voice messages, pregnancy applications, helplines	Helps women and families identify symptoms requiring urgent care	Recognition does not ensure transport, money, permission, or respectful emergency response
Place-of-birth planning	Facility information, digital antenatal counselling, community health worker applications	Supports selection of a facility, skilled attendant, and birth companion	Facility preference may be influenced by previous mistreatment, perceived poor quality, or lack of trust
Financial and transport planning	Digital reminders, mobile-money prompts, community health worker follow-up, emergency transport directories	Encourages saving, transport mapping, and identification of emergency contacts	Women may lack control over household finances, phones, or transport decisions
Continuity of antenatal and postnatal care	Appointment reminders, electronic registers, defaulter tracing systems	Improves recall, follow-up, and continuity of contact with services	Reminder effectiveness is limited when distance, opportunity costs, user fees, or poor service quality remain unresolved
Emergency referral readiness	Digital referral forms, ambulance dispatch systems, WhatsApp or phone referral groups, dashboards	Can shorten communication delays between community and facility care	Referral communication is useful only when receiving facilities have staff, blood, medicines, surgical capacity, and respectful emergency response
Shared decision-making	Couple messages, family-inclusive counselling, community health worker-mediated digital education	May help women negotiate care-seeking with partners or elders	Inclusion of household decision-makers must not compromise confidentiality or reinforce male control
Privacy and trust	Consent options, discreet messages, data minimization, human helpdesks	Protects sensitive pregnancy information and supports safe disclosure	Shared phones and weak data governance may expose women to stigma, surveillance, coercion, or unintended disclosure

DIGITAL INFORMATION AS A DECISION RESOURCE, NOT A DECISION SUBSTITUTE

The strongest evidence for digital maternal health in low- and middle-income countries relates to information delivery, appointment reminders, and prompts that encourage contact with health services [11]. Reviews published since 2016 suggest that mHealth interventions can improve selected maternal and newborn health outcomes, particularly antenatal attendance, reminder response, immunization-related follow-up, and maternal knowledge [12]. More recent evidence also indicates benefits across several intermediate outcomes from conception to 24 months postpartum, although effects are less consistent for facility delivery, infant feeding outcomes, mortality-related endpoints, and sustained changes in care-seeking behaviour [13]. This pattern is important because digital interventions appear more effective at improving exposure to information and continuity of contact than at resolving the structural determinants of emergency obstetric outcomes.

The central implication for digital birth preparedness is that interventions should not be designed as though women are simply uninformed. In many resource-limited settings, women may already recognize the value of facility birth or antenatal care but delay action because of financial constraints, lack of transport, absence of social permission, fear of poor treatment, limited trust in facilities, or

uncertainty about whether care will be respectful and clinically competent. Digital messages can help translate risk into urgency, but they cannot replace a functioning referral pathway, affordable transport, emergency obstetric readiness, or respectful maternity care. They are most useful when connected to human support, community health worker follow-up, transport planning, and facility preparedness. By contrast, they become largely performative when programmes measure only the number of messages sent or received without assessing whether women understood the message, trusted it, could act on it, and received appropriate care after acting.

The evidence also highlights the difference between direct and mediated decision support. Direct-to-beneficiary messages can increase maternal knowledge, normalize antenatal attendance, reinforce danger-sign recognition, and provide repeated cues for birth planning. However, community health worker-mediated digital tools may be better positioned to convert information into counselling, household negotiation, risk identification, follow-up, and referral support. Facility or district dashboards may further support continuity of care by helping health systems identify missed visits, high-risk pregnancies, referral delays, and service gaps. Digital birth preparedness is therefore likely to be most effective when information systems are integrated across the woman, household, community worker, and facility, rather than functioning as isolated messaging platforms.

EVIDENCE FROM DIGITAL MODALITIES

Short message service is the most extensively evaluated digital modality in maternal health because it is relatively inexpensive, scalable, and compatible with basic mobile phones. Reviews and meta-analyses indicate that SMS-based reminders can improve focused antenatal care attendance and may support skilled birth attendance in selected contexts [14,15]. However, SMS interventions depend on literacy, language compatibility, phone access, and message privacy [16]. Their effectiveness may be reduced when women share phones, cannot read messages independently, speak a minority language, or fear that pregnancy-related messages may be seen by others. SMS is also usually a limited one-way communication tool unless paired with helpdesks, call-back systems, or provider follow-up.

