

A Scoping Review: Maternal Health at the Water's Edge: Geographic, Health-System, and Digital-Care Barriers to Maternal Healthcare in Riverine South-South Nigeria.

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Abstract

Background: Maternal mortality remains a major health-system and equity challenge in Nigeria, with riverine communities facing distinctive barriers related to water-based transportation, dispersed settlements, limited referral capacity, health-worker shortages, cost, and uneven digital infrastructure. Bayelsa State, located in the Niger Delta, provides an important setting for examining how these barriers intersect and how community and digital-health strategies may strengthen maternal care.

Objective: To map evidence on geographic, health-system, socioeconomic, sociocultural, community-level, and digital-health factors influencing access to and utilization of maternal healthcare in Bayelsa State and comparable riverine or underserved settings in South-South Nigeria.

Methods: A scoping review was structured according to JBI guidance and reported using PRISMA-ScR. A structured evidence search conducted in August 2026 identified peer-reviewed studies and authoritative reports addressing maternal healthcare access, utilization, community interventions, or digital-health approaches in Bayelsa State, South-South Nigeria, or closely comparable Niger Delta settings. Twenty-three records were identified, three duplicates were removed, 20 records were screened, 14 full texts were assessed, and 11 sources were included in the final synthesis.

Results: Six interrelated themes emerged: riverine geography and transport; health-system readiness and referral capacity; financial and socioeconomic barriers; sociocultural factors and respectful care; community engagement; and digital-health opportunities and constraints. Bayelsa-specific intervention evidence suggests that strengthened community governance can markedly improve antenatal care, facility delivery, and postnatal care utilization. Digital approaches may reduce informational and communication delays, but cannot substitute for emergency transport, skilled personnel, medicines, blood, and functional referral facilities.

Conclusion: Maternal-health inequities in riverine South-South Nigeria are produced by interacting geographic, structural, financial, interpersonal, and technological barriers. Bayelsa State requires a hybrid maternal-health access strategy that combines resilient primary healthcare, water-based emergency referral, community mobilization, respectful maternity care, financial protection, and low-bandwidth digital/tele-nursing support.

Keywords: Bayelsa State; Maternal Health; Riverine Communities; South-South Nigeria; Niger Delta; telehealth; mHealth

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I. Introduction

Maternal mortality remains one of the clearest indicators of inequity in health-system performance. The most recent United Nations inter-agency estimates indicate that more than 700 women died each day in 2023 from preventable causes related to pregnancy and childbirth. Nigeria had an estimated maternal mortality ratio of 993 deaths per 100,000 live births in 2023 and accounted for approximately 75,000 maternal deaths, or 28.7% of the global total ¹. These figures underscore the urgency of context-specific strategies that improve timely access to high-quality care before, during, and after childbirth.

National and regional averages can obscure substantial within-country inequalities. Nigeria's 2024 health-sector reporting shows that skilled birth attendance remains uneven across states and geopolitical zones; although the South-South performs better than the national average, important gaps persist within rural, coastal, and hard-to-reach communities². In riverine parts of the Niger Delta, physical access is shaped by waterways, seasonal flooding, transport cost, fuel availability, travel time, and the concentration of higher-level obstetric services in urban centers.

Bayelsa State is particularly relevant to this problem. Much of the state is riverine, and a large proportion of communities are accessible primarily by water. Recent Bayelsa research has documented the importance of community-level systems for improving reproductive, maternal, and child health service utilization. In a quasi-experimental evaluation of strengthened Ward Development Committees, facility delivery increased from 46% at baseline to 72% at endline, attendance at four or more antenatal visits increased from 78% to 92%, and postnatal-care attendance increased from 52% to 93%³. This finding suggests that maternal-health access in Bayelsa is not fixed by geography alone; organized community action and stronger links between communities and primary healthcare can change utilization patterns.

Evidence from the wider Niger Delta similarly identifies poor income, limited social support, cultural and religious influences, and health-system inefficiencies as barriers to maternal service use.^{4,5} More recent South-South qualitative evidence highlights negative staff attitudes, breaches of confidentiality, financial constraints, stigma, and systemic inefficiencies as additional reasons women may avoid or delay formal care⁶. Thus, the challenge is multidimensional: women may recognize the value of skilled care yet remain unable or unwilling to use it because the pathway to care is physically difficult, financially burdensome, socially complex, or experienced as disrespectful.

