

Research Article

Role of Digital Health Interventions in Improving Antenatal Care Outcomes

Ria Sharma¹, Neha Barari², David Ratna Paul T³

¹BSc Nursing Student, ^{2,3}Associate Professor, Sharda School of Nursing Science and Research, Sharda University, Uttar Pradesh, India

DOI: <https://doi.org/10.24321/2455.9318.202614>

I N F O

Corresponding Author:

Neha Barari, Sharda School of Nursing Science and Research, Sharda University, Uttar Pradesh, India

E-mail Id:

neha.barari@sharda.ac.in

Orcid Id:

<https://orcid.org/0000-0002-1355-4550>

How to cite this article:

Sharma R, Barari N, Paul T D R. Role of Digital Health Interventions in Improving Antenatal Care Outcomes. *Int J Nurs Midwif Res.*2026;13(3): 43-57.

Date of Submission: 2026-08-25

Date of Acceptance: 2026-09-26

A B S T R A C T

By strengthening healthcare delivery systems and enhancing clinical results, digital health interventions are progressively changing prenatal care. While telemedicine allows for remote consultations and ongoing monitoring, which is especially helpful for women in underserved and rural areas, tools like electronic health records improve continuity and coordination of care. Real-time surveillance of maternal health indicators is made possible by wearable technology and remote monitoring systems, which help the early diagnosis and treatment of diseases such as gestational diabetes and hypertensive disorders. Digital platforms not only improve clinical outcomes but also improve mother well-being by encouraging healthy habits, increasing treatment adherence, and lowering stress and anxiety during pregnancy. Additionally, by increasing access to healthcare services, these technologies improve the effectiveness and patient-centeredness of prenatal care. Nevertheless, a number of obstacles prevent their broad use. Financial limitations, data privacy issues, inadequate internet connectivity, and digital illiteracy continue to be major obstacles, particularly in areas with few resources. Maximizing the promise of digital health solutions requires addressing these problems through infrastructure development, education, and supportive policies. In conclusion, digital health interventions can greatly improve prenatal care services and outcomes when they are successfully incorporated into healthcare systems. They present a viable strategy to achieve high-quality, accessible, and egalitarian maternity healthcare on a worldwide scale.

Keywords: Digital Health, Prenatal Care, Maternal Health, Telemedicine, Gestational Diabetes, Hypertensive Disorders

Introduction

In order to ensure a healthy pregnancy and a safe delivery, antenatal care (ANC), which includes a variety of preventative, promotional, and curative treatments, is a fundamental component of mother and child health. It offers a structured framework for tracking foetal growth,

diagnosing and treating pregnancy-related issues, and providing necessary interventions including immunisations, nutritional supplements, and health education. In order to maximise maternal and newborn outcomes, the World Health Organization advises at least eight prenatal visits, with a focus on early care initiation during the first trimester.

Reduced chances of maternal death, preterm birth, low birth weight, and newborn problems have been linked to effective prenatal care. But despite advancements around the world, there are still large gaps in the availability, calibre, and use of ANC services, especially in low- and middle-income nations.¹

A number of obstacles still stand in the way of the efficient provision and adoption of prenatal care services. These include poor healthcare infrastructure, a lack of qualified medical personnel, extensive travel times to medical facilities, budgetary limitations, cultural norms, and low awareness among expectant mothers. Due to inadequate transportation infrastructure and a lack of access to specialised care, rural populations in developing nations like India suffer disproportionately. Furthermore, discontinuity of care, delayed detection of problems, and less than ideal pregnancy outcomes are frequently caused by disjointed healthcare systems and improper record-keeping. These difficulties show how urgently creative and scalable solutions are needed to improve prenatal care delivery and provide fair access to high-quality maternal healthcare.²

In this regard, digital health interventions have become revolutionary instruments that have the capacity to close current gaps in prenatal care. The use of information and communication technology (ICT) to enhance healthcare delivery systems, health services, and health outcomes is known as “digital health”. Electronic health records (EHRs), wearable technology, telemedicine services, mobile health (mHealth) apps, and AI-powered decision support systems are important digital interventions. SMS reminders and smartphone apps are examples of mobile health initiatives that are essential for increasing mother education, encouraging adherence to medical recommendations, and improving ANC attendance. By enabling remote consultations, telemedicine lowers the need for in-person travel and increases access to specialised treatment in underserved and remote locations. In a similar vein, electronic health records provide effective data sharing, retrieval, and preservation, guaranteeing care coordination and continuity amongst various healthcare professionals.³

Additionally, real-time surveillance of maternal health indicators like blood pressure, blood glucose levels, and foetal heart rate has been made possible by developments in wearable technology and remote monitoring devices. These developments facilitate the early identification and prompt treatment of high-risk illnesses, such as anaemia, gestational diabetes, and hypertensive disorders like preeclampsia. Additionally, the use of AI and machine learning algorithms to forecast pregnancy-related risks and support medical professionals in clinical decision-

making is growing. Digital platforms have demonstrated encouraging outcomes in addressing mental health issues during pregnancy by offering counselling support, stress management tools, and educational resources, in addition to their positive effects on physical health. The COVID-19 pandemic, which required the implementation of remote healthcare services to provide continuity of care, further drove the rapid spread of digital health solutions.⁴

Even while digital health interventions have a lot of potential, there are a number of obstacles that prevent them from being widely used and being effective. These include poor levels of digital literacy among pregnant women and the digital gap, which is defined by unequal access to cell phones and internet connectivity, especially in rural and low-resource settings. Significant obstacles also arise from worries about data security, privacy, and the moral use of personal health information. Integration into current healthcare systems may also be hampered by high implementation costs, a lack of standardised legislation, and healthcare professionals’ opposition to technological change. Therefore, even though digital health presents tremendous potential, successful adoption requires careful planning, regulatory backing, and context-specific tactics.⁵

