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Review Article

Evaluation of digital health technology acceptance for breastfeeding support among perinatal women in rural areas: A scoping review

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ABSTRACT

Background & Aim: Breastfeeding is fundamental to maternal and infant health, yet rural populations face barriers to support due to limited infrastructure and geographic constraints. Although digital health technologies are increasingly used to promote maternal and child health, evidence on their acceptance and effectiveness in supporting breastfeeding among perinatal women in rural settings remains limited. This scoping review aims to examine digital interventions supporting breastfeeding areas and to identify their outcomes, challenges, and enabling factors.
Materials & Methods: Following the Joanna Briggs Institute methodology, systematic searches were conducted in Scopus, PubMed, Wiley Online Library, ScienceDirect, DOAJ, and Web of Science. Studies published in English between January 2015 and May 2025 were included. Two reviewers independently screened studies, with disagreements resolved by a third reviewer. Data were synthesized thematically, and methodological quality was assessed using the Mixed Methods Appraisal Tool (MMAT).
Results: A total of 22 studies (n=22) were included, identifying four categories of interventions: mobile health (mHealth) applications, messaging services (SMS/IVR), telelactation, and social media platforms. These interventions improved exclusive breastfeeding rates, maternal knowledge, confidence, and satisfaction with care. Key facilitators included culturally tailored content, hybrid human–digital models, and interactive features. Barriers were low digital literacy, poor connectivity, weak integration with health systems, and socio-cultural resistance.
Conclusion: Digital health technologies demonstrate significant potential to strengthen breastfeeding support in rural areas. Their effectiveness depends on accessibility, cultural relevance, and integration into existing health and community structures. The findings underscore the need for policies that promote digital equity, community-based design, and sustainable integration of technology into rural maternal care programs. Future research should also assess cost-effectiveness and long-term user engagement.

Introduction

The adoption of digital health technologies has grown significantly over the past decade, offering tremendous potential to improve maternal and infant health outcomes, particularly in promoting and supporting breastfeeding (1,2,3). However, digital inequality remains a critical challenge, especially in rural areas of low- and middle-income countries (LMICs), where access to healthcare services and digital information is often limited (1,3,4). Perinatal women in remote regions frequently face structural and social barriers to accessing breastfeeding support, including shortages of trained health professionals, geographic isolation, and cultural stigma (5,6).

Digital health tools, including mobile applications, text messaging (SMS), and online educational platforms, have the potential to bridge these gaps by providing timely, cost-effective, and accessible breastfeeding information and support (7,8). In this review, "acceptance" is

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conceptually guided by the Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology Acceptance Model (TAM) frameworks, emphasizing the roles of perceived usefulness, ease of use, social influence, and facilitating conditions in shaping behavioral intention and technology use(9,10). Studies have shown that user acceptance is a key determinant of the success of technology-based interventions (11).

The perinatal period, ranging from pregnancy to early postpartum, is a critical window for educational and behavioral interventions, including those related to breastfeeding. During this time, women tend to have increased interaction with health services, presenting key opportunities to introduce digital health support (12,13). Unfortunately, women's preferences, perceptions, and readiness to use these technologies are often overlooked in the design and implementation of such programs (14).

The World Health Organization (WHO) recommends the use of digital technologies to strengthen maternal and child healthcare, including support for exclusive breastfeeding (15). However, in-depth research on the acceptance of digital health technologies among perinatal women in rural settings remains limited, particularly in LMICs. Evidence from high-income countries may not be applicable to rural contexts due to differences in social, cultural, economic, and health system conditions (16,17).

Rural areas are highly diverse in terms of geography, culture, and infrastructure, all of which directly influence women's acceptance and use of digital technologies (18). Therefore, a contextual understanding of the factors that affect the acceptance of digital health technologies for breastfeeding support is essential for designing effective, relevant, and sustainable interventions (19).

This scoping review extends beyond prior mHealth and breastfeeding reviews by specifically focusing on technology acceptance among perinatal women in rural contexts, an aspect that remains underexplored in previous works, which primarily assessed intervention efficacy rather than user perception or contextual acceptance. Specifically, it seeks to answer the question: "What are the barriers and facilitators influencing the acceptance of digital health technologies for breastfeeding support among perinatal women in rural areas?" In this review, the term "perinatal women" includes pregnant women, breastfeeding mothers, and women in the early postpartum period.

Methods

This scoping review followed the methodological framework proposed by Arksey & O'Malley (2005) and refined by Levac, Colquhoun, & O'Brien (2010), and the Joanna Briggs Institute (JBI) guidelines (22). The review aimed to map and synthesize current evidence regarding the acceptance of digital health technologies for breastfeeding support among perinatal women in rural settings.

Research questions

This review was guided by the central research question: What are the barriers and facilitators influencing the acceptance of digital health technologies for breastfeeding support among perinatal women in rural areas? To support this inquiry, the review also explored what types of digital health technologies have been utilized to promote breastfeeding in rural contexts, and which sociodemographic or contextual factors shape the acceptance and use of these technologies by perinatal women.

Eligibility criteria

Studies were eligible for inclusion if they focused on perinatal women, encompassing those who were pregnant, breastfeeding, or in the early postpartum period. Eligible studies specifically addressed aspects related to the acceptance, feasibility, usability, uptake, or user perceptions of digital health interventions. Only studies conducted in rural, semi-rural, or remote settings were considered, as the focus of this review is on geographical contexts where digital disparities are often more pronounced. All types of primary research designs, quantitative, qualitative, and mixed

methods, were included, as well as relevant scoping or systematic reviews. To maintain the relevance of findings to recent developments in digital health, Studies published in English between January 2015 and May 2025 were included.

Studies were excluded if they focused exclusively on urban populations, did not examine technology acceptance or user engagement, or were non-peer-reviewed materials such as editorials, commentaries, conference abstracts, or other forms of grey literature.

Systematic and scoping reviews were included to capture higher-level syntheses and recurring patterns of barriers and facilitators, complementing primary studies and allowing triangulation of evidence. The inclusion and exclusion criteria used to guide study selection are summarized in Table 1.

Table 1. Inclusion and exclusion criteria for study selection

Criteria	Inclusion	Exclusion
Population	Perinatal women (pregnant, breastfeeding, postpartum)	Urban populations
Intervention	Digital health tools for breastfeeding support	Non-digital or traditional interventions
Study Design	Primary studies and scoping/systematic reviews	Grey literature, editorials
Setting	Rural, semi-rural, or remote	Urban or high-income exclusive

Information sources and search strategy

A comprehensive literature search was conducted across six major electronic databases: Scopus, PubMed, Wiley Online Library, ScienceDirect, DOAJ, and Web of Science. The search was carried out between May 1 and July 15, 2025, with the aim of identifying peer-reviewed studies related to the acceptance of digital health technologies for breastfeeding support among perinatal women in rural settings. To ensure thorough coverage, additional records were identified through manual screening of reference lists from included studies.

The search strategy combined both free-text terms and controlled vocabulary (e.g., MeSH terms), with Boolean operators applied to structure the search across databases. The core search terms included:
("digital health" OR "mHealth" OR "mobile health" OR "text messaging" OR "telehealth") AND ("breastfeeding" OR "lactation support" OR "exclusive breastfeeding") AND ("acceptance" OR "feasibility" OR "uptake" OR "user perception") AND ("perinatal women" OR "pregnant women" OR "postpartum") AND ("rural" OR "remote" OR "semi-rural") Search terms were refined as needed to align with the indexing systems and search interfaces of each database (Table 2). No restrictions were applied beyond limiting results to English-language articles published between July 1, 2015, and July 1, 2025.

Table 2. Search strategy

Database	Search Terms	Total Results
PubMed	("digital health" OR "mHealth" OR "mobile health" OR "text messaging" OR "telehealth") AND ("breastfeeding" OR "lactation support" OR "exclusive breastfeeding") AND ("acceptance" OR "feasibility" OR "uptake" OR "user perception") AND ("perinatal women" OR "pregnant women" OR "postpartum") AND ("rural" OR "remote" OR "semi-rural")	83
Scopus	("digital health" OR "mHealth" OR "mobile health" OR "text messaging" OR "telehealth") AND ("breastfeeding" OR "lactation support" OR "exclusive breastfeeding") AND ("acceptance" OR "feasibility" OR "uptake" OR "user perception") AND ("perinatal women" OR "pregnant women" OR "postpartum") AND ("rural" OR "remote" OR "semi-rural")	117
Wiley Online Library	("digital health" OR "mHealth" OR "mobile health" OR "text messaging" OR "telehealth") AND ("breastfeeding" OR "lactation support" OR "exclusive breastfeeding") AND ("acceptance" OR "feasibility" OR "uptake" OR "user perception") AND ("perinatal women" OR "pregnant women" OR "postpartum") AND ("rural" OR "remote" OR "semi-rural")	42
ScienceDirect	("digital health" OR "mHealth" OR "mobile health" OR "text messaging" OR "telehealth") AND ("breastfeeding" OR "lactation support" OR "exclusive breastfeeding") AND ("acceptance" OR "feasibility" OR "uptake" OR "user perception") AND ("perinatal women" OR "pregnant women" OR "postpartum") AND ("rural" OR "remote" OR "semi-rural")	55
DOAJ	("digital health" OR "mHealth" OR "mobile health" OR "text messaging" OR "telehealth") AND ("breastfeeding" OR "lactation support" OR "exclusive breastfeeding") AND ("acceptance" OR "feasibility" OR "uptake" OR "user perception") AND ("perinatal women" OR "pregnant women" OR "postpartum") AND ("rural" OR "remote" OR "semi-rural")	34