Voice-based approaches, including interactive voice response and recorded calls, may reduce literacy barriers and are particularly relevant in settings where women use basic phones or prefer audio messages in local languages. The Kilkari programme in India demonstrates the feasibility of delivering stage-based maternal and child health voice messages at large scale [17]. However, programme experience shows that enrolment does not guarantee exposure, listening, comprehension, or action [18]. Missed calls, phone switching, poor network coverage, shared household devices, and control of phones by other family members can reduce the effective dose of the intervention. Voice messages may also be overheard, creating confidentiality concerns when pregnancy status, adolescent pregnancy, HIV-related information, intimate partner violence, or other sensitive issues are involved.

Interactive digital tools such as helplines, chatbots, WhatsApp groups, and helpdesks can extend digital birth preparedness beyond passive reminders by allowing women to ask questions and seek clarification. The South African MomConnect platform illustrates the value of a national maternal messaging programme that combines pregnancy-stage messaging, registration, and a helpdesk function [19]. Such tools are important because maternal decisions often involve uncertainty, including whether a symptom is dangerous, whether a facility visit is needed, or how to respond when relatives advise waiting at home [20]. Nevertheless, interactive systems require trained staff, clinical escalation protocols, documentation, language coverage, misinformation safeguards, and clear accountability for delayed or incorrect advice.

Provider-facing digital tools may influence maternal decision-making indirectly by strengthening counselling, follow-up, risk identification, and referral coordination. Community health worker applications can support pregnancy tracking, household counselling, antenatal follow-up, danger-sign recognition, and linkage with facilities [21]. Digital referral systems may reduce communication delays between community and facility care and are increasingly relevant for emergency obstetric and newborn

care in low- and middle-income settings [22]. However, these tools can also become surveillance or reporting instruments if they prioritize data entry over woman-centred support. Digital decision-support systems should therefore strengthen respectful counselling, referral preparedness, and continuity of care rather than reducing maternal care to algorithmic compliance.

Table 2. Digital Modalities for Birth Preparedness: Evidence Signals and Critical Interpretation

Modality	Common Functions	Evidence Signal	Critical Interpretation
SMS messaging	Antenatal reminders, danger-sign education, facility-birth prompts	Generally favourable for knowledge, reminders, and selected service-use outcomes	May exclude women with low literacy, shared phones, minority languages, or limited privacy
Voice/interactive voice response messages	Stage-based audio counselling, reminders, behaviour prompts	Useful for basic phones and low-literacy audiences; Kilkari demonstrates feasibility at scale	Effective exposure may be lower than enrolment when calls are missed, phones are shared, or others control devices
Helpdesks and chat platforms	Question-answering, triage, psychosocial reassurance, feedback	MomConnect demonstrates the value of interactive national maternal messaging	Requires quality assurance, escalation protocols, trained staff, language coverage, and misinformation control
Community health worker digital applications	Pregnancy tracking, counselling scripts, visit reminders, risk flags	Can connect household counselling with digital records, follow-up, and referral support	May burden health workers or prioritize reporting over relational counselling
Digital referral systems	Referral alerts, ambulance coordination, facility notification	Potential to reduce communication delays in emergency obstetric care	Cannot compensate for absent transport, staff, blood, surgery, essential medicines, or respectful emergency response
Dashboards and predictive tools	Risk stratification, defaulter tracing, service monitoring, stock or readiness tracking	Can support programme management and prioritization	Risk of opaque decisions, privacy harms, and inequitable targeting if data are incomplete or biased

MATERNAL AUTONOMY, HOUSEHOLD NEGOTIATION, AND GENDERED PHONE ACCESS

Maternal autonomy is central to birth preparedness and complication readiness because decisions about antenatal care, place of birth, emergency transport, and skilled attendance often depend on women's ability to access information, negotiate support, and act without avoidable delay. Recent evidence from low- and middle-income countries indicates that women continue to experience unequal decision-making autonomy in relation to maternal health-service use [23]. This autonomy is shaped by education, household wealth, place of residence, media exposure, partner relationships, family structure, and the wider social position of women within the household [24]. Similar determinants are also reported in studies of birth preparedness and complication readiness, where maternal education, antenatal care contact, residence, distance from health facilities, and regional context influence preparedness practices [25]. These factors are equally relevant to digital birth preparedness because they determine not only whether a woman receives a digital intervention, but also whether she can understand, trust, and act on it [26].