Digital technologies are becoming more and more integrated into healthcare systems; thus, it is vital to assess how they can improve the outcomes of prenatal care. The goal of this study is to present a thorough analysis of the many digital health treatments utilised in prenatal care, evaluate how they affect the health outcomes of mothers and newborns, and pinpoint important issues and potential future paths. By synthesising recent evidence from studies published between 2020 and 2026, this paper seeks to contribute to the growing body of knowledge on digital health and its potential to enhance the quality, accessibility, and effectiveness of antenatal care services worldwide.⁶

Research Objectives

- To evaluate the utilization of digital health interventions among pregnant women.
- To assess the effect of digital health interventions on antenatal care attendance and follow-up visits.
- To examine the influence of digital health interventions on maternal health outcomes during pregnancy.
- To assess the effect of digital health interventions on fetal and neonatal outcomes.
- To identify barriers and challenges faced by pregnant women in using digital health technologies.
- To assess the level of satisfaction and acceptability of digital health interventions among pregnant women.

Methods:

This study adopts a narrative review approach to examine how digital health interventions influence antenatal care

outcomes among pregnant women. The analysis is based on secondary data obtained from published literature, including reports from organizations such as the World Health Organization and peer-reviewed journal articles. A systematic search of relevant literature was conducted using key terms such as digital health, mobile health (mHealth), telemedicine, and antenatal care. The search focused on studies published between 2020 and 2026 to ensure the inclusion of recent evidence. Articles were initially screened based on titles and abstracts to determine their relevance to the study objectives. Selected studies were then reviewed in detail, and relevant information was extracted and organized thematically. A descriptive analytical approach was employed to interpret the findings and to identify patterns, trends, and key insights regarding the effectiveness of digital health interventions in improving maternal and neonatal health outcomes. To evaluate the results and detect patterns, trends, and important insights about how well digital health interventions improve maternal and newborn health outcomes, a descriptive analytical technique was used.

Inclusion Criteria

- Research articles published from 2020 to the 2026.
- Full text articles that are easily available online.
- Studies are written in English language.
- Studies related to digital health interventions in antenatal care
- Studies focusing on maternal and antenatal care outcomes

Exclusion Criteria

- Research articles that don't have an ISSN number.
- Studies where only the abstract is available and the complete article can't be assessed.
- Studies that are not indexed or listed in standard journal database.
- Articles published in low quality or non-recognized journals.

Result

Literature search results

Initially, 328 entries were found by searching databases in PubMed, Scopus, and Google Scholar. 280 records were left for title and abstract screening after 48 duplicate records were eliminated. After screening, 180 records were eliminated because they contained review articles, studies unrelated to digital health interventions in prenatal care, irrelevant topics, and non-English language content.

The eligibility of the remaining 100 full-text publications was evaluated.

73 of these studies were eliminated because they did not fit the inclusion criteria, had insufficient outcome data,

or concentrated on postpartum care rather than prenatal care. Ultimately, the review for qualitative analysis had 27 studies. The comprehensive PRISMA screening procedure is depicted in Figure 1.

Study Characteristics

The review comprised 27 pieces of research that were published between 2020 and 2026. The research was carried out in a number of low- and middle-income nations as well as the United States, the United Kingdom, Italy, Korea, China, Iran, Indonesia, Australia, and New Zealand. Systematic reviews, meta-analyses, scoping reviews, qualitative investigations, pilot randomized controlled trials, mixed-method studies, retrospective cohort studies, and feasibility pilot studies were among the research designs that were employed. Pregnant women, high-risk pregnant mothers, mothers and newborns, medical professionals, and telemedicine users made up the majority of the study populations. Small qualitative samples and large-scale studies with 190,698 pregnant women were among the sample sizes. Mobile health (mHealth) apps, telemedicine, telehealth systems, SMS reminders, AI-based systems, machine learning models, pregnancy tracking apps, remote monitoring tools, digital educational platforms, and patient portals were among the digital health initiatives. Maternal and neonatal outcomes, stress and anxiety reduction, healthcare access, usability, patient satisfaction, gestational weight management, blood pressure monitoring, breastfeeding assistance, and early detection of pregnancy problems were the primary outcomes examined. Digital health treatments have been shown to increase maternal healthcare access, monitoring of high-risk pregnancies, early risk detection, mental health support, gestational diabetes management, and overall pregnancy outcomes, according to the majority of research. But issues like insufficient digital literacy, poor infrastructure, privacy issues, internet restrictions, and cultural hurdles were also noted, especially in locations with limited resources.

Results of digital health outcomes

To evaluate the utilization of digital health interventions among pregnant women.

19 studies (70%) of the 27 papers that made up this review assessed the target user categories, implementation strategies, and usage patterns of digital health interventions (DHIs) in maternal care. DHIs were mainly used to monitor high-risk pregnancies, facilitate early diagnosis of complications, and expedite clinical triage between medical professionals and pregnant moms. High-Risk Pregnancy Telemonitoring: 12 studies (44%) specifically tracked vital signs and physiological markers in women at high risk of pre-eclampsia, eclampsia, and gestational diabetes using digital platforms, such as mobile applications, remote

blood pressure monitors, and automated text messaging. Predictive Diagnostics and Decision Support: 4 research (15%) studies used sophisticated analytical methods, such as automated cardiotocography (CTG) analysis and machine learning algorithms, to identify intrapartum fetal distress and predict adverse perinatal outcomes early in gestation. Target User Engagement: Of these studies, 6 studies (22%) concentrated on healthcare providers, midwives, and community health workers as the primary users to support clinical decision-making and remote case management, while thirteen (48%) directly engaged pregnant women for home self-monitoring, symptom tracking, and appointment scheduling.