Database	Search Terms	Total Results
Web of Science	("digital health" OR "mHealth" OR "mobile health" OR "text messaging" OR "telehealth") AND ("breastfeeding" OR "lactation support" OR "exclusive breastfeeding") AND ("acceptance" OR "feasibility" OR "uptake" OR "user perception") AND ("perinatal women" OR "pregnant women" OR "postpartum") AND ("rural" OR "remote" OR "semi-rural")	91
Total		**422**
Duplicates removed	Removed using Mendeley's deduplication feature	**193**
Total screened	Screened using the Covidence platform	**229**

Study selection

All records retrieved from the database searches were imported into Rayyan (23), an online platform for managing systematic reviews. Duplicate entries were automatically detected and removed. The remaining citations underwent a two-stage screening process. In the first stage, two independent reviewers screened all titles and abstracts to assess their relevance based on the predefined inclusion and exclusion criteria. In the second stage, the full texts of potentially eligible studies were retrieved and reviewed in detail for final eligibility.

Each article was evaluated using a standardized eligibility framework aligned with the review question. Any discrepancies between reviewers were resolved through discussion; if agreement could not be reached, a third reviewer served as an adjudicator. The entire study selection process followed the PRISMA 2020 guidelines and is illustrated in Figure 1. In total, 22 studies were included in the final scoping review.

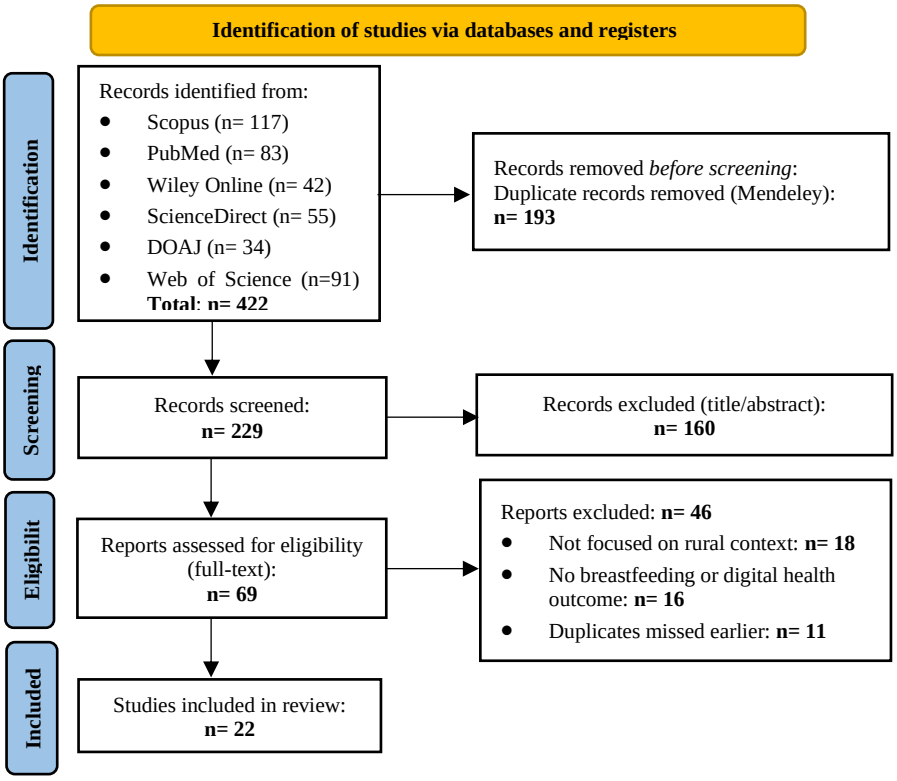

Figure 1. PRISMA-based flowchart illustrating identification, screening, and inclusion of studies

Data extraction

A standardized data extraction form was developed and consistently applied across all included studies to ensure the systematic collection of relevant information. Key variables extracted included the author(s), year of publication, country or region of the study, and the study design (qualitative, quantitative, or mixed-methods). Detailed data were also collected on the study population, with particular attention to rural or remote contexts and relevant sociodemographic characteristics. The type of digital health intervention was documented, including mobile applications, SMS-based

programs, telehealth services, or web-based platforms. Key findings related to the use and impact of the interventions were noted, along with reported barriers to technology acceptance and identified facilitators that supported user engagement (Table 3). Data extraction was conducted independently by two reviewers to ensure accuracy and consistency. Discrepancies were resolved through discussion, and a third reviewer was consulted when necessary. All extracted data were compiled into a structured summary table to support comparison and thematic synthesis across studies.

Table 3. Digital health acceptance in breastfeeding support among rural perinatal women

Ref .no	Country/ Region	Study design	Population	Type of digital intervention	Key findings	Barriers	Facilitators
(2)	Australia	Prospective longitudinal self-report survey design	Rural Australian breastfeeding women in southwest Victoria, Australia	Smartphone application: Breastfeeding Solutions	- High usability and acceptability: 93.5% rated the app favorably, 96.8% found it helpful, and 87.1% would recommend it. - High breastfeeding rate at 6 months: 79% of participants were breastfeeding. -Comparison to local rate: Higher than the local breastfeeding rate at 6 months (approximately 50%).	-Difficulty in accessing local breastfeeding resources -Limited access to reliable, evidence-based information	The facilitators in this study include the "Breastfeeding Solutions" app itself, which was found to be usable and helpful by participants, and the support it provided to rural breastfeeding women. The app's accessibility and usefulness facilitated breastfeeding by providing reliable, evidence-based information.
(3)	USA/ Pennsylvania	Descriptive study within the context of a randomized controlled trial, using online surveys and EMR call log data.	Rural, predominantly Caucasian mothers in Pennsylvania, aged >18 years, with infants of gestational age >35 weeks, who initiated breastfeeding and planned to continue after hospital discharge.	Telelactation services using a mobile app (Pacify Health) for video calls with lactation consultants	- High participation rate with 92% completing the final survey. -50% of participants used telelactation services, with 33% having substantive discussions about breastfeeding challenges. -Users were more likely to be working at 12 weeks postpartum and less likely to have prior breastfeeding experience or to have breastfed exclusively. -Most video calls occurred in the first month, with 41% outside business hours. -Common topics discussed included breast pain, nipple shield use, and latch issues. -High satisfaction rate among users (91%). -Higher uptake rate compared to other telehealth interventions. -Study limited to rural, predominantly Caucasian population.	-Lack of access to IBCLCs in rural areas - Lower breastfeeding initiation rates in rural areas -Breast pain, soreness, and infection - Use of nipple shields -Latch or positioning issues - Milk supply and production concerns - Breast pump use issues - Not experiencing breastfeeding problems - Discomfort with video calls -Cessation of breastfeeding - Being too busy -Technical difficulties with internet connectivity	- Introduction by trusted healthcare providers - Orientation to the app, including a test call -Convenience and flexibility (shorter call durations, scheduling outside business hours) -Commitment to long-duration, exclusive breastfeeding - Increased access to professional breastfeeding support in rural areas
(4)	Australia/ Victoria	Mixed-method pre-post feasibility study	Rural Australian breastfeeding women in southwest Victoria, Australia (Pregnant women 20–30 weeks of gestation)	mHealth app (My Baby Now app)	- The My Baby Now app is feasible for providing perinatal breastfeeding support. - Mothers without university education rated the app higher in quality, usefulness, and impact compared to those with university education. -Breastfeeding knowledge increased from 59.6% to 66.5% ($p < 0.001$) from baseline to 36-38 weeks of gestation. -Exclusive breastfeeding intentions increased from 76.6% to 80.9% ($p < 0.001$) from baseline to 36-38 weeks of gestation. -Breastfeeding attitudes and confidence scores increased significantly from baseline to 36-38 weeks of gestation and from baseline to 8-12 weeks post-partum. -App engagement during pregnancy predicted changes in breastfeeding attitudes for mothers without university education.	-Suboptimal breastfeeding rates, particularly for women with lower socioeconomic position. - Poor quality of breastfeeding apps. -Differences in perception of app quality and usefulness based on educational background. -Limited effectiveness of app engagement in predicting changes in breastfeeding knowledge, confidence, or intentions.	The My Baby Now app itself is a facilitator for breastfeeding support. It was particularly facilitative for mothers without university education, who rated it higher in quality and usefulness. App engagement during pregnancy facilitated changes in breastfeeding attitudes among this group.