Digital interventions may support maternal autonomy in several ways. First, they can provide repeated, stage-specific information that women may not receive during brief or overcrowded antenatal visits. Second, they can strengthen women's ability to justify care-seeking by providing credible information that can be shared with partners, elders, or other household decision-makers. Third, they can connect women to community health workers, helpdesks, referral contacts, or facility-based support when household support is uncertain. However, digital tools can also reproduce dependence when phones are owned or controlled by husbands, when pregnancy-related messages are sent to shared devices, or when programme designers assume that reaching a household phone is equivalent to reaching the pregnant woman herself.

The gendered digital divide is therefore a central concern in maternal decision-making. Global digital development reports continue to show persistent gaps in women's access to mobile services and the internet [27]. Mobile internet remains one of the main routes to connectivity in low-resource settings,

but access is shaped by affordability, literacy, network coverage, device ownership, and gender norms [28]. A digital BPCR intervention that depends on smartphones, continuous data access, app downloads, or private device ownership may disproportionately benefit urban, wealthier, younger, and more literate women. This creates a paradox in which programmes appear modern and scalable while underserving women at highest risk of delayed or inadequate maternal care.

Relational autonomy must therefore be carefully balanced in programme design. Involving partners, mothers-in-law, or other household decision-makers may support transport planning, financial preparation, and timely care-seeking, especially where childbirth decisions are collective. However, family-inclusive digital counselling should not transfer control over reproductive information to male partners or reinforce women's dependence on household permission. Couple messaging, family-oriented counselling, and community health worker-mediated education may be appropriate when they are consent-based, culturally sensitive, and protective of women's confidentiality. Opt-in systems, privacy settings, neutral message options, and discreet communication channels should be treated as essential components of safe maternal digital health rather than optional technical features.

TRUST, CULTURAL FIT, AND RESPECTFUL MATERNITY CARE

Maternal decision-making depends not only on trust in the digital message but also on trust in the service to which the message directs the woman. Digital reminders may normalize antenatal attendance, facility delivery, and timely care-seeking, but women interpret these messages through their previous experiences with health-care providers and facilities. Evidence on mistreatment during facility-based childbirth in low- and middle-income settings shows that disrespect, verbal abuse, stigma, non-consented procedures, neglect, and poor communication are not isolated problems [29]. A message encouraging facility attendance may therefore be ignored or resisted when the facility is perceived as unsafe, humiliating, expensive, clinically unreliable, or socially unacceptable.

Cultural fit is also essential to digital birth preparedness. Even when messages are translated into local languages, they may fail if they do not align with local understandings of pregnancy risk, disclosure practices, childbirth planning, family authority, and acceptable care-seeking behaviour. In some communities, early pregnancy disclosure may be discouraged, while in others, advance planning for birth may be viewed as inappropriate or culturally sensitive. Digital programmes should not interpret these beliefs as ignorance. Instead, they should be addressed through participatory design, respectful engagement with women and families, involvement of trusted community actors, and careful adaptation of message content to local social realities.

Misinformation further complicates maternal decision-making. Pregnant women may receive conflicting advice from family members, social networks, traditional medicine sellers, informal drug vendors, online sources, and community norms. Digital BPCR programmes can provide trusted counter-information only when the source is recognizable, the content is consistent with provider counselling, and uncertainty can be escalated to trained personnel. Interactive digital tools therefore require human moderation, referral protocols, quality assurance, language coverage, and accountability mechanisms to reduce the risk of delayed advice, misinformation, or inappropriate reassurance.

EQUITY AND DIGITAL EXCLUSION

Equity should not be treated as a secondary benefit of digital birth preparedness; it must be considered a core design and evaluation principle. Women at greatest risk of preventable maternal harm may also be least likely to access digital support, including adolescents, women with disabilities, migrants and refugees, remote rural women, women with low literacy, women living in extreme poverty, women without private phones, and women experiencing intimate partner violence. Programmes that report only total registrations or message delivery counts may therefore make excluded groups invisible.