Digital health is increasingly proposed as part of the solution. Mobile health and telemedicine can support health education, appointment reminders, remote counselling, follow-up, triage, referral communication, and links between frontline providers and higher-level clinicians. In rural Edo State, the Text4Life maternal-health intervention demonstrated that acceptability of mHealth is shaped by perceived usefulness, social support, trust, affordability, and ease of communication⁷. At the national level, a recent systematic review of telemedicine in Nigeria found that power outages, poor internet connectivity, inadequate technical expertise, weak regulation, and organizational-policy gaps remain major implementation barriers⁸. These limitations are particularly consequential in riverine settings.

Despite the growing literature, evidence relevant to Bayelsa is fragmented across maternal-service utilization, community interventions, health-system studies, and digital-health research. A scoping review is therefore appropriate for mapping the breadth of available evidence, identifying recurring barriers and facilitators, and clarifying which problems may be addressed through digital care and which require physical health-system investment. This review asks: What is known about geographic, health-system, socioeconomic, sociocultural, community, and digital-health factors influencing maternal healthcare access and utilization in Bayelsa State and comparable riverine or underserved settings in South-South Nigeria?

II. Methods

2.1 Review design and reporting

This review followed the methodological principles for scoping reviews described by JBI and was reported with reference to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)^{9,10}. A scoping approach was selected because the literature spans diverse study designs, intervention studies, qualitative research, cross-sectional studies, implementation reports, and digital-health evidence. The purpose was to map the evidence and identify gaps rather than calculate a pooled intervention effect.

2.2 Eligibility framework

Eligibility was defined using the Population–Concept–Context framework. The population included pregnant women, birthing women, postpartum women, mothers/caregivers, and maternal-health providers where provider evidence directly addressed maternal-care access or delivery. The concept included access to, utilization of, experience of, or interventions to strengthen antenatal, intrapartum, emergency obstetric, postnatal, and related maternal-health services. Digital-health, telehealth, mHealth, referral, community-mobilization, and health-system interventions were eligible when linked to maternal care. The primary context was Bayelsa State; evidence from other South-South Nigerian states and Niger Delta riverine settings was included when it provided transferable contextual evidence. English-language peer-reviewed articles and authoritative institutional reports were eligible. Studies with no maternal-health component, studies outside the defined context without clear transferability, opinion pieces without empirical or policy evidence, and duplicate publications were excluded.

2.3 Information sources and search strategy

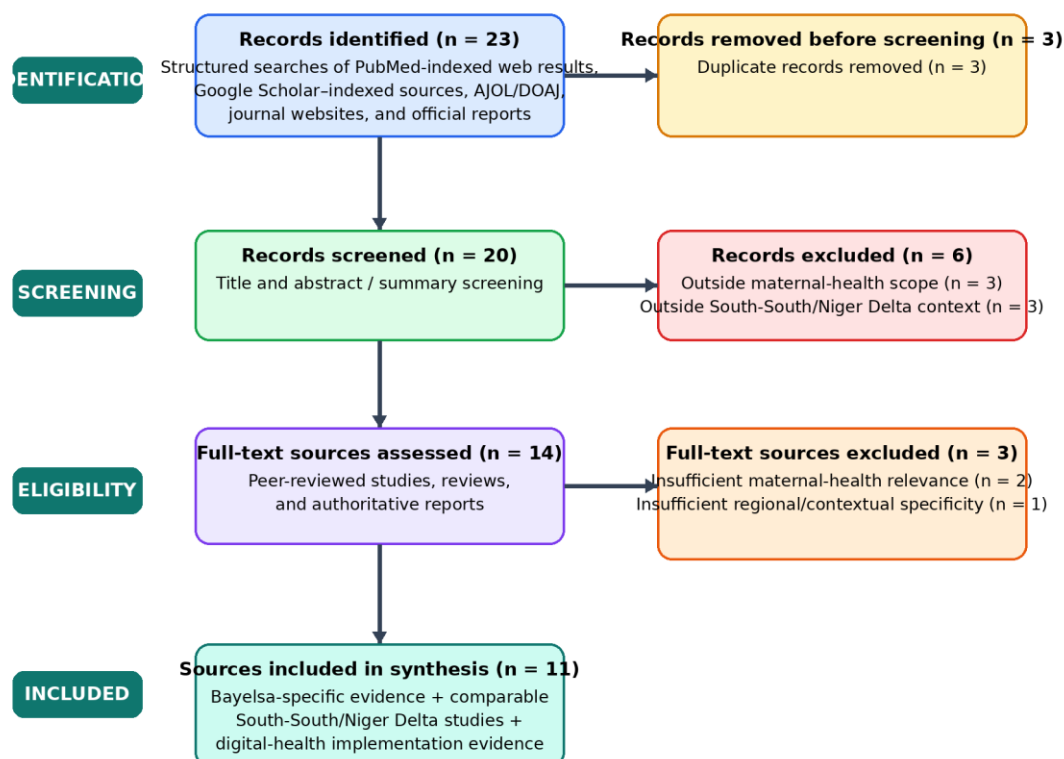
A structured evidence search was conducted on August 20, 2026. Search pathways covered PubMed-indexed web results, Google Scholar-indexed web results, African Journals Online/DOAJ-indexed material, publisher journal websites, and authoritative governmental or international sources. Search concepts were combined around four domains: (1) maternal health, pregnancy, antenatal, delivery, postnatal, obstetric; (2) Bayelsa, South-South Nigeria, Niger Delta, riverine; (3) access, utilization, barriers, transport, referral, community; and (4) telehealth, telemedicine, mHealth, digital health, tele-nursing. Citation chaining and targeted searches for Bayelsa-specific evidence were also used.