Ref .no	Country/ Region	Study design	Population	Type of digital intervention	Key findings	Barriers	Facilitators
(5)	USA/ Pennsylvania	Randomized Controlled Trial (RCT) with a pragmatic, parallel design	Rural breastfeeding women in Pennsylvania	Telelactation via personal electronic devices, including video calls	- Telelactation can be implemented with a rural underserved population. - Participants in the telelactation arm had slightly higher rates of breastfeeding and exclusive breastfeeding at 12 weeks postpartum compared to the control group. -Differences in breastfeeding rates between the telelactation and control groups were not statistically significant. -Telelactation remains a promising approach for further investigation despite the lack of significant differences in breastfeeding outcomes.	- Lack of access to lactation support in rural areas -Geographical distance and lack of access to in-person lactation services	-Use of personal electronic devices -Video calls -Ability to reach rural underserved populations - Potential for future research and application
(6)	China	Randomized Controlled Trial (RCT)	First-time mothers aged 18 years or above, 14-36 weeks pregnant, living in Huzhu County, Qinghai Province, China, with no known illness limiting breastfeeding, able to use WeChat, and willing to participate	WeChat-based digital health education program with components including feeding lecture classroom, feeding knowledge competition, baby growth chart, online forum, and rewards system.	The study explores using WeChat to promote breastfeeding in rural China. It provides tailored educational content (text, videos, pictures) based on WHO guidelines, targeting pregnant women and mothers at different stages. The intervention aims to improve exclusive breastfeeding rates, knowledge, and practices. The study found that the intervention group showed increased breastfeeding knowledge and better practices compared to the control group. The WeChat platform's popularity in China makes it a promising tool for health promotion. Limitations include recruitment from a single rural county and potential bias.)	-Socio-economic, cultural, and individual factors: maternal age, illness, delivery patterns, premature delivery, lactation factors, food intake before breastfeeding, infant's sucking ability, mother's milk supply, intention to breastfeed, understanding of breastfeeding benefits, breastfeeding experience, returning to work, family support. -Lack of education and support: limited knowledge about exclusive breastfeeding duration, and few receive feeding information during pregnancy or after delivery. -Limited time and resources of health workers to provide breastfeeding education.	-Feeding lecture classroom: Provides key breastfeeding knowledge and infant feeding advice. -Feeding knowledge competition: Tests mothers' knowledge of breastfeeding. - Baby growth chart: Based on the WHO growth chart standard for monitoring infant growth. -Online forum: Provides feedback activity between mothers and experts. -Rewards component: Stimulates participation in the study.
(7)	Indonesia	Quasi-experimental group control pre- and post-test	All pregnant women entering the 8th month of North Tomohon Subdistrict (Kakaskasen Public Health Center) numbered as many as 134 people.	The type of digital intervention used in this study is the use of WhatsApp (WA) groups for sending videos, E-Modules, and conducting question-and-answer sessions to support exclusive breastfeeding .	-The intervention group had a higher mean score for the success of exclusive breastfeeding compared to the control group. -Technology-based support increased mothers' self-confidence and knowledge about breastfeeding. - The use of WhatsApp groups, videos, and e-modules was effective in supporting breastfeeding mothers. - Technology-based support had a positive impact on the success of exclusive breastfeeding during the first 40 days postpartum.	-Lack of knowledge - Lack of support from health workers and family -Family environment challenges -Workplace challenges -Social environment challenges -Mother's characteristics challenges -Household chores - Work schedules - Family influences -Low milk production - Swollen breasts or sore nipples	Health workers providing mentoring activities through technology (videos, e-modules, WA groups) for exclusive breastfeeding support.
(8)	India/ Northern India	Qualitative study using in-depth interviews and framework analysis, oriented by the Realist	The population in this study consisted of 16 postpartum women aged 21-35, married, living	- Type: Interactive mHealth community-based postnatal intervention	- High acceptability and perceived impact of MeSSSSage among participants. - Satisfaction with educational content and social support. - Increased capability and motivation to adopt healthy behaviors.	- Network and connectivity challenges - Lack of time due to household responsibilities -Feeling uncomfortable	- Family buy-in, particularly from the husband and mother-in-law - Features of the mobile App and group chats: repeat mode for audio messages and videos

Ref .no	Country/ Region	Study design	Population	Type of digital intervention	Key findings	Barriers	Facilitators
		Evaluation approach.	in intergenerational households, with at least a primary education, and some living below the poverty line. They were part of a larger group of users of the MeSSSSage intervention in rural Northern India.	- Modalities: Mobile app, Interactive Voice Recognition System (IVR), Virtual weekly meetings, Group text chat (WhatsApp) -Focus: Promoting healthy maternal behaviors such as breastfeeding , immunization, and care-seeking -Theoretical Framework: COM-B model	- Technical issues (network connectivity, app download difficulties) as barriers. - Sociocultural factors (household responsibilities, comfort levels) as barriers. - Family buy-in and support as facilitators.	sharing personal experiences - Technical difficulties with the mobile application - Lower literacy levels -Lack of guidance regarding interaction with other users - Sociocultural factors, including social norms around household responsibilities and childcare - Perception of competitiveness and breach of privacy during group calls	-Intervention moderator's guidance on technological issues - User motivation
(9)	USA	Secondary analysis of a randomized control trial (RCT) with participants stratified into usage quartiles based on app usage.	Nulliparous, low-income women	- Control App: Digital breastfeeding handouts - Breastfeeding Friend (BFF) App: Interactive app with on-demand educational and video content	- Increased usage of breastfeeding apps did not improve breastfeeding rates among low-income women. - Rates of sustained and exclusive breastfeeding were similar between high and low app usage groups. - Smartphone apps were the most preferred breastfeeding resource at 6 weeks postpartum. - Over 50% of users preferred technology-based breastfeeding resources, including alternative online resources.	- Reliance on public transportation -Need to bring additional family members to appointments - Transportation issues - Privacy concerns	-Providing access to smartphones and prepaid internet services to ensure financial barriers do not limit access to breastfeeding resources. - Preference for in-person breastfeeding support during hospitalization and mHealth resources post-discharge. - High usage of breastfeeding apps as a preferred resource. - Potential for telelactation to minimize barriers such as transportation and childcare issues. - Provision of useful educational content and ensuring that resources are utilized by patients.
(10)	China	2-arm randomized controlled trial	This 2-arm randomized controlled trial was conducted among pregnant women from May 2019 to April 2020 in Huzhu County, Qinghai Province, China.	WeChat official account with four components: feeding messages, feeding knowledge competition, baby growth chart, and online forum.	- At 0-1 month postpartum, the exclusive breastfeeding rate was significantly higher in the intervention group (81.1%) compared to the control group (63.3%). - The intervention increased predominant breastfeeding rates and reduced dairy product supplementation at 0-1 month postpartum. - Although not statistically significant, the intervention group had higher exclusive breastfeeding rates at 2-3 and 4-5 months postpartum. - The WeChat intervention was effective in promoting exclusive breastfeeding in early life by reducing dairy product supplementation.	- Lack of access to accurate breastfeeding information in rural areas - Pressure from family and social culture to introduce formula or wean early -Gap between knowledge and practice -Lack of support in addition to education - Unsustainability of intervention effects over time	WeChat as a platform for providing breastfeeding information and support; WeChat's ability to be used in addition to local breastfeeding promotion programs; WeChat's effectiveness in improving breastfeeding practices and behavior change.
(11)	Iran	Randomized Controlled Trial (RCT) with two arms: intervention (smartphone app education + routine care) and control (routine care)	-Location: Urmia, Iran - Age of infants: Mean age of 1.25 months for the intervention group and 0.98 months for the control group	Smartphone -based educational app	- The smartphone-based educational intervention significantly improved mothers' knowledge, attitude, and practice (KAP) related to breastfeeding. - The intervention group showed significant increases in knowledge and attitude scores compared to the control group. - The practice score showed marginal significance, indicating some	-New mothers encounter several breastfeeding challenges. -Lack of knowledge about lactation improvement. -Low confidence in possessing breastfeeding skills.	Facilitators include the use of mHealth technology, evidence-based content from the Ministry of Health guidelines, a participatory design process, regular follow-ups by midwives, comprehensive app content, and