Several forms of inequity operate simultaneously. Device inequity concerns whether a woman owns, controls, or privately accesses a phone. Connectivity inequity relates to network coverage, electricity, airtime, data affordability, and continuity of service. Literacy inequity includes reading ability, digital confidence, language access, and ability to interpret health information. Social inequity concerns whether women can act on information without permission, coercion, or punishment. Health-system inequity reflects whether facilities are able to respond respectfully and effectively when women seek care. A rigorous digital BPCR programme should therefore assess not only whether messages were delivered, but also who received them, who understood them, who trusted them, who acted on them, and who ultimately benefited from them.

The implementation implication is that low-technology and human-supported options remain essential. Basic-phone compatibility, voice messages, offline community health worker tools, community-based counselling, disability-accessible formats, local-language options, and integration with routine antenatal counselling may be more equitable than smartphone-first models. Monitoring should examine differential reach and benefit by age, parity, education, residence, wealth, disability, language, phone ownership, and household decision-making power. Programmes should then be adapted when the women most likely to experience delayed or unsafe care are least likely to be reached.

PRIVACY, CONFIDENTIALITY, AND DATA GOVERNANCE

Pregnancy-related information is sensitive, and unintended disclosure can expose some women to stigma, coercion, conflict, or harm. This is particularly important for unmarried adolescents, women with unintended pregnancies, migrants, women living with HIV, women experiencing intimate partner violence, and women whose reproductive choices are closely monitored by families or communities. Digital birth preparedness therefore raises privacy concerns that are immediate and practical, not merely technical. A message sent to a shared phone may reveal pregnancy status, gestational age, facility plans, HIV-related visits, or emergency concerns. Mobile applications and helplines may also collect identifiers, symptoms, location data, reproductive history, and referral information.

The broader mHealth privacy literature shows that privacy assessment remains inconsistent and often underdeveloped, with concerns related to app permissions, privacy policies, communication security, remote storage, third-party access, and user control [30]. Governance principles in digital health also emphasize transparency, accountability, data minimization, user safety, and harm prevention. In maternal digital health, these principles should translate into explicit consent, clear sender identity, opt-out options, safe timing of messages, discreet content choices, limited data collection, restricted access for health workers, secure referral transmission, and careful anonymization of data used for secondary analysis or programme monitoring.

Privacy should not be viewed as an obstacle to scale. Rather, it is a condition for trustworthy and safe scale. A programme that reaches thousands or millions of women but exposes some to stigma, coercion, surveillance, or unintended disclosure has not resolved the ethical challenge of digital maternal health. Privacy-by-design is especially important when digital BPCR platforms are linked with national registries, insurance databases, mobile network operators, private technology vendors, or artificial intelligence-enabled decision-support systems. Responsible implementation requires that women's safety, consent, confidentiality, and control over reproductive information remain central to programme architecture.

IMPLEMENTATION IMPLICATIONS FOR RESOURCE-LIMITED SETTINGS

Digital birth preparedness should be implemented as a component of the maternal health system rather than as a stand-alone communication campaign. Digital implementation guidance emphasizes needs assessment, alignment with national digital architecture, governance, interoperability, costed planning, implementation readiness, and long-term sustainability [10]. In maternal health, these principles mean

that digital BPCR tools should be integrated with antenatal counselling, community health worker activities, facility referral pathways, emergency transport, postpartum follow-up, supervision, and quality-improvement systems.

Programme design should begin with women's real decision journeys. Digital interventions need to account for how women recognize pregnancy, disclose pregnancy, attend antenatal care, choose a place of birth, save money, arrange transport, identify danger signs, and seek emergency help. Such journey mapping should include household decision-makers where appropriate, but without compromising women's consent, confidentiality, or safety. Content should be staged by gestational period, locally adapted, action-oriented, and realistic. Advising a woman to attend a facility without addressing transport, cost, permission, distance, or likely treatment at the facility may function more as moral instruction than practical support.

Digital and human support should also be deliberately combined. Messages can remind, normalize, and inform, whereas community health workers, midwives, and facility staff can interpret symptoms, counsel families, negotiate barriers, and escalate urgent concerns. Helpdesks can support women when uncertainty arises, but they require trained personnel, supervision, documentation, language coverage, and clear referral protocols. Emergency functions should be assessed against actual referral capacity. A digital referral alert has limited value if ambulances lack fuel, referral facilities are understaffed, essential medicines are unavailable, blood supplies are absent, or surgical capacity is not functional.