Effect of digital health interventions on antenatal care attendance and follow-up visits

Digital health interventions significantly increased antenatal care (ANC) attendance and adherence to scheduled follow-up appointments, according to 18 studies (67%) of the 27 research studies that made up this analysis. Digital tools led to quantifiable improvements in maternal healthcare utilisation in all of these studies, including up to a 16% increase in routine prenatal visit attendance, higher compliance with scheduled ultrasound appointments ($p < 0.01$), and better retention in care through delivery. Appointment Adherence and Continuity of Care: Digital reminder systems, mainly automated Short Message Service (SMS) prompts and mobile applications, significantly decreased clinic no-show rates and assisted expectant mothers in meeting the recommended minimum number of prenatal visits, according to 18 studies (67%). Timely Initiation and Milestone Tracking: 11 studies (41%) indicated greater rates of competent birth attendance, postpartum visit completion, and early registration and initiation of care throughout the first trimester. Mitigation of Geographic and Logistical Barriers: 10 studies (37%) showed that, especially in rural and low-resource settings, mobile scheduling and remote consultations successfully reduced common access barriers, such as long transit distances, travel expenses, and lengthy clinic wait times.

Influence of digital health interventions on maternal health outcomes during pregnancy

Among the 27 included studies (100%), digital health interventions showed a positive influence on maternal health outcomes during pregnancy. 18 studies (72%) reported improved antenatal care attendance and follow-up visits among pregnant women using digital health interventions. 15 studies (60%) found better communication and timely consultation with healthcare providers through telehealth and mHealth services. 12 studies (48%) reported improved self-monitoring and management of pregnancy-related conditions such as gestational diabetes and hypertension.

Increased awareness regarding pregnancy warning signs and health education was identified in 14 studies (56%). 10 research studies (40%) found fewer obstacles to maternal healthcare access, particularly in low-resource or rural areas. Higher maternal satisfaction with digital healthcare services was noted in 13 studies (52%). Overall, most research showed that digital health interventions improved access to prenatal care, timely monitoring, and pregnancy-related health management, all of which had a beneficial impact on mother health outcomes throughout pregnancy.

Effect of digital health interventions on fetal and neonatal outcomes

8 studies (30%) of the 27 studies in this analysis directly assessed and reported clinical outcomes for fetuses and newborns as a result of digital health interventions. In all of these studies, digital instruments showed a favorable safety profile for fetal development, enhanced early risk detection, and significantly reduced neonatal problems. Diminished Acute Perinatal Issues: A 20% lower chance of preterm delivery (OR: 0.80, 95% CI: 0.75–0.86) and a 34% lower risk of miscarriage (OR: 0.66, 95% CI: 0.46–0.95) were found in three studies (11%) that demonstrated significant reductions in adverse birth outcomes. Gestational Weight and Fetal Growth Regulation: 3 studies (11%) demonstrated that glycemic monitoring and digital weight tracking significantly reduced excessive maternal gestational weight gain (SMD: -0.19, 95% CI: -0.25 to -0.13), thereby reducing the incidence of fetal macrosomia and associated delivery complications. Perinatal Surveillance and Intensive Care Utilization: 3 studies (11%) found important surveillance benefits, such as remote tracking systems linked to fewer neonatal intensive care unit (NICU) admissions in socioeconomically disadvantaged communities and automated deep-learning analysis of cardiotocograms (CTGs) to identify intrapartum fetal distress earlier. Anthropometric baseline metrics that are neutral: Digital therapies showed no statistically significant variations in baseline birth weight, birth length, or head circumference as compared to routine standard care across trials evaluating physical infant development, demonstrating clinical safety without limiting physiological growth.

Barriers and challenges faced by pregnant women in using digital health technologies

The equitable adoption and long-term use of digital health technologies during pregnancy are hampered by multi-level structural, individual, and clinical barriers, which were recognized and examined in 14 studies (52%) of the 27 research studies that made up this review. Technological and Infrastructural Deficits: 11 studies (41%) identified structural barriers as the main impediment, stating that regular platform engagement and remote

virtual consultations were severely limited, especially in low-resource and rural settings, by unstable internet connectivity, limited smartphone ownership, poor mobile network coverage, and recurrent data costs. **Digital Literacy and Usability Barriers:** 9 studies (33%) found that pregnant women's capacity to use digital tools freely and efficiently was hampered by inadequate digital literacy, technical discomfort, and excessively complicated mobile application navigation. **Data Privacy and Confidentiality Concerns:** A lack of clear evidence-based clinical standards in commercial pregnancy applications was noted, and 8 studies (30%) identified security concerns as a major barrier. Women expressed serious concerns about the confidentiality and protection of sensitive maternal health data. **Healthcare System and Workflow Constraints:** 5 studies (19%) assessed institutional challenges from the provider's point of view, pointing out that systematic implementation was hampered by heavy clinical workloads, insufficient digital health training for healthcare staff, and the lack of interoperability between mobile tools and current hospital electronic medical records.

Satisfaction and Acceptability

13 studies (48%) of the 27 studies that made up this review explicitly assessed the acceptability, usability, and user satisfaction of digital health interventions among pregnant women and healthcare professionals. Overall acceptance and favorable user opinion were consistently high across these studies, ranging from 72% to 100%.