Ref .no	Country/ Region	Study design	Population	Type of digital intervention	Key findings	Barriers	Facilitators
			-Age of mothers: Mean age of about 26 years -Education: 30% had an academic education - Job status: 75% were homemakers - Income status: 51.25% had a middle-high income status -Residency: 71.25% lived in rural areas		improvement but not as pronounced as knowledge and attitude. - Breastfeeding self-efficacy significantly improved in the intervention group compared to the control group. - The intervention had a positive effect on breastfeeding self-efficacy and maternal KAP.	-Lack of support from healthcare providers in delivering educational materials. -Concerns about the quality of health-related apps providing inaccurate information. -Limited intervention period and app availability.	recommendations by health professionals.
(12)	India	Pilot study with an intervention and control group, testing the usability of the BEST4Baby app in supporting exclusive breastfeeding practices in rural India.	Mothers residing in rural India	mHealth app for peer counselors to support exclusive breastfeeding practices	- The study's findings align with best practices in user-centered design to address EBF barriers. - The BEST4Baby app was culturally tailored and aligned with the WHO breastfeeding programs. - The app was highly usable, scoring over the 95th percentile on the SUS scale. - The app statistically increased EBF practices. - The app was accepted by PCs and led to positive outcomes in EBF rates. - The app was an important support tool for PCs during home visitations.	Low rates of exclusive breastfeeding in low- and middle-income countries, including India, are falling below the WHO benchmark of 90%.	Peer counselors (PCs)
(13)	Malaysia	2-arm, parallel, single-blind, cluster randomized controlled field trial	Pregnant women between 34 and 37 weeks of pregnancy in the Hulu Langat District, Selangor, who were primigravida or multigravida and had previously failed to exclusively breastfeed. Total participants: 172 (86 intervention, 86 control).	Hybrid digital intervention using WhatsApp for follow-up and reinforcement, based on social cognitive theory	- Significant increase in breastfeeding self-efficacy in the intervention group compared to the control group. - Significant increase in breastfeeding knowledge in the intervention group compared to the control group. -No significant difference in breastfeeding attitude between the intervention and control groups. -Face-to-face and WhatsApp communication were effective in improving self-efficacy and knowledge. - Recommendations for further research with a longer duration and new strategies to improve breastfeeding attitudes.	-Difficulty in tracking engagement with intervention materials distributed via WhatsApp. - Limited accessibility for individuals without access to a smartphone.	-Face-to-face sessions: health educational talks, practical video demonstrations, model demonstrations, group discussions - Introduction to the district's breastfeeding support group - Use of WhatsApp for follow-up and communication - Assistance from the breastfeeding support group
(14)	USA/ District of Columbia	Mixed-methods study with two phases: Phase 1 for identifying technological components and content, Phase 2 for testing prototype usability, using the community -based participatory research and user-centered technology design methods;	Pregnant and postpartum African American women from the District of Columbia	Mobile health app with text messaging technology	- Participants preferred an app with text messaging technology. - Identified areas for intervention: self-efficacy, parent-child attachment beliefs, social support, public breastfeeding and social desirability, and returning to work. - Desired features: local resources, support person access, baby care logs, identification of public breastfeeding venues, and peer discussions. - System Usability Scale score: 73.8, indicating above average usability. - KULEA-NET can meet breastfeeding needs and build social desirability.	-Lower breastfeeding rates among African Americans -Psychological and social barriers: self -efficacy, parent-child attachment beliefs, social support, public breastfeeding and social desirability, returning to work - Unclear appeal of African American -specific interventions - Challenges in addressing mixed feeding practices	-Self-efficacy -Parent-child attachment beliefs -Social support -Public breastfeeding and social desirability -Returning to work - Local resources -Support person access - Baby care logs -Identification of public breastfeeding venues - Peer discussions -Building social desirability -Complementing traditional healthcare

Ref .no	Country/ Region	Study design	Population	Type of digital intervention	Key findings	Barriers	Facilitators
		involving focus groups, in-depth interviews, and usability testing with the System Usability Scale.					
(15)	Indonesia	quasiexperimental study with a pre-post control design	100 pregnant women in their third trimester until their infants were 7 days old, from Candirejo, Magetan, East Java, Indonesia	Mobile application (Breast Milk Mother) providing information on breastfeeding	-The "Breast Milk Mother" mobile applications effectively improve knowledge, attitudes, breastfeeding timing, and breast milk adequacy for infants. - Initially, there were no significant differences in knowledge and attitudes between the intervention and control groups. -Post-treatment, significant differences were observed, indicating the effectiveness of the intervention. - Both groups showed significant improvements in knowledge and attitudes after treatment.	Barriers for the Breast Milk Mother app include limited smartphone access, technical issues, user difficulties with navigation, and limited geographical scope. Sustained user engagement and long-term participation can also be challenging.	The "Breast Milk Mother" mobile applications are the facilitators in this study, as they provide information on breastfeeding and are effective in improving knowledge, attitudes, breastfeeding timing, and breast milk adequacy for infants.
(16)	USA	Randomized Controlled Trial (RCT)	Underserved, rural mothers	Direct-to-consumer telelactation	The study found that 44% of rural, underserved mothers used a telelactation app for breastfeeding support, with common topics including milk supply, latching, and breast pump use. Utilization was more likely among women with lower household incomes and those comfortable with mobile apps. Non-users cited reasons such as no perceived need for support, privacy concerns, or lack of access. Despite free, unlimited access, few mothers used the service frequently, indicating the need for more personalized engagement to boost usage.)	-Unmet need for lactation support in the US - Lack of published research on telelactation among underserved mothers - Limited access to professional breastfeeding support in underserved communities	-Improved convenience -Improved timeliness - Reduced costs -Increased access to professional breastfeeding support in underserved communities
(17)	Uganda	Randomized Controlled Trial (RCT)	Pregnant women with limited education initiating antenatal care in Uganda	Mobile health app (MatHealth App)	- Women in the MatHealth App arm had higher odds of knowing the recommended gestation period for starting ANC, the number of ANC visits, and HIV testing timing and frequency. - All women in the MatHealth App arm exclusively breastfed their babies and brought them for HIV testing at 6 weeks. - Just over half of the women attended at least 4 prenatal visits. - Lack of transport to the clinic was the main reason for noncompliance with ANC appointments. - The app increased knowledge and practices, but not to a statistically significant.	Lack of transport to the clinic	The mobile health app (MatHealth App) itself is a facilitator for improving maternal and child health knowledge and practices, particularly in exclusive breastfeeding and timely HIV testing. It may also facilitate adherence to prenatal care recommendations
(18)	USA	Two-group repeated measures quasi-experimental design	Rural Hispanic women	Computer-based breastfeeding education program	-Duration of breastfeeding did not differ between intervention and control groups. - Greatest decline in breastfeeding occurred between weeks 2 and 6 and months 3 and 6. - Top reasons for discontinuing breastfeeding: milk supply issues, returning to work, and latch problems. - Breastfeeding mothers had higher self-efficacy scores, significantly so at week 6 and months 3 and 6. - Computer-based program showed potential in improving breastfeeding self-efficacy in rural Hispanic women.	issues with milk supply, returning to work, and latch	- Greater self-efficacy scores - Use of the bilingual computer-based breastfeeding education support program
(19)	Indonesia	True Experiment with Control Group Pretest and Posttest Design	Breastfeeding mothers with babies 0-4 months, total population of 181	Mobile phone application (MAPSI)	- A mobile phone application was proven effective in reducing breastfeeding problems. - There was a significant difference in pretest and posttest scores in the intervention group ($p<0.05$), but not in the control	-Lack of knowledge among breastfeeding mothers - Perceptions of low breastmilk production -Physical problems	The mobile phone application (MAPSI) used in the study is a facilitator as it effectively improves mothers' knowledge about breastfeeding problems

Ref .no	Country/ Region	Study design	Population	Type of digital intervention	Key findings	Barriers	Facilitators
					group. - Posttest scores differed significantly between the intervention and control groups ($p<0.05$). - The application improved mothers' knowledge about breastfeeding problems.	- Lack of family support -Lack of workplace support -Negative attitude towards exclusive breastfeeding -Breastfeeding problems (sore nipples, inappropriate technique, swelling, blocked ducts, mastitis, breast abscesses) - Age - Economic status - Early pacifier use -History of breast surgery - Type of exercise - Early breastfeeding initiation -Breastfeeding attachment - Prematurity - Experience - Cultural beliefs - Lack of support	prevention and reduces breastfeeding issues.
(20)	Nigeria	Cluster-randomized controlled trial	Microcredit clients in Nigeria, specifically women of all ages, with a target group of 195 women whose babies were born during the intervention.	Group cell phone messaging to promote breastfeeding practices among microcredit clients in Nigeria, involving weekly voice and text messages shared by a designated recipient within each group.	- Group cell phones were feasible and acceptable for promoting breastfeeding practices among microcredit clients in Nigeria. - 64% of the target group found the group phone system to work well or very well. - Trust in information and support from others were key motivators for trying recommended practices. - Regular meetings and message sharing were associated with higher odds of exclusive breastfeeding. - Non-phone recipients had positive feelings towards phone recipients, and messages were often shared outside the group. - Group cell phones can be an effective part of a behavior change package, especially for reaching disadvantaged women.	- Disparities in cell phone penetration, particularly affecting women in low and middle-income countries. -Low percentage of women who are phone recipients within their groups. - Inadequacy of having only one phone per group for efficient message dissemination. -Technical issues such as trouble hearing messages, needing phone repairs, and network coverage problems. -The sustainability of providing cell phones to groups is impractical on a large scale.	-Trust in the information provided (58%) - Support from others (35%) -Regular sharing of messages within groups (44% met at least once a week) -Positive feelings towards phone recipients -Group phone meeting participants' needs - Sharing of messages outside the group - Role of older women as conduits for messages
(21)	India	Qualitative analysis of digital support groups	Expectant and new mothers in rural India	Digital support groups facilitated through WhatsApp	- Digital support groups on WhatsApp compensate for gaps in existing healthcare for expectant and new mothers in low-resource settings. - These groups provide reassurance and support on routine health, explanation of test reports, validation, and counseling support in ongoing treatments. - The use of digital support groups has implications for future research on unplatformed design models in resource -constrained settings.	Limited interaction with professionals, infrastructural constraints, social constraints	Non-government organization in India
(22)	Pakistan	A three-arm, 10-month, multicentre, randomized controlled trial conducted at 15 social franchise health facilities in Punjab, Pakistan, with	Pregnant women aged 15-44 years in their first or second trimester with access to a mobile phone, literate, and permanent	mHealth intervention using text and voice messages, and interactive phone calls	-Expected increase in antenatal visits, skilled birth, postpartum contraceptive use, postnatal check-ups, child immunization, and breastfeeding. -Potential non-inferiority of text and voice messages compared to interactive calls for promoting healthcare.	- Side effects or health concerns related to contraceptive methods - Unavailability of contraceptive methods - Lack of access to health services - High	-Increasing mobile penetration and declining prices of mobile services - High mobile phone ownership among the target population