A representative search string was: (maternal OR pregnancy OR antenatal OR childbirth OR postnatal OR obstetric) AND (Bayelsa OR "South-South Nigeria" OR "Niger Delta" OR riverine) AND (access OR utilization OR barrier* OR transport OR referral OR community OR telehealth OR telemedicine OR mHealth OR "digital health"). Because the present synthesis was developed from web-accessible indexed sources rather than direct exports from subscription bibliographic databases, the review should be regarded as a rigorously structured scoping synthesis; a final journal submission would be strengthened by librarian-assisted replication of the search directly in PubMed/MEDLINE, CINAHL, Scopus, and Web of Science.

2.4 Study selection

Search results were deduplicated and screened first by title and abstract or indexed summary, followed by full-text assessment. Twenty-three records were identified, three duplicate records were removed, and 20 unique records were screened. Six were excluded during title/summary screening because they were outside the maternal-health scope or lacked South-South/Niger Delta relevance. Fourteen full-text sources were assessed; three were excluded because of insufficient maternal-health relevance or inadequate contextual specificity. Eleven sources were retained for the final narrative synthesis. Figure 1 summarizes the selection process.

Figure 1. PRISMA-ScR Flow Diagram for Evidence Selection



PRISMA-ScR = Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews.

Figure 1. PRISMA-ScR flow diagram for evidence identification, screening, eligibility, and inclusion.

2.5 Data charting

A standardized charting framework was used to extract author/year, setting, study design, population, maternal-health domain, principal barriers or facilitators, intervention characteristics where applicable, and implications for Bayelsa State. Consistent with scoping-review methodology, the synthesis emphasized the

range, nature, and distribution of evidence rather than excluding studies solely on the basis of methodological design.

2.6 Synthesis

Evidence was synthesized descriptively and thematically. Findings were compared across Bayelsa-specific and broader South-South/Niger Delta sources. Themes were developed iteratively and organized according to the maternal-care access pathway: ability to recognize need, ability to reach care, ability to receive acceptable and effective care, and ability to maintain continuity after initial contact. Digital-health findings were analyzed separately to distinguish barriers that are potentially addressable through remote communication from barriers requiring physical infrastructure or clinical capacity.

III. Results

3.1 Characteristics of the evidence

The included evidence comprised Bayelsa-specific intervention and observational studies, South-South/Niger Delta qualitative and cross-sectional studies, digital-health implementation research, a Nigerian telemedicine systematic review, and authoritative national/international reports. The literature was heterogeneous in design and outcome measurement, supporting narrative rather than statistical synthesis. Bayelsa-specific evidence was relatively limited compared with the broader Nigerian literature, reinforcing the need for locally grounded implementation research.