Monitoring should move beyond message delivery and registration counts. More meaningful indicators include effective exposure, comprehension, perceived usefulness, completeness of birth plans, household support, transport readiness, emergency referral completion, delay intervals, respectful-care experiences, privacy incidents, and differential benefit across equity groups. Programmes should also assess sustainability, including long-term financing, government ownership, integration with routine health information systems, avoidance of vendor lock-in, database maintenance, staff training, interoperability, and data-sharing governance.

Table 3. Conceptual Pathway Linking Digital Birth Preparedness to Maternal Decision-Making and Care-Seeking

Pathway Stage	Core Components	Interpretation for Resource-Limited Settings
Digital access and exposure	Phone ownership or access, network coverage, language, literacy, timing, trusted sender	Digital contact is possible only when women can access and safely receive messages in a usable format
Understanding and trust	Danger-sign recognition, perceived relevance, cultural fit, privacy, confidence in source	Information must be understood, trusted, and perceived as relevant before it can influence planning
Negotiation and planning	Partner or family discussion, saving money, transport plan, birth companion, preferred facility	Birth preparedness often depends on household bargaining and practical readiness rather than individual knowledge alone
System activation	Community health worker follow-up, helpdesk advice, referral communication, ambulance or transport, facility readiness	Digital support must connect women to functioning human and institutional response systems
Care-seeking and outcome	Timely antenatal care, skilled birth attendance, emergency care, respectful treatment, postnatal follow-up	Safer outcomes depend on whether digital prompts lead to timely, respectful, and clinically capable care

Equity, autonomy, privacy, household power, and health-system quality moderate every stage of this pathway. The pathway can fail at any point if digital contact is not translated into feasible, safe, affordable, and trusted action.

RESEARCH GAPS

The current evidence base has several important gaps. First, many studies measure service attendance, message recall, or programme registration but do not assess the quality of maternal decision-making, women's control over decisions, or whether digital information changes household bargaining. Second, relatively few studies examine privacy harms, unintended disclosure, coercive partner monitoring, or women's preferences for discreet communication. Third, evaluation findings often report average effects

without sufficient equity analysis, making it difficult to determine whether digital programmes reduce or widen disparities among adolescents, rural women, women with low literacy, women with disabilities, migrants, women without private phones, and women living in poverty.

Fourth, evidence remains limited regarding emergency obstetric outcomes. Digital messages may improve antenatal attendance, but stronger evidence is needed to determine whether digital birth preparedness reduces delays in seeking emergency care or improves outcomes related to haemorrhage, eclampsia, sepsis, obstructed labour, neonatal complications, or referral completion. Fifth, the long-term sustainability of scaled programmes requires greater attention, including financing, interoperability, government ownership, data governance, workforce workload, and integration into routine maternal health systems. Future research should use theory-informed qualitative, mixed-methods, implementation, and equity-focused designs to trace the full pathway from message exposure to household negotiation, referral activation, facility arrival, care experience, and postpartum reflection.

CONCLUSION

Digital birth preparedness can strengthen maternal decision-making in resource-limited settings when it is designed as decision support embedded within social relationships and health systems rather than as a stand-alone package of messages. Current evidence suggests that mHealth interventions can improve maternal knowledge, reminders, antenatal contact, and selected service-use behaviours, but the pathway from information to safer birth is mediated by autonomy, phone access, literacy, trust, privacy, transport, household support, respectful maternity care, and facility readiness. A critical narrative synthesis therefore cautions against assuming that digital messages alone can empower women or reduce care-seeking delays. Digital BPCR may support empowerment when it increases access to credible information, strengthens negotiation with families, connects women to community health workers or helpdesks, and activates responsive referral systems. However, it may worsen inequity when it assumes private phone ownership, overlooks low literacy, collects excessive data, exposes sensitive information, or shifts responsibility to women without improving services. The priority for future programmes is responsible, inclusive, privacy-protective, and health-system-integrated digital birth preparedness that demonstrably improves women's capacity to make and act on safe birth choices.

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