Ref .no	Country/ Region	Study design	Population	Type of digital intervention	Key findings	Barriers	Facilitators
		participants randomly allocated to receive voice and text messages, interactive telephone-based counselling, or no additional phone-based support.	residents in the catchment area of social franchise health facilities in Punjab province, Pakistan.		- Insights into challenges and best practices in postpartum family planning services. -Use of mobile technology as a reference for promoting reproductive health and family planning.	maternal mortality ratio despite universal awareness of family planning -Significant unmet need for family planning -High unmet need for postpartum family planning - Low adoption rate of modern contraceptive methods postpartum - Lack of follow-up visits after discharge -Social taboo around family planning	
(23)	India	Quasi-Experimental Pre-Post Pilot Study	Postpartum mothers and their infants in Punjab, India (n=135)	- Provider -led group sessions -Virtual mHealth support through: -Weekly calls - Texts - Interactive voice response (IVR) - Phone app	-Participants in the synchronous arm showed a statistically significant increase in knowledge of infant danger signs compared to the control arm. - Participants in the synchronous arm had nearly 3-fold increased odds of an infant health checkup by a clinical provider compared to the asynchronous arm. - No significant differences were noted in age-appropriate vaccine coverage among infants between arms, with coverage being over 80% across all arms. -Early initiation of breastfeeding remained low across all arms (~47%). -The study showed modest yet promising results, indicating a need for further rigorous testing.	-Low maternal knowledge of infant danger signs - Limited improvement in maternal knowledge despite intervention -Low rate of early initiation of breastfeeding -No significant improvement in age-appropriate vaccine coverage	Research personnel with backgrounds similar to community health officers

Data synthesis

Extracted data were synthesized using a descriptive and thematic approach. Summary tables were constructed to present the characteristics and findings of the included studies. A thematic analysis was performed to identify recurring patterns, themes, and insights regarding the barriers and facilitators to digital health technology acceptance for breastfeeding support in rural perinatal populations. Findings are presented narratively and are supported by relevant tables and figures to enhance clarity and interpretation.

Methodological quality review

The methodological quality of the 22 studies included in this review was critically appraised using the Mixed Methods Appraisal Tool (MMAT) (24), a comprehensive framework designed to evaluate diverse research designs. All studies passed the two initial screening criteria, confirming the presence of clearly formulated research questions and data collection strategies appropriate to address those questions.

Among the included studies, two employed mixed-methods designs, three adopted qualitative approaches, and seventeen followed quantitative methodologies, comprising randomized controlled trials, quasi-experimental designs, and descriptive studies. The mixed-methods studies were assessed using criteria focused on the rationale for methodological integration, the coherence between components, and the rigor of each strand. Both studies met all five criteria, reflecting a high standard of methodological integrity.

Quantitative studies were evaluated on the relevance of the sampling strategy, representativeness of the sample, appropriateness of measurements, potential non-response bias, and the adequacy of statistical analysis. While most studies satisfied at least four out of five criteria, some were rated "Can't tell" in relation to non-response bias due to insufficient reporting on recruitment procedures and participant

attrition, particularly in studies conducted in low-resource or geographically isolated settings.

The qualitative studies were reviewed for alignment between data sources and research objectives, methodological transparency, and the depth of interpretation. All three studies met most criteria, although minor concerns were noted in two cases due to limited detail in the description of analytic procedures.

Overall, 20 studies were rated as high quality (five stars), while 2 were rated as moderate quality (four stars). No studies were classified as low quality. Despite isolated limitations related to reporting and sample representation, the overall methodological quality of the included studies was sufficient to ensure confidence in the validity and reliability of the evidence base. A full summary of the appraisal findings is presented in Table 4.

The overall methodological quality informed the weighting of findings: themes drawn primarily from high-quality studies were prioritized in the synthesis, while evidence from moderate-quality studies was interpreted cautiously and highlighted as areas requiring further research.

Table 4. Quality appraisal

Category of Study Design	Wheaton et al. (2018)	Kapinos et al. (2019)	Laws et al. (2023)	Uscher-Pines et al. (2020)	Wu et al. (2019)	Pasambo et al. (2022)	Cox et al. (2023)	Griffin et al. (2021)	Wu et al. (2020)	Seyyedi et al. (2021)	Ma et al. (2022)	Mohamad Pilus et al.	Patchen et al. (2020)	Usnawati & Hanifah	Uscher-Pines et al. (2019)	Musimenta et al. (2022)	Aguirre et al. (2018)	Ependi et al. (2022)	Flax et al. (2017)	Yadav et al. (2022)	Gul et al. (2019)	Verma et al. (2025)
S1. Clear research question?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S2. Data answer the research question?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Qualitative 1.1	NA	NA	Yes *	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	NA	Yes *	NA	NA
Qualitative 1.2	NA	NA	Yes *	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	NA	Yes *	NA	NA
Qualitative 1.3	NA	NA	Yes *	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	NA	Yes *	NA	NA
Qualitative 1.4	NA	NA	Yes *	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	NA	Yes *	NA	NA
Qualitative 1.5	NA	NA	Yes *	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	NA	Yes *	NA	NA
Quantitative 4.1	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *
Quantitative 4.2	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *
Quantitative 4.3	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *
Quantitative 4.4	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *
Quantitative 4.5	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	Yes *	NA	Yes *	Yes *
Mixed Methods 5.1–5.5	NA	NA	Yes *	NA	NA	NA	NA	NA	NA	NA	NA	NA	Yes *	NA	NA	NA	NA	NA	NA	NA	NA	NA
Quality Rating	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	4**** (Medium)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	5***** (High)	4**** (Medium)	5***** (High)	5***** (High)

*The asterisk (*) indicates that the criterion is applicable to the corresponding study design and that the study meets the criterion based on the assessment guidelines.

Results

A total of 22 peer-reviewed studies were included in this scoping review, spanning a wide range of geographic regions including Australia, the United States, Indonesia, Iran, Uganda, China, and Malaysia (25, 26, 27, 28, 29, 30, 31, 32,33,34,35,36,37,38,39,40,41,42,43,44,45, 46).

The included studies utilized various research methodologies, including qualitative, quantitative descriptive, and mixed-method designs. Publication dates ranged from 2017 to 2025, reflecting a growing body of research into the role of digital health tools in supporting maternal and infant care, especially within rural and underserved communities.

Study characteristics

The majority of studies targeted perinatal women residing in rural or semi-rural settings, including those who were pregnant,

breastfeeding, or in the early postpartum period (25, 26, 31). The types of digital health interventions employed varied considerably, ranging from mobile health (mHealth) applications (34), SMS-based reminder systems (41), and telehealth consultations (28) to interactive websites and online educational platforms (32, 38).

These technologies were generally designed to enhance breastfeeding outcomes by delivering targeted educational content, reinforcing evidence-based practices, and offering emotional or professional support. Some interventions integrated automated messaging features (45), peer support forums (36), real-time health provider chats (33), or culturally tailored content (42). Key objectives across the studies included improving breastfeeding initiation, exclusivity, and duration, while also strengthening maternal knowledge, confidence, and engagement.

Despite contextual and technological diversity, a unifying theme across all studies was the use of accessible and scalable digital strategies to address persistent barriers to breastfeeding support in rural communities (27, 35, 44).

Types of digital interventions

The 22 included studies employed a diverse array of digital health interventions aimed at enhancing breastfeeding practices among perinatal women. These interventions can be classified into four main categories based on their technological format and mode of delivery: mobile applications (mHealth), messaging services, telelactation, and social media platforms. An infographic summarizing the key features, purposes, platforms, and supporting studies of each digital intervention type is presented in Figure 2 below.

- *Mobile applications (mHealth)*

Mobile health apps were the most frequently used intervention type, featured in 15 out of 22 studies. These applications typically provided structured educational modules, breastfeeding tracking tools, behavior change prompts, push notifications, peer communication forums, and personalized guidance. Notable examples include My Baby Now, MAPSI, BEST4Baby, and Breast Milk Mother. mHealth apps were associated with improved maternal breastfeeding knowledge, increased confidence, and better breastfeeding outcomes across diverse geographic and socioeconomic contexts (25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43).