Source	Setting/design	Focus	Key finding	Relevance to Bayelsa
³ Akinyemi et al., 2025	Bayelsa; quasi-experimental	WDC strengthening	ANC, facility delivery and PNC improved substantially	Community governance can improve utilization
¹³ Eguvbe et al., 2026	Bayelsa; comparative study	Birth preparedness	Rural–urban differences in preparedness/readiness	Supports geographic tailoring
¹² Oweibia et al., 2025	Bayelsa; secondary program data	Maternal micronutrient coverage	Coverage gaps linked to delivery/system constraints	Shows programmatic inequity across LGAs
¹¹ Robinson-Mbato et al., 2024	Rivers; cross-sectional	Maternal-service utilization	Geographic and facility-operational factors affected use	Comparable Niger Delta context
⁵ Opara et al., 2021	Rivers; qualitative	Riverine maternal access	Income, culture, support and system inefficiencies were barriers	Directly transferable riverine evidence
⁶ Ekpenyong, 2025	South-South; qualitative	Women's care experiences	Staff attitude, confidentiality, cost and stigma mattered	Highlights respectful-care dimension
⁷ Akinyemi et al., 2022	Edo; qualitative digital-health study	mHealth acceptability	Usefulness, trust, affordability and usability shaped acceptance	Digital design implications
⁸ Olu et al., 2025	Nigeria; systematic review	Telemedicine barriers/facilitators	Power, internet, skills, regulation and policy were major barriers	Defines enabling conditions for tele-nursing
² Federal Ministry of Health and Social Welfare, 2025	Nigeria; national report	Maternal-service coverage	Subnational and regional inequalities persist	Policy and service benchmark
¹ WHO et al., 2025	Global/Nigeria estimates	Maternal mortality	Nigeria remains among highest-burden countries	Establishes urgency
¹⁴ Walker & Akpe, 2025	South-South; rural survey	Availability/utilization	Persistent gaps in rural maternal-service availability/use	Supports rural service-readiness theme

3.2 Theme 1: Riverine geography, distance, and transportation

Geography emerged as a foundational determinant of maternal-health access. Riverine communities experience a distinctive form of spatial disadvantage because reaching a facility may require boat transport rather than road travel. Transport availability, fuel cost, weather, darkness, flooding, and travel time can transform a clinically manageable complication into a time-critical emergency. Evidence from riverine Rivers State showed that maternal service use was constrained by multiple interacting barriers, including health-system inefficiency and household-level resources ⁵. Bayelsa's geography intensifies these concerns because many communities are dispersed along waterways.

The implications extend beyond routine antenatal attendance. For obstetric emergencies, a referral pathway is only effective when transport can be activated rapidly, receiving facilities are prepared, communication occurs

before arrival, and costs do not prevent movement. Consequently, interventions that improve knowledge without improving transport and referral readiness may have limited impact on maternal outcomes.

3.3 Theme 2: Health-system readiness, quality, and referral capacity

Maternal access is not equivalent to physical arrival at a facility. Women must encounter functioning services, skilled personnel, essential medicines and supplies, appropriate diagnostics, reliable referral systems, and respectful care. South-South evidence indicates that facility operational conditions influence maternal-service utilization¹¹. Recent Bayelsa program evidence also points to systemic delivery gaps in maternal interventions across Local Government Areas¹².

These findings support a systems interpretation of delay. A woman may overcome geographic barriers yet experience a second set of delays after reaching care if staff, commodities, transport for onward referral, or receiving-facility coordination are inadequate. Strengthening primary healthcare must therefore be linked to emergency obstetric referral capacity rather than treating PHC attendance as an endpoint.

3.4 Theme 3: Financial and socioeconomic barriers

Direct and indirect costs recur across the evidence. Even when specific maternal services are nominally free or subsidized, women may incur costs for boat transport, fuel, medicines, diagnostics, food, accompanying family members, and lost income. Financial constraints were prominent in South-South qualitative evidence and in riverine Niger Delta research^{5, 6}. These costs are especially important in emergency situations, when households have little time to mobilize money.

Financial protection strategies should therefore include the cost of reaching care, not merely the clinical fee at the destination. Maternal-health insurance, transport vouchers, emergency community funds, and contracted water-ambulance or boat-referral arrangements are plausible components of an equity-oriented Bayelsa strategy.

3.5 Theme 4: Sociocultural factors, trust, and respectful maternity care

Women's decisions are shaped by relationships, cultural expectations, prior experiences, privacy, and perceived treatment by healthcare workers. Ekpenyong (2025)⁶ identified negative staff attitudes, confidentiality concerns, stigma, and systemic inefficiencies alongside women's continuing recognition of the value of skilled providers. This tension is important: women may trust biomedical competence while distrusting the experience of formal care.