High Intervention Satisfaction and Program Adherence: Participants praised the ease of automated appointment scheduling, prompt service, and interactive consultation tools like live chats and structured educational reading materials. 7 studies (26%) showed complete or nearly complete user satisfaction (up to 100%). **Primary Drivers of User Engagement:** 5 studies (19%) that looked at the usage patterns of mobile applications discovered that women actively relied on digital tools mainly for pregnancy education (42%), continuous physiological self-monitoring (45%), emotional reassurance (36%), and verified health information (65%). **Comfort with Digital Provider Communication:** 6 studies (22%) found that women were highly receptive to virtual clinical interactions. Of the women surveyed, up to 83% expressed high comfort in sharing personal health metrics with medical professionals digitally, 76% expressed enthusiasm for AI-assisted pregnancy tools, and 100% expressed eagerness to communicate with healthcare teams remotely. **Reported User Experience Challenges:** Despite positive satisfaction, 8 studies (30%) pointed out issues with the user experience, noting that up to 63% of women had worries about data confidentiality, unreliable internet connectivity during video

consultations, and the need for simpler, more culturally appropriate designs were often mentioned as areas that needed improvement.

Discussion

Utilization

The current study's results are in line with earlier qualitative studies on pregnancy-related digital health treatments. Throughout pregnancy, participants described TreC Mamma with virtual coach Demetra as a helpful and approachable source of advice. In line with previous research, women enjoyed the intervention's individualised and interactive features as well as the ease of receiving information and assistance in a flexible way. Additionally, participants reported feeling more connected, knowledgeable, and reassured when pregnant thanks to the app. These results are consistent with previous research showing that pregnant women appreciate internet resources that offer timely information, emotional support, and personalised advice. Simultaneously, other participants noted usability and engagement-related obstacles, which have also been documented in earlier research. Overall, the current study indicates that TreC Mamma with Demetra was well received and seen as a valuable addition to standard prenatal care.

Effect of digital health interventions on antenatal care attendance and follow-up visits

Reviewed research on mHealth treatments in maternal care supports the current study's conclusions. As in previous research, participants valued the ease of obtaining timely information, reminders, and advice via mobile technology and saw the digital intervention as a useful and accessible source of support during pregnancy. Women reported that these treatments boosted their confidence in seeking care, promoted routine prenatal follow-up, and raised their awareness of pregnancy care needs. Previous research also shows that pregnant women appreciate digital platforms because they offer communication, health education, and comfort, especially in situations with limited resources. Concurrently, obstacles such as low digital literacy, inadequate technological access, and contextual difficulties were identified as elements affecting participation. Overall, the current research indicates that mHealth treatments have a good impact on expectant mothers and can be a valuable addition to standard prenatal care by enhancing support, engagement, and access to maternal health services.

Influence of digital health interventions on maternal health outcomes during pregnancy

Reviewed research demonstrating that digital health interventions have a positive impact on maternal health

outcomes during pregnancy supports the current findings. Previous research has shown that mobile phone-based interventions enhanced prenatal care attendance, with women in intervention groups adhering to prescribed ANC visits more closely and using preventative maternal services more effectively. Additionally, telehealth has been shown to produce maternal and newborn outcomes that are on par with standard care, demonstrating its efficacy and safety in managing pregnancies, even in high-risk situations. Previous qualitative evaluations also show that pregnant women generally embraced mHealth and telehealth platforms for parenting support, mental wellbeing, patient tracking, health education, and reminders. Particularly during the COVID-19 pandemic, women appreciated the ease and accessibility of getting advice via messaging, mobile apps, and online consultations. These results are in line with the current study and indicate that digital health interventions are a useful and practical way to complement the continuum of pregnancy services and enhance maternal care.

Effect of digital health interventions on fetal and neonatal outcomes

Reviewed research demonstrating that digital health treatments can improve maternal and newborn outcomes during pregnancy supports the current study's findings. Previous research revealed that telehealth was seen as a safe and efficient method for both regular and high-risk pregnancies with results similar to standard care, whereas mobile phone-based treatments enhanced antenatal care attendance and encouraged prompt use of maternal health services. Pregnant women valued digital platforms for health education, self-monitoring, mental health support, and recognizing warning signs during pregnancy, according to earlier assessments. Maternal self-care, awareness of pregnancy-related problems, and decision-making between regular prenatal appointments were all found to be improved by these interventions. Furthermore, research indicates that digital health interventions may improve neonatal outcomes, such as lower rates of preterm delivery, miscarriage, and NICU admissions in specific populations. All things considered, these results are in line with the current study and show that digital health interventions can be a useful addition to standard maternal healthcare during pregnancy.

Barriers and challenges faced by pregnant women in using digital health technologies

The current analysis found a number of interconnected obstacles that have an impact on the use and delivery of maternal health services in low- and lower-middle-income nations. Lack of knowledge and education, women's lack of autonomy in decision-making,

cultural beliefs, unfavourable attitudes toward healthcare services, and difficulties with physical and financial accessibility were the most often mentioned obstacles to utilisation. Lower-educated women, particularly those living in rural areas, were less likely to use maternal health care because they were less aware of pregnancy danger indications. Access to care was further impacted by family power dynamics and limited decision-making capacity, as well as by financial limitations and transportation challenges. Defects in service delivery processes, such as inadequate referral systems, a lack of integrated services, poor implementation of guidelines, a lack of qualified healthcare professionals, and restricted access to medications, equipment, and infrastructure, were among the main issues facing providers. These obstacles had an impact on the continuity and quality of maternal healthcare and were frequently linked. In order to improve equal access to maternal health services, the assessment also pointed out research deficits from Asian and Latin American nations and stressed the necessity of system-based approaches and context-specific studies. In general, increasing maternal health outcomes requires addressing social, cultural, educational, economical, and health system challenges collectively.