- *Messaging services (SMS and IVR)*

Two studies utilized messaging-based interventions, involving either SMS (short message service) or IVR (interactive voice response) systems. These interventions delivered time-sensitive breastfeeding tips, behavioral reminders, and motivational messages. Messaging tools were particularly effective in low-resource settings due to their low cost, broad accessibility, and compatibility with basic mobile phones (30, 44).

- *Telelactation (Video-based lactation support)*

Telelactation services appeared in 3 studies, providing synchronous, real-time video consultations with certified lactation consultants. These interventions allowed for immediate, individualized problem-solving, especially for mothers experiencing early breastfeeding difficulties. They proved particularly valuable during the COVID-19 pandemic and in rural or underserved communities with limited access to in-person care (26,28,46).

- *Social media and online forums*

Two studies employed social media platforms such as WhatsApp, Facebook, and Telegram to create virtual communities for breastfeeding mothers. These platforms enabled experience sharing, peer support, and emotional reinforcement, often within culturally sensitive frameworks.

The interactive and community-driven nature of social media proved effective in normalizing breastfeeding behaviors and reducing maternal isolation (29,45).

Across all studies, digital interventions were deployed as either standalone tools or as part of integrated hybrid models. These hybrid approaches often combine digital content with in-person counseling, phone-based support, or involvement from community health workers. The flexibility of digital formats, ranging from basic SMS to interactive mobile apps, demonstrates their potential scalability and adaptability across different healthcare systems and cultural contexts.

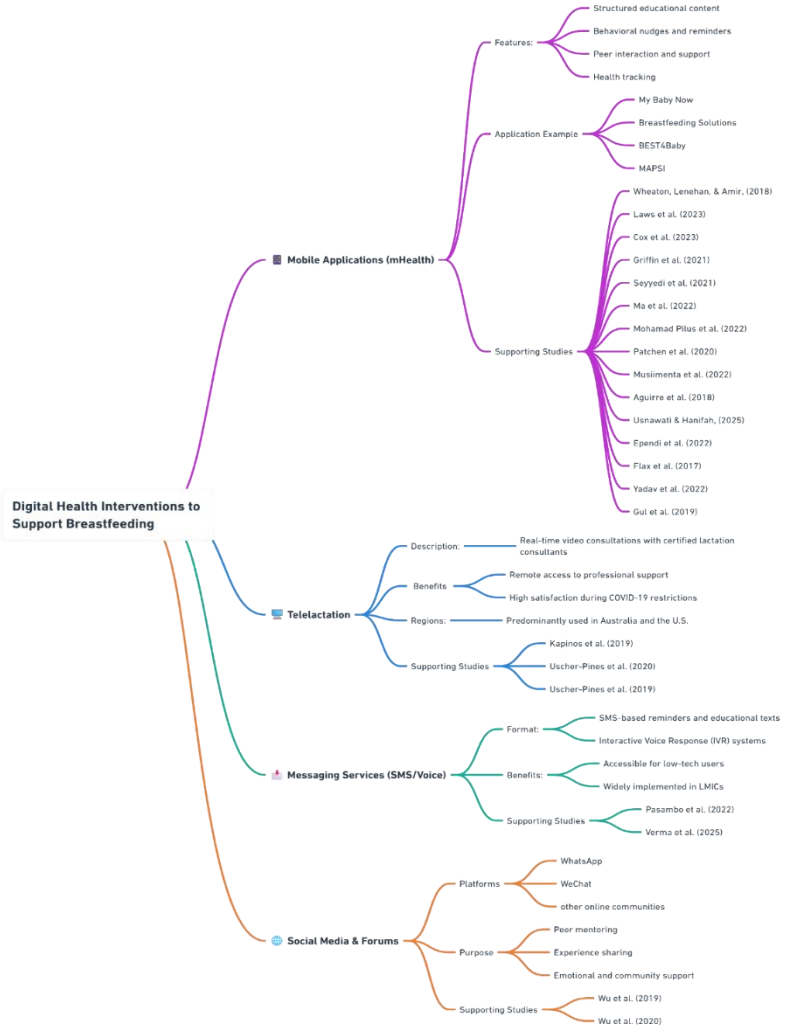

Figure 2. Classification of digital health interventions to support breastfeeding

Digital health tools and breastfeeding outcomes

Across the 22 studies reviewed, digital health interventions demonstrated notable positive impacts on various breastfeeding-related outcomes. These outcomes included:

- Increased rates of exclusive breastfeeding (EBF) within the first six months postpartum;
- Higher breastfeeding self-efficacy and confidence, particularly among first-time mothers;
- Improved maternal knowledge regarding breastfeeding techniques, benefits, and common challenges;
- Enhanced maternal satisfaction with the support received through digital channels.

In particular, studies such as those by Wu et al. (2019), Ma et al. (2022), and Mohamad Pilus et al. (2022) reported statistically significant improvements in breastfeeding behaviors and knowledge retention after the implementation of mobile-based educational apps. Similarly,

interventions utilizing telelactation services (e.g., (28,26) showed strong acceptability among rural users, especially during the COVID-19 pandemic when in-person lactation support was limited or unavailable.

Identified barriers to technology acceptance

Despite the promise of digital health tools, several challenges inhibited their full adoption and sustained use:

- Infrastructure limitations, such as poor internet connectivity, inconsistent electricity, or lack of smartphone ownership, especially in LMICs (41,37).
- Low digital literacy, particularly among older, less-educated women, leading to difficulties in navigating apps or understanding content (32,33).
- Cultural and social factors, including family resistance to exclusive breastfeeding, gender norms limiting decision-making autonomy, and stigma around technology use (30,31).
- Privacy and trust issues, such as concerns about sharing personal health information through digital platforms (36).
- Limited integration with formal health systems, where digital tools functioned in isolation without reinforcement from clinical care providers (44,38).

These barriers were more pronounced in settings with limited health infrastructure, lower education levels, or where breastfeeding practices were not widely supported at the household or community level.

Facilitators of successful implementation and use

Conversely, several factors were found to enhance the acceptability and success of digital breastfeeding interventions:

- Integration of human support, such as midwives, peer counselors, or community health workers, in hybrid models that combine digital education with personalized follow-up (34,30).
- Culturally appropriate design, including local language use, culturally resonant visuals, and alignment with traditional postpartum care practices (40,42).
- Interactive and multimedia content, such as video demonstrations, gamified quizzes, or real-time Q&A forums, which increased user engagement and information retention (36,29).
- Flexible access, allowing mothers to engage with content at any time, reducing reliance on clinic-based support and enabling asynchronous learning (26).
- Peer support platforms, such as WhatsApp or WeChat groups, which created safe spaces for emotional sharing and experience-based learning among breastfeeding mothers (45,42).

These facilitators significantly contributed to user retention, program satisfaction, and behavioral change. Notably, digital tools that embraced a human-centered design approach and incorporated social elements consistently outperformed those that were static or one-directional in nature.

Global insights and regional patterns

A comparative synthesis of the studies revealed that:

- In high-income countries (e.g., Australia, USA), the focus was on sophisticated app development, telelactation, and video-based interventions with attention to usability, privacy, and individual preferences.
- In low and middle-income countries (LMICs) (e.g., Indonesia, Iran, Uganda, Pakistan), interventions were more community-centered, utilizing low-tech tools such as SMS, WhatsApp, or basic mHealth apps, often supported by local health workers or NGOs.

Regardless of context, the most successful interventions shared three features:

- Accessibility, in terms of language, literacy level, and technology platform;
- Support structures, whether professional or peer-based;
- Cultural relevance, ensuring the technology is aligned with local beliefs, practices, and norms.

Collectively, these findings highlight a complex interaction between contextual determinants such as infrastructure, digital literacy, and sociocultural norms and the acceptance of digital health tools among perinatal women in rural settings. These relationships, and their influence on breastfeeding knowledge, self-efficacy, and exclusive breastfeeding (EBF) outcomes, are synthesized in Figure 3.

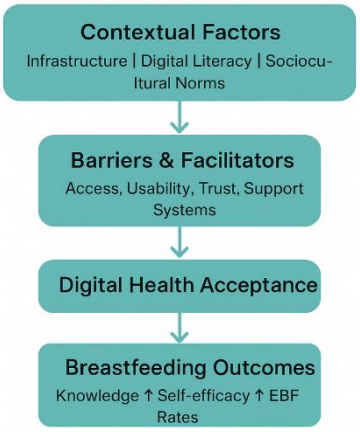

Figure 3. Conceptual model of barriers and facilitators

Discussion

This scoping review underscores the growing relevance of digital health interventions in supporting breastfeeding among perinatal women, particularly in rural and underserved settings. A synthesis of 22 peer-reviewed studies revealed a wide range of digital modalities ranging from mobile applications and SMS-based tools to telelactation and social media platforms that positively influenced breastfeeding behaviors, maternal knowledge, and emotional well-being.

Mobile health applications (mHealth) emerged as the most frequently utilized digital modality. These apps offered structured educational modules, tracking features, behavior change prompts, and community engagement tools. Grounded in behavior change theory, particularly Bandura's self-efficacy framework, these interventions enhanced maternal confidence and decision-making autonomy (47). Studies from Australia, Iran, and Malaysia reported significant improvements in exclusive breastfeeding duration and maternal engagement through apps like My Baby Now, MAPSI, and BEST4Baby (27,34,35,31). A recent systematic review by DeNicola et al. (2020) further supports the role of mHealth in improving breastfeeding outcomes across diverse populations.