Respectful maternity care is therefore not an optional quality improvement. In settings where reaching a facility already requires substantial effort and expense, a disrespectful or stigmatizing encounter can further reduce future utilization and influence community narratives about facility care. Tele-nursing interventions must similarly address confidentiality, respectful communication, language, consent, and women's control over when and how they are contacted.

3.6 Theme 5: Community engagement as an access intervention

The strongest Bayelsa-specific intervention evidence in the included literature concerned community governance. Strengthening Ward Development Committees in Kolokuma/Opokuma LGA was associated with large improvements in maternal and reproductive service utilization, including facility delivery, antenatal attendance, and postnatal care³. The intervention demonstrates that community structures can function as active components of the health system by mobilizing women, advocating for services, disseminating information, and linking households with facilities.

For riverine maternal health, community engagement may also be essential for emergency planning. Ward and community structures can help identify local boat operators, establish emergency transport arrangements, support pregnant-woman mapping, promote birth preparedness, and create trusted channels for digital maternal-health communication.

3.7 Theme 6: Digital health and tele-nursing—opportunity with conditions

Digital health offers a means of reducing informational and communication distance, but not physical distance itself. Maternal mHealth evidence from rural Edo State suggests that acceptability depends on perceived usefulness, affordability, social support, and ease of use⁷. A recent Nigerian systematic review similarly found that telemedicine implementation is constrained by electricity, internet connectivity, technical skills, regulation, and organizational policy⁸.

For Bayelsa, the most appropriate digital model is therefore likely to be low-bandwidth and multimodal rather than video-first. Voice calls, SMS, secure messaging, structured tele-triage, appointment reminders, postpartum follow-up, danger-sign education, and provider-to-provider consultation may be more resilient than models that assume continuous broadband. Digital communication can also reduce referral delays by allowing PHC nurses or community health workers to contact receiving facilities before transfer.

However, digital care has clear boundaries. A mobile phone cannot control postpartum hemorrhage, perform a cesarean delivery, provide blood transfusion, or transport a woman across a river. Tele-nursing should be conceptualized as an access and coordination layer embedded within a functioning maternal-health system, not as a replacement for physical infrastructure and emergency obstetric care.

IV. Discussion

This scoping review demonstrates that maternal-health access in riverine South-South Nigeria is best understood as a chain of interdependent conditions rather than a single problem of service availability. Geography shapes whether women can reach care; household resources shape whether they can afford the journey; health-system readiness shapes whether useful care is available on arrival; interpersonal experiences shape trust and willingness to return; and digital infrastructure shapes whether remote communication can bridge some of these gaps.

The findings are consistent with the classic logic of maternal delay while adding a riverine and digital-health perspective. In Bayelsa, the decision to seek care and the ability to reach care may be separated by waterways, weather, transport scarcity, and fuel costs. The ability to receive adequate care may then depend on staffing, referral coordination, supplies, and respectful treatment. Digital interventions can act across these stages by improving knowledge, supporting early contact, coordinating referral, and maintaining follow-up, but their effectiveness depends on the underlying physical health system.

The Bayelsa Ward Development Committee evidence is particularly important because it shows that utilization can improve even in a difficult geographic context when community-health-system relationships are strengthened³. This suggests that a future maternal-health strategy should not be framed as technology versus community intervention. A stronger model would combine community mobilization with digital communication and a reliable physical referral network.

Recent national data reinforce the need for subnational approaches. The Federal Ministry of Health and Social Welfare (2025)² reports substantial variation in skilled birth attendance across Nigeria despite improvements in southern zones. A state such as Bayelsa therefore requires granular LGA- and community-level planning rather than reliance on geopolitical-zone averages. The newest global estimates also show that Nigeria remains at an exceptionally high level of maternal mortality, making implementation research in high-barrier settings urgent¹.

4.1 A proposed Riverine Maternal Health Access Framework for Bayelsa State

Based on the synthesis, a Bayelsa-specific access framework should contain five linked layers. The first is community readiness: pregnancy identification, birth preparedness, danger-sign literacy, trusted community mobilization, and emergency plans. The second is communication readiness: low-bandwidth tele-nursing, provider hotlines, appointment and postnatal reminders, remote counselling, and pre-referral communication. The third is transport readiness: mapped boat routes, emergency transport agreements, fuel contingency, transport vouchers or community emergency funds, and 24-hour activation mechanisms. The fourth is facility readiness: skilled staff, essential medicines, blood and surgical referral capacity, respectful care, and functional receiving-facility communication. The fifth is governance and equity: digital privacy standards, quality monitoring, community feedback, financial protection, and routine disaggregation of service data by riverine/rural location.