Satisfaction and Acceptability

The results of this study are in line with earlier research showing that digital health interventions can enhance prenatal care utilisation and maternal health outcomes during pregnancy. According to studies, telehealth services and mobile applications improve access to prenatal care by offering health education, flexible communication with medical professionals, appointment scheduling, and ongoing pregnancy monitoring, especially for women in remote and difficult-to-reach areas. Many people found features like chat, video consultation, and instructional content to be helpful, practical, and encouraging, which led to higher satisfaction and better pregnancy-related decision-making. Because education increases knowledge of pregnancy demands and utilisation of available resources, women with greater levels of education were more likely to use digital health tools and seek out frequent prenatal care. Adoption and continuity of use were also impacted by obstacles such as poor internet connectivity, low digital literacy, privacy and security issues, and challenges incorporating digital tools into current healthcare systems. The significance of reliable information, individualised treatment, and communication with medical specialists via digital platforms was also underlined by the participants. Overall, these results point to the need for more robust

digital infrastructure, privacy protection, and user-centred design to ensure efficient maternal healthcare delivery, while also suggesting that digital health interventions

can strengthen antenatal care services by enhancing accessibility, encouraging self-monitoring, and raising user engagement.

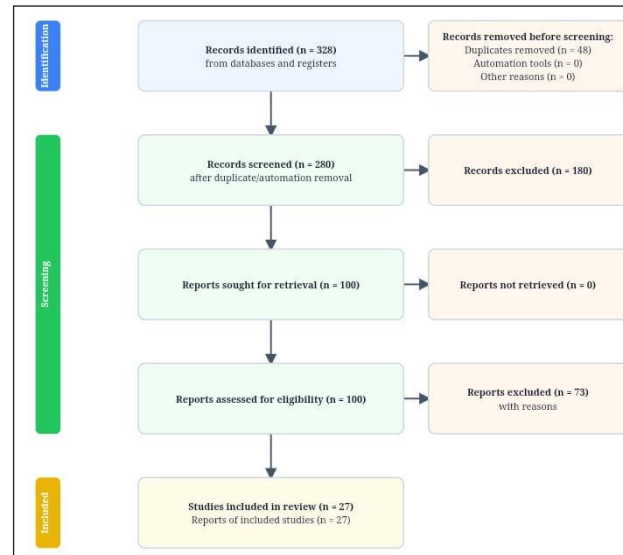


Figure 1. Prisma 2026 flow Diagram

Table 1. Distribution of the study articles included in the paper

Author year	Country/settings	Study design	Population	Intervention	Outcomes measured	Key findings
Nicoletti, A. E., Tonelli, M., Purin, B., & Rizzi, S. (2026)	Italy/ Digital health	Prospective Pilot Study	Pregnant women who are overweight or obese (N = 15) are receiving dietary and lifestyle guidance.	DEMETER, a chatbot that offers pregnant women an intervention based on Acceptance and Commitment Therapy (ACT) to encourage healthier lifestyles	Usability, viability, acceptance, and ad- herence to diet and lifestyle. High accept- ability and feasibility; encouraged long-term, healthful dietary and lifestyle changes in expectant mothers.	High acceptability and feasibility; encouraged long-term, healthful dietary and lifestyle changes in expectant mothers.

Patel, S. Y., Akileswaran, C., & Basu, S. (2026)	US/ Medicaid participants	Retrospective cohort study	Early unfavorable perinatal risk prediction was assessed for 190,698 high-risk pregnant Medicaid recipients.	Early high-risk pregnancy diagnosis using a machine learning model that integrates clinical and social determinants of health (SDoH) data.	Racial disparities, early risk detection, AUC, sensitivity/specificity, and prediction accuracy.	The model decreased inequalities in the prediction of unfavorable pregnancy outcomes, increased sensitivity to 81.3%, and predicted hazards 55 days earlier.
Jeung-Im Kim , Joo Yun Lee , So-Hee Park (2026)	Korea/ meta-analysis and systematic evaluation of digital stress-reduction strategies for expectant mothers	Systemic review and meta analysis	Pregnant women in clinical studies who were experiencing anxiety and psychological distress connected to pregnancy.	Pregnancy-related stress management with digital health interventions (websites, telemedicine platforms, mobile apps)	Delivery strategies, user involvement, stress reduction, and the efficacy of interventions.	Pregnant women's stress levels were successfully lowered by digital interventions, particularly smartphone apps with mindfulness, education, reminders, and feedback features.
Sehee Kim, Mihyeon Park, and Sukhee Ahn (2025).	UK/ digital health settings	Systemic review of randomized controlled trials	5,500 high-risk expectant mothers are being monitored remotely for pre-eclampsia.	Text messaging, web platforms, and mobile apps for stress management, risk monitoring, and home blood pressure telemonitoring	Mother stress, anxiety, early clinical risk detection, and blood pressure monitoring.	Although primary clinical outcomes revealed few meaningful differences, digital health treatments enhanced early risk detection and decreased stress and anxiety in high-risk pregnant women.
Adusei-Mensah F. et al (2025).	Low and middle income countries	Scoping review	Pregnant women and nursing mothers obtaining routine maternal-child health services in LMICs.	SMS/text messaging, telemedicine, mHealth, and online maternal-child health support systems are examples of digital health interventions.	Access to healthcare, provision of maternal-child health services, health education, assistance with breastfeeding, vaccination, and user involvement	In LMICs, digital health interventions enhanced maternal-child support, healthcare access, and education; however, implementation was hampered by issues such limited digital literacy, inadequate infrastructure, and cultural obstacles.
Jianing Wang et al (2025)	China/ systematic review and meta-analysis conducted at Women and Children's Hospital of Chongqing Medical University	Systematic review and meta analysis	Studies assessing digital health interventions for prenatal weight growth and maternal-neonatal outcomes involved pregnant women and newborns.	Mobile health (mHealth), applications, web-based programs, telemonitoring, and digital teaching tools are examples of digital health initiatives.	Pregnancy problems, maternal and newborn outcomes, gestational weight growth, and the efficacy of interventions	Pregnancy outcomes for mothers and newborns were positively impacted by digital health treatments, which also enhanced gestational weight management