Telelactation services provided real-time video access to lactation consultants and were widely accepted by mothers, particularly during the COVID-19 pandemic. Although these services were initially developed in high-income settings, recent studies demonstrate their expansion into LMICs through adaptive models supported by NGOs and mobile health teams (26,28,38). The WHO (2023) also highlights telemedicine, including telelactation, as a strategic priority to strengthen maternal and newborn health systems, especially in remote and post-crisis contexts.

Messaging-based interventions, particularly SMS and IVR (interactive voice response), offered scalable, low-cost solutions in areas with limited smartphone penetration. In Indonesia and Pakistan, such tools improved knowledge retention, encouraged early initiation of breastfeeding, and maintained user engagement (30,44). These findings align with WHO and UNICEF's Digital Health Guidelines, which recommend SMS-based outreach for improving maternal, newborn, and child health indicators (50).

Social media platforms, including WhatsApp, Facebook, and Telegram, played a vital role in peer-to-peer support and emotional resilience. Studies in China and Indonesia showed how group chats created supportive virtual communities that helped normalize

breastfeeding behaviors, address maternal anxieties, and foster a sense of connectedness (45,36). These digital forums echoed broader findings from systematic reviews by Lau, Htun, Wong, Tam, & Klainin-Yobas (2016), which underscore the value of social connectivity in enhancing breastfeeding duration and adherence.

Despite these positive outcomes, challenges persist. Infrastructure barriers such as limited internet coverage, intermittent electricity, and low device ownership remain significant in many LMICs. Furthermore, digital literacy gaps, particularly among older or less-educated mothers, reduced the usability and uptake of mobile tools (32,33,52). Cultural norms and gender dynamics often influenced technology acceptance, with family members or community expectations sometimes discouraging mothers from using digital tools or from breastfeeding exclusively (31,30). Issues of privacy, data security, and limited health system integration also undermined sustained engagement (36,44).

Several facilitators, however, emerged as essential to overcoming these challenges. The inclusion of human support midwives, peer counselors, or community health workers was critical to engagement, especially in hybrid models. Culturally tailored content and local language usage significantly enhanced trust and relevance (40,42). Interventions with interactive features, such as videos, quizzes, and personalized reminders, improved user experience and learning outcomes (29,36). Flexibility in access, allowing asynchronous use of tools, empowered mothers to engage at their own pace and reduced dependency on in-person services.

Global insights indicate that while high-income countries prioritize innovation, personalization, and data privacy, LMICs focus on community involvement, offline compatibility, and cost-effectiveness. Yet, across all contexts, successful interventions consistently shared three traits: accessibility, support systems, and cultural alignment. Digital breastfeeding interventions that embraced user-centered design and social connectedness rather than static, one-way messaging were more likely to achieve long-term behavioral change and maternal empowerment.

Structural barriers such as poor connectivity, low digital infrastructure, and limited health workforce contrast with cultural barriers like gender norms, stigma toward technology use, and intergenerational beliefs about breastfeeding. Understanding this distinction is critical: structural barriers require policy-level interventions, whereas cultural barriers demand community engagement and culturally adaptive strategies.

This review affirms the transformative potential of digital health in promoting equitable breastfeeding support. Future implementation should emphasize co-design with end-users, integration with national health infrastructure, and continuous evaluation to ensure digital equity, cultural relevance, and maternal agency.

These findings highlight key implications for nursing education and policy. Integrating digital literacy into nursing curricula and capacity-building programs can strengthen nurses' roles in facilitating technology-mediated breastfeeding support in rural settings. Policymakers should prioritize investment in digital infrastructure and culturally adaptive training to ensure equitable access to digital maternal health services.

Conclusion

Digital health technologies present promising solutions to support breastfeeding among perinatal women, especially in rural and low-resource settings. Interventions such as mobile applications, SMS reminders, telelactation, and social media platforms have demonstrated improvements in breastfeeding initiation, exclusivity, maternal knowledge, and self-efficacy. Their success is closely linked to cultural appropriateness, ease of access, and integration with human support systems like midwives and peer counselors.

While digital tools are not a substitute for direct care, they can effectively complement traditional services when designed inclusively and implemented within supportive community and health system frameworks. Moving forward, investments in digital literacy, infrastructure, and culturally sensitive content are critical to ensuring equitable and sustainable breastfeeding support.

Future research should explore cost-effectiveness analyses, longitudinal designs to track sustained technology use, and hybrid human–digital models integrating midwives or

peer counselors within digital platforms. Developing context-specific digital literacy training and localized content co-designed with rural women is also a key direction for equitable implementation.

References

1. Almohanna AA, Win KT, Meedya S. Effectiveness of internet-based electronic technology interventions on breastfeeding outcomes: systematic review. Journal of Medical Internet Research. 2020 May 29;22(5):e17361.
2. Whitehead L, Seaton P. The effectiveness of self-management mobile phone and tablet apps in long-term condition management: A systematic review. Journal of Medical Internet Research. 2016 May 16;18(5):e97.
3. Sulfikar A, Rajab MA. Evaluation of the feasibility of digital health applications based on best practice guidelines for diabetes management: A scoping review. Informatics in Medicine Unlocked. 2024 Jan 1;51:101601.
4. Gagnon MP, Desmartis M, Labrecque M, Car J, Pagliari C, Pluye P, Frémont P, Gagnon J, Tremblay N, Légaré F. Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. Journal of Medical Systems. 2012 Feb;36(1):241-77.
5. Lumbiganon P, Martis R, Laopaiboon M, Festin MR, Ho JJ, Hakimi M. Antenatal breastfeeding education for increasing breastfeeding duration. Cochrane Database of Systematic Reviews. 2016 Dec;12(12):CD006425.
6. Hossain S, Mihrshahi S. Effect of exclusive breastfeeding and other infant and young child feeding practices on childhood morbidity outcomes: associations for infants 0–6 months in 5 South Asian countries using Demographic and Health Survey data. International Breastfeeding Journal. 2024 May 16;19(1):35.
7. Gordon RD, Kishi A, Brown JA, Voisin C, Thomas N, Riley SR, Fareed N, Bunger A, Gillespie SL, Venkatesh KK, Juckett L. Rural maternal health interventions: A scoping review and implications for best practices. The Journal of Rural Health. 2025 Jan;41(1):e70007.
8. Sondaal SF, Browne JL, Amoakoh-Coleman M, Borgstein A, Miltenburg AS, Verwijs M, Klipstein-Grobusch K. Assessing the effect of mHealth interventions in improving maternal and neonatal care in low-and middle-income countries: a systematic review. PloS One. 2016 May 4;11(5):e0154664.
9. Purnamasari R, Hasanudin AI, Zulfikar R, Yazid H. Technological infrastructure and financial resource availability in enhancing public services and government performance: The role of digital innovation adoption in Indonesia. Social Sciences & Humanities Open. 2025 Jan 1;11:101621.
10. Susiana S. Urgency of Digital Literacy To Address the Digital Gap. Singkat [Internet]. 2023;XV(5). Available from: http://puslit.dpr.go.id
11. Western MJ, Smit ES, Gültzow T, Neter E, Sniehotta FF, Malkowski OS, Wright C, Busse H, Peuters C, Rehackova L, Gabriel Oteșanu A. Bridging the digital health divide: a narrative review of the causes, implications, and solutions for digital health inequalities. Health Psychology and Behavioral Medicine. 2025 Dec 31;13(1):2493139.
12. World Health Organization. Global strategy and action plan on oral health 2023–2030. World Health Organization; 2024 May 26.
13. Krah E, de Kruijf J, Ragno L. Integrating traditional healers into the health care system: challenges and opportunities in rural northern Ghana. Journal of Community Health. 2018 Feb;43(1):157-63.
14. Yao L, Li Q, Li Q, Wang T, Peng S, Fu X, Wang W, Yu C, Zhou L, Chen M. Factors influencing the adoption of telemedicine services among middle-aged and older patients with chronic conditions in rural China: A multicentre cross-sectional study. BMC Health Services Research. 2025 May 30;25(1):775.
15. World Health Organization. WHO recommendations on maternal health: Guidelines approved by the WHO Guidelines Review Committee. World Health Organization; 2025 May 26.
16. Perski O, Short CE. Acceptability of digital health interventions: Embracing the complexity. Translational Behavioral Medicine. 2021 Jul 1;11(7):1473-80.
17. Girmay M. Digital health divide: opportunities for reducing health disparities and promoting equitable care for maternal and child health populations. International Journal of Maternal and Child Health and AIDS. 2024 Dec 20;13:e026.
18. Chatterjee S, Gupta SD, Upadhyay P. Technology adoption and entrepreneurial orientation for rural women: Evidence from India. Technological Forecasting and Social Change. 2020 Nov 1;160:120236.
19. Naderbagi A, Loblay V, Zahed IU, Ekambareshwar M, Poulsen A, Song YJ, Ospina-Pinillos L, Krausz M, Mamdouh Kamel M, Hickie