4.2 Implications for nursing and midwifery

Nurses and midwives are well positioned to lead the communication and continuity components of this framework. Tele-nursing protocols could standardize remote antenatal education, symptom screening, postpartum checks, breastfeeding support, medication and appointment reminders, and referral escalation. Training should emphasize that remote assessment has limits and that maternal danger signs require rapid escalation. Documentation standards, privacy procedures, culturally appropriate communication, and clinical supervision are essential.

Community health workers and Ward Development Committees can complement nursing roles by identifying pregnant women, reinforcing health information, supporting digital inclusion, and activating local transport pathways. The goal should be a connected maternal-care network rather than a stand-alone telehealth project.

4.3 Policy implications

Bayelsa State policy should prioritize hybrid investment. First, maternal referral plans should explicitly account for waterways and seasonal flooding. Second, maternal-health financing should include transport and referral costs. Third, PHC digitalization should favor technologies that remain usable under weak connectivity. Fourth, state protocols should define tele-nursing scope, privacy, documentation, escalation, and accountability. Fifth, maternal-health dashboards should track access and outcomes by LGA, riverine status, referral route, and

socioeconomic vulnerability. Finally, community governance structures should be treated as implementation partners rather than peripheral stakeholders.

4.4 Evidence gaps

Several gaps were evident. There are few contemporary Bayelsa-specific studies that follow women across the full continuum from antenatal care through childbirth and postpartum care. Evidence on emergency water transport, referral completion, maternal near-miss, respectful maternity care, postpartum mental health, and digital-health effectiveness in Bayelsa is particularly limited. There is also little implementation research comparing digital modalities under real-world connectivity constraints. Future studies should incorporate women's experiences, health-worker perspectives, geospatial access measures, referral data, and implementation outcomes.

5. Strengths and Limitations

A strength of this review is its deliberate integration of geographic, health-system, community, interpersonal, and digital-health evidence around a specific high-barrier context. It also incorporates recent Bayelsa-specific intervention evidence and the latest global maternal-mortality estimates. However, the evidence base is heterogeneous and relatively small. The search used structured web-accessible indexed sources rather than direct exports from all subscription databases, and some relevant local studies may therefore have been missed. The included studies also vary substantially in design, population, and outcome measurement, precluding meta-analysis. These limitations should be considered when interpreting the thematic synthesis. Before journal submission, replication of the search in MEDLINE/PubMed, CINAHL, Scopus, and Web of Science with independent dual screening would strengthen reproducibility.

V. Conclusion

Maternal-health inequity in riverine South-South Nigeria is produced by the interaction of geography, transport, poverty, health-system capacity, sociocultural context, women's experiences of care, and digital infrastructure. Bayelsa State illustrates why maternal-health strategies designed for road-connected settings may be insufficient for hydrologically complex environments. Community mobilization can improve utilization, and digital health can reduce informational and communication delays, but neither can replace reliable transport, skilled clinical care, emergency obstetric capacity, and respectful services.

A timely policy direction for Bayelsa is therefore a hybrid riverine maternal-health system: community anchored, nurse- and midwife-led, digitally supported, transport enabled, and linked to functional emergency referral care. Future implementation research should test such integrated models using equity-sensitive outcomes and should determine whether tele-nursing can improve continuity, referral timeliness, postpartum follow-up, and women's experience of care without widening the digital divide.

Declarations

Ethics approval and consent to participate: Not applicable. This study synthesized publicly available literature and did not involve recruitment of human participants.

Consent for publication: Not applicable.

Availability of data and materials: All evidence synthesized in this review is available in the cited publications and reports. During the preparation of this manuscript, the author(s) used **OpenAI's ChatGPT** to assist with the organization and structuring of the manuscript, refinement of academic language and readability, and preparation of preliminary written material. The tool was used as an AI-assisted writing resource and not as an author or substitute for scholarly judgment. The author(s) independently reviewed, revised, and verified the manuscript, including the accuracy and appropriateness of the scientific content, interpretations, citations, and references. All final decisions regarding the content and conclusions of the manuscript were made by the author(s), who take full responsibility and accountability for the integrity and content of the publication.

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