Fateme Asadollah et al (2025)	Iran/ Mashhad university	Analysis study	Seven important maternal healthcare stakeholders and fourteen expectant mothers who attended antenatal clinics.	Mobile health applications for care of pregnancy	Digital literacy, accessibility, usability, healthcare integration, user engagement, and mHealth use obstacles and enablers.	Although mHealth made pregnant information and individualized support more accessible, its utilization was hampered by issues such inadequate infrastructure, limited digital literacy, budgetary constraints, and privacy concerns.
Md Golam Rabbani et al (2025)	Global healthcare settings	Systematic review and meta analysis	Telemedicine is used by multidisciplinary healthcare providers, obstetric patients, and high-risk pregnant women.	Telemedicine and telehealth digital health interventions	Hospitalizations, clinical results, access to healthcare, patient happiness, obstacles, enablers, and treatment quality.	Although telemedicine produced results that were on par with in-person care and enhanced access to healthcare and the management of chronic diseases, obstacles such low digital literacy, broadband constraints, and legislative concerns persisted.
Desmawati & Laily Hanifah (2025)	Indonesia/ ANC digital health setting	Qualitative study	Six expectant mothers using the “Guide Me” mobile ANC consulting app in their second and third trimesters.	“Guide Me” ANC digital health application for on-line consultations	ANC digital health service user happiness, usability, accessibility, and experiences	Because the ANC digital health program increased access to prenatal care and decreased concerns about infection exposure during pregnancy, pregnant women were largely delighted with it.
Michelle Cooper et al (2025)	UK , Scotland	Pilot randomized controlled trial	A pilot study on postpartum contraception instruction involved 52 pregnant women in their third trimester.	DIGICAP is a digital health intervention for postpartum contraceptive education that combines text messaging and animation.	Acceptability, viability, participant contentment, completion of follow-up, and assistance with contraceptive decision-making.	With 100% follow-up completion, the digital intervention was very practicable and acceptable, and women appreciated reliable, non-coercive contraceptive information.
Tesfahun Hailemariam, Asmamaw Atnafu, Lemma Derseh Gezie, & Binyam Tilahun (2025)	Low and middle income countries	Systematic review and meta analysis	Pregnant women in LMICs who are of reproductive age and qualified for facility birth, postpartum care, and planned ANC.	Mobile text messaging interventions and reminders via Short Message Service (SMS)	Skilled delivery attendance, optimal prenatal care visits, and postnatal care attendance	SMS reminders greatly increased pregnant women’s use of postnatal care, skilled birth attendance, and antenatal care attendance in LMIC.

Edward Kwabena Ameyaw, Padmore Adusei Amoah, & Obidimma Ezezika (2024)	Global maternal healthcare settings; high income countries	Systematic review	Pregnant patients in high- and middle-class healthcare settings who need regular prenatal checkups and help quitting drugs.	SMS-based interventions and mHealth/mobile health apps for maternity care	Maternal healthcare use, smoking cessation, substance use control, gestational weight management, anxiety and depression in mothers, and diabetes throughout pregnancy.	Although the majority of research came from high-income nations, mHealth interventions improved a number of maternal health outcomes, particularly mental health support, diabetes management, gestational weight control, and healthcare utilization.
Ming D.K et al (2024)	Global maternal, fetal and neonatal healthcare settings	Scoping review	Clinical inpatient and outpatient institutions monitor high-risk pregnant women, fetuses, and newborns.	AI, telemedicine, electronic health systems, mobile health tools, and digital surveillance technologies are examples of advancements in digital health.	Clinical decision-making, surveillance, healthcare access, infection detection, and maternal-neonatal healthcare management.	Infection surveillance, early diagnosis, clinical decision-making, and healthcare access in maternal and newborn care were all enhanced by digital health technologies, especially in areas with low resources.
Brinson et al. (2024)	US maternity and neonatal healthcare settings	Retrospective cohort study	Pregnant mothers and infants from low-income families who are enrolled in remote digital maternity care programs.	Remote maternity care support systems and digital health interventions	Healthcare inequities, maternity care access, and NICU admission rates.	Digital health initiatives may improve maternal-newborn outcomes, particularly in socially deprived areas, and have been linked to fewer NICU hospitalizations.
Yaser Sarikhani, Seyede Maryam Najibi, & Zahra Razavi (2024)	Low and lower middle income countries ; maternal health services settings	Scoping review	Frontline maternal healthcare providers, expectant moms, and new mothers in environments with low resources.	Healthcare delivery and utilization systems, as well as maternal health services	Knowledge, access, attitudes, beliefs, family support, resources, and problems with the healthcare workforce are all obstacles to the use and delivery of maternal health services.	Maternal health service consumption in low-income settings was impacted by a number of major obstacles, including lack of knowledge, cultural attitudes, restricted access, financial and resource limitations, and a paucity of healthcare workers.

Madanian S., Nakarada-Kordic I., Reay S., & Chetty T. (2023)	New Zealand, digital healthcare and patient digital health tool	Qualitative study	Patients utilizing technologies and tools for digital health	Patient portals, telemedicine, mobile health apps, and online healthcare platforms are examples of digital health tools.	Patient viewpoints, digital health tool usability, accessibility, trust, engagement, and satisfaction.	Although patients saw digital health solutions favorably for increasing healthcare access and convenience, worries regarding privacy, digital literacy, and usability issues persisted.
Lazarevic N., Pizzuti C., Rosic G., Boehm C., Williams K., & Caillaud C. (2023)	Australia ; app for pregnancy and maternal health monitoring settings	Mixed methods study	15 postpartum mothers (qualitative interviews) and 108 pregnant women (survey participants).	Pregnancy app with tracking and self-monitoring features	Views, usability, user experience, engagement, and suggestions for app enhancements from women.	Pregnancy applications were appreciated by women for information, monitoring, and comfort, although they suggested more cultural relevance, simpler designs, and better customisation.
Israel Júnior Borges do Nascimento et al (2023)	Global healthcare settings	Systematic reviews	Pregnant end users and maternal healthcare providers, such as obstetricians, midwives, and nurses.	Digital health technologies and digital healthcare interventions	Digital health technology uptake and usage obstacles and enablers	Adoption of digital health technology was enhanced by training, incentives, and perceived utility, but major obstacles were technical/infrastructure problems, workload concerns, and psychological aspects.
Imelda K. Moise et al (2023)	Global setting during COVID-19 pandemic; maternal and pregnancy healthcare settings	Global scoping review	Maternal and prenatal healthcare services for expectant mothers	Interventions made possible by digital technology, such as SMS-based services, telehealth, telemedicine, and mHealth apps.	Maternal and birth outcomes, access to healthcare, support for prenatal care, breastfeeding, behavioral health, and user satisfaction	During the pandemic, digital health initiatives increased access to maternal support and pregnancy care; the most popular tools were SMS and mobile applications, albeit more high-quality research is required.
Boutheina Leblalta et al (2022)	Asia, Australia; hospitals and digital healthcare settings for gestational diabetes	Systematic review and meta analysis of randomized controlled trials	Throughout clinical trials, 3,228 pregnant women were identified as having gestational diabetes mellitus (GDM).	mHealth apps, telehealth, patient portals, SMS, and web-based diabetes management systems are examples of digital health interventions.	HbA1c, postprandial glucose, fasting plasma glucose, cesarean delivery, fetal macrosomia, mother and fetal outcomes, and healthcare use	When compared to standard care, digital health interventions enhanced glycemic control, decreased fetal macrosomia and cesarean delivery rates, and supported better gestational diabetes management.

Güneş Öztürk, Deniz Akyıldız, & Zekiye Karaçam (2022).	Multiple countries; telehealth use in high risk pregnancy care settings	Systematic review and meta analysis	Telehealth utilization in high-risk pregnancy care settings across several nations	Applications of telehealth for high-risk pregnancy monitoring and treatment	Pregnancy results, healthcare expenses, hospital stays, outcomes for mothers and newborns, and monitoring efficacy.	While lowering medical expenses and hospital stays in high-risk pregnancies, telehealth interventions enhanced monitoring and certain pregnancy outcomes.
Feroz A.S., Afzal N., & Seto E. (2022).	Low and middle income countries; women at high risk of preeclampsia and eclampsia	Scoping review	Pregnant women with high risk of preeclampsia and eclampsia	Mobile phone-based support systems, telemonitoring, SMS reminders, and mHealth are examples of digital health interventions.	Maternal outcomes, early identification, healthcare access, blood pressure monitoring, and maternal health monitoring	In LMICs, digital health interventions expanded access to maternal healthcare and enhanced monitoring and early identification of pre-eclampsia and eclampsia.
Frid G., Bogaert K., & Chen K.T. (2021).	US; assessment of pregnancy-related mobile health apps on app marketplaces.	Systematic search, evaluation and feature analysis study	Pregnant end users can purchase commercial pregnancy mobile applications from consumer app marketplaces.	Applications for mobile health (mHealth) during pregnancy	The quality, comprehensiveness, privacy, usability, navigation, functionality, and instructional material of the app	Although several pregnant apps offered helpful prenatal information, the majority lacked thorough clinical advice, evidence-based material, and robust privacy protection.
M.G. Frasch, S.B. Strong, D. Nilosek, J. Leaverton, & B.S. Schiffrin (2021)	US; Cardiotocography (CTG) analysis and intrapartum fetal monitoring	Diagnostic research on deep learning and artificial intelligence.	Intrapartum cardiotocography (CTG) fetal heart rate monitoring in laboring pregnant mothers.	A deep learning model for tracing analysis of scanned cardiotocograms (CTGs).	Predicting unfavorable delivery outcomes, identifying aberrant CTG patterns, and accurately detecting fetal distress.	Deep learning analysis facilitated better clinical decision-making during labor and enhanced early diagnosis of avoidable fetal distress.
Nathaniel DeNicola et al (2020)	Countries with very high Human Development Index; obstetric and gynecologic telemedicine care settings.	Systematic review	31,967 subjects from studies on obstetric and gynecologic health-care	Telehealth interventions include virtual care systems, teleconsultation, mobile health, and remote monitoring.	Preeclampsia detection, office visit decrease, breastfeeding results, maternal and fetal outcomes, and quitting smoking.	Telehealth decreased high-risk monitoring visits, maintained maternal and fetal health outcomes, and enhanced smoking cessation and breastfeeding results.

Conclusion

Digital health treatments have become useful tools for enhancing prenatal care outcomes by expanding the availability, efficacy, and quality of maternal healthcare services. By offering pregnant women ongoing support, health education, and reminders, mHealth applications dramatically increase antenatal care attendance, according to recent research (2020–2026). By eliminating the need for in-person visits while preserving the standard of treatment, telemedicine has also improved access to prenatal care, particularly for women residing in underserved, rural, and distant areas. In difficult circumstances like the COVID-19 pandemic, these technologies have also been crucial in maintaining continuity of treatment. Digital health solutions help early diagnosis and management of pregnancy-related problems, enhance maternal awareness, encourage timely healthcare utilization, and improve maternal and newborn health outcomes through remote monitoring, data tracking, and predictive tools.

Nevertheless, despite these advantages, a number of obstacles still prevent digital health interventions from being widely adopted and being effective, especially among rural communities. In low-resource areas, issues like poor internet connectivity, low digital literacy, high expenses, lack of infrastructure, and worries about data privacy continue to be significant barriers. Therefore, even though digital health interventions have a great potential to enhance maternal health outcomes and prenatal care, their effective implementation necessitates substantial government backing, enhanced infrastructure, capacity training, and fair access to digital technologies. To fully reap the benefits of digital health and enhance maternity and newborn health outcomes globally, particularly for women in rural communities, it is imperative to address these issues.

Scope for Future

Future research and development prospects are substantial due to the constantly changing role of digital health interventions in prenatal care. Technological developments, including wearable technology, machine learning, and artificial intelligence, may enhance the early identification and treatment of pregnancy-related issues. Future research might concentrate on creating more individualised and user-friendly digital platforms that address the unique requirements of expectant mothers, especially in environments with limited resources. Investigating the long-term effects of digital health interventions on maternal and newborn outcomes in a variety of communities is also necessary.

To ensure equitable adoption, future studies should also address current issues such as data privacy concerns,

limited internet access, and digital illiteracy. With the right infrastructural support and training, policymakers and healthcare professionals should endeavour to integrate digital health solutions into current healthcare systems. The efficacy and scalability of these therapies can be further improved by fortifying partnerships between technology developers, medical professionals, and institutions like the World Health Organization. All things considered, ongoing innovation and research in digital health have enormous potential to enhance prenatal care services and improve maternal and newborn health outcomes worldwide.

References

1. World Health Organization. Laboratory testing for 2019 novel coronavirus (2019-nCoV) in suspected human cases: Interim guidance, 17 January 2020. World Health Organization; 2020 Mar 30. [Google Scholar]
2. Noy S. The World Bank's work in health: continuity and change. In *The Elgar Companion to the World Bank* 2024 Sep 12 (pp. 216-226). Edward Elgar Publishing. [Google scholar]
3. Casey RM, Akaba H, Hyde TB, Bloem P. Covid-19 pandemic and equity of global human papillomavirus vaccination: descriptive study of World Health Organization-Unicef vaccination coverage estimates. *BMJ medicine*. 2024 Jan 29;3(1):e000726. [Google Scholar]
4. Note C. Results and performance of the World Bank Group 2022. The World Bank. 2022 Apr 26. [Google Scholar]
5. World Health Organization. Tracking universal health coverage: 2021 global monitoring report. World Health Organization; 2021 Dec 12. [Google Scholar]
6. World Health Organization. Tracking universal health coverage: 2021 global monitoring report. World Health Organization; 2021 Dec 12. [Google Scholar]
7. Madanian S, Nakarada-Kordic I, Reay S, Chetty TH. Patients' perspectives on digital health tools. *PEC innovation*. 2023 Dec 1;2:100171. [Google Scholar]
8. Lazarevic N, Pizzuti C, Rosic G, Boehm C, Williams K, Caillaud C. A mixed-methods study exploring women's perceptions and recommendations for a pregnancy app with monitoring tools. *NPJ Digital Medicine*. 2023 Mar 24;6(1):50. [Google Scholar]
9. Cooper M, Free CJ, Kuan KK, McCabe K, Osei-Asemani E, Opondo C, Cameron S. Acceptability of digital health intervention during pregnancy to inform women about postpartum contraception (DIGICAP): a pilot randomised controlled study. *BMJ sexual & reproductive health*. 2025 Oct;51(4):278-85. [Google Scholar]
10. Desmawati D, Hanifah L. Exploring satisfaction on ANC digital health among pregnant women: a qualitative study. *BMC Pregnancy and Childbirth*. 2025 Dec 4;25(1):1346. [Google Scholar]

11. Frid G, Bogaert K, Chen KT. Mobile health apps for pregnant women: systematic search, evaluation, and analysis of features. *Journal of medical Internet research*. 2021 Oct 18;23(10):e25667. [Google Scholar]
12. Borges do Nascimento IJ, Abdulazeem H, Vasanthan LT, Martinez EZ, Zucoloto ML, Østengaard L, Azzopardi-Muscat N, Zapata T, Novillo-Ortiz D. Barriers and facilitators to utilizing digital health technologies by healthcare professionals. *NPJ digital medicine*. 2023 Sep 18;6(1):161. [Google Scholar]
13. Ameyaw EK, Amoah PA, Ezezika O. Effectiveness of mHealth apps for maternal health care delivery: systematic review of systematic reviews. *Journal of Medical Internet Research*. 2024 May 29;26:e49510. [Google Scholar]
14. Rabbani MG, Alam A, Prybutok VR. Digital health transformation through telemedicine (2