IB, LaMonica HM. Cultural and contextual adaptation of digital health interventions: Narrative review. Journal of Medical Internet Research. 2024 Jul 9;26:e55130.
20. Arksey H, O'malley L. Scoping studies: towards a methodological framework. International Journal of Social Research Methodology. 2005 Feb 1;8(1):19-32.
21. Levac D, Colquhoun H, O'Brien KK. Scoping studies: Advancing the methodology. Implementation science. 2010 Sep 20;5(1):69.
22. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, Moher D, Peters MD, Horsley T, Weeks L, Hempel S. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. Annals of Internal Medicine. 2018 Oct 2;169(7):467-73.
23. Johnson N, Phillips M. Rayyan for systematic reviews. Journal of Electronic Resources Librarianship. 2018 Jan 2;30(1):46-8.
24. Hong QN, Gonzalez-Reyes A, Pluye P. Improving the usefulness of a tool for appraising the quality of qualitative, quantitative, and mixed methods studies, the Mixed Methods Appraisal Tool (MMAT). Journal of Evaluation in Clinical Practice. 2018 Jun;24(3):459-67.
25. Wheaton N, Lenehan J, Amir LH. Evaluation of a breastfeeding app in rural Australia: Prospective cohort study. Journal of Human Lactation. 2018 Nov;34(4):711-20.
26. Kapinos K, Kotzias V, Bogen D, Ray K, Demirci J, Rigas MA, Uscher-Pines L. The use of and experiences with telelactation among rural breastfeeding mothers: Secondary analysis of a randomized controlled trial. Journal of Medical Internet Research. 2019 Sep 3;21(9):e13967.
27. Laws RA, Cheng H, Rossiter C, Kuswara K, Markides BR, Size D, Corcoran P, Ong KL, Denney-Wilson E. Perinatal support for breastfeeding using mHealth: A mixed methods feasibility study of the My Baby Now app. Maternal & Child Nutrition. 2023 Apr;19(2):e13482.
28. Uscher-Pines L, Ghosh-Dastidar B, Bogen DL, Ray KN, Demirci JR, Mehrotra A, Kapinos KA. Feasibility and effectiveness of telelactation among rural breastfeeding women. Academic Pediatrics. 2020 Jul 1;20(5):652-9.
29. Wu Q, Huang Y, van Velthoven MH, Wang W, Chang S, Zhang Y. The effectiveness of using a WeChat account to improve exclusive breastfeeding in Huzhu County, Qinghai Province, China: Protocol for a randomized controlled trial. BMC Public Health. 2019 Dec 2;19(1):1603.
30. Pasambo Y, Tamunu EN, Runtulalo F, Sarimin DS, Desyani J. Exclusive breastfeeding support methods for pregnant and breastfeeding mothers using technology. Open Access Macedonian Journal of Medical Sciences. 2022 Feb 15;10(G):154-9.
31. Cox V, Sharma P, Verma GS, Gill N, Diamond-Smith NG, Duggal M, Kumar V, Bagga R, Kaur J, Singh P, El Ayadi AM. User acceptability and perceived impact of a mobile interactive education and support group intervention to improve postnatal health care in northern India: a qualitative study. BMC Medical Informatics and Decision Making. 2025 Feb 20;25(1):93.
32. Griffin LB, López JD, Ranney ML, Macones GA, Cahill AG, Lewkowitz AK. Effect of novel breastfeeding smartphone applications on breastfeeding rates. Breastfeeding Medicine. 2021 Aug 1;16(8):614-23.
33. Seyyedi N, Rahmatnezhad L, Mesgarzadeh M, Khalkhali H, Seyyedi N, Rahimi B. Effectiveness of a smartphone-based educational intervention to improve breastfeeding. International Breastfeeding Journal. 2021 Sep 20;16(1):70.
34. Ma T, Chang K, Alyusuf A, Bajracharya E, Washio Y, Kelly PJ, Bellad RM, Mahantashetti NS, Charantimath U, Short VL, Lalakia P. Design, development, and testing of BEST4Baby, an mHealth technology to support exclusive breastfeeding in India: Pilot study. JMIR Formative Research. 2022 Sep 8;6(9):e32795.
35. Pilus FM, Ahmad N, Zulkefli NA, Shukri NH. Effect of face-to-face and WhatsApp communication of a theory-based health education intervention on breastfeeding self-efficacy (SeBF Intervention): Cluster randomized controlled field trial. JMIR mHealth and uHealth. 2022 Sep 14;10(9):e31996.
36. Patchen L, Ellis L, Harrington CB, Ma T, Mohanraj R, Andrews V, Evans WD. Engaging African American parents to develop a mobile health technology for breastfeeding: KULEA-NET. Journal of Human Lactation. 2020 Aug;36(3):448-60.
37. Usnawati N, Hanifah AN. Effectiveness of "Breast Milk Mother" Mobile Applications to Increase Knowledge and Attitude about Breastfeeding, Time to Release Breast Milk, and Adequacy of Breast Milk for Infants. Iranian Journal of Nursing and Midwifery Research. 2025 Mar 1;30(2):226-31.
38. Musiimenta A, Tumuhimbise W, Atukunda EC, Mugaba AT, Asasira J, Katusiime J, Zender R, Pinkwart N, Mugyenyi GR, Haberer JE. A mobile health app may improve maternal and child health knowledge and practices among rural women with limited education in Uganda: A pilot randomized controlled trial. JAMIA Open. 2022 Oct 4;5(4).

39. Aguirre TM, Joshi A, Koehler AE, Rodriguez EK, Wilhelm SL. Impact of a computer-based breastfeeding education program on breastfeeding self-efficacy and duration in rural Hispanic women. Health and Primary Care. 2018;2(4):1-5.
40. Ependi KR, Anggraeni MD, Kartikasari A. Health education using mobile phone application to prevent breastfeeding problems. JKG (Jurnal Keperawatan Global). 2022 Mar 2:109-17.
41. Flax VL, Ibrahim AU, Negerie M, Yakubu D, Leatherman S, Bentley ME. Group cell phones are feasible and acceptable for promoting optimal breastfeeding practices in a women's microcredit program in Nigeria. Maternal & Child Nutrition. 2017 Jan;13(1).
42. Yadav D, Dabas K, Malik P, Bhandari A, Singh P. "Should I visit the clinic?": Analyzing WhatsApp-mediated online health support for expectant and new mothers in rural India. In: Proceedings of the 2022 CHI conference on human factors in computing systems; 2022 Apr 29; New York, NY, USA. p. 1-20.
43. Gul X, Hameed W, Hussain S, Sheikh I, Siddiqui JU. A study protocol for an mHealth, multi-centre randomized control trial to promote use of postpartum contraception amongst rural women in Punjab, Pakistan. BMC Pregnancy and Childbirth. 2019 Aug 8;19(1):283.
44. Verma GS, Gopalakrishnan L, Ayadi AE, Diamond-Smith N, Bagga R, Dhir SK, Singh P, Gill N, Miglani V, Mutyala N, Kankaria A. Preliminary Effectiveness of a Postnatal mHealth and Virtual Social Support Intervention on Newborn and Infant Health and Feeding Practices in Punjab, India: Quasi-Experimental Pre-Post Pilot Study. JMIR Pediatrics and Parenting. 2025 Jun 27;8:e65581.
45. Wu Q, Huang Y, Liao Z, van Velthoven MH, Wang W, Zhang Y. Effectiveness of WeChat for improving exclusive breastfeeding in Huzhu County, China: Randomized controlled trial. Journal of Medical Internet Research. 2020 Dec 3;22(12):e23273.
46. Uscher-Pines L, Kapinos K, Demirci J, Ghosh B, Ray K, Kotzias V, et al. Use of Virtual Breastfeeding Support Among Underserved, Rural Mothers. Pediatrics. 2019 Aug 1;144:275.
47. Bandura A. Self-efficacy: The exercise of control. Macmillan; 1997.
48. DeNicola N, Grossman D, Marko K, Sonalkar S, Tobah YS, Ganju N, Witkop CT, Henderson JT, Butler JL, Lowery C. Telehealth interventions to improve obstetric and gynecologic health outcomes: A systematic review. Obstetrics & Gynecology. 2020 Feb 1;135(2):371-82.
49. World Health Organization. Report of the WHO consultation on digital technologies for tuberculosis, Geneva, Switzerland, 14-16 November 2022. World Health Organization; 2023 Feb 28.
50. Guideline WH. Recommendations on digital interventions for health system strengthening. World Health Organization. 2019:2020-10.
51. Lau Y, Htun TP, Wong SN, Tam WS, Klainin-Yobas P. Efficacy of internet-based self-monitoring interventions on maternal and neonatal outcomes in perinatal diabetic women: A systematic review and meta-analysis. Journal of Medical Internet Research. 2016 Aug 15;18(8):e220.
52. Suarnianti Suarnianti, Nyoman Anita Damayanti, Indah Restika, Erna Kadrianti1, Kartika Sari Wijayaningsih SS. Challenges and opportunities for HIV screening with the support of health digital technology: A scoping review. Nursing Practice Today. 2025;12(4):346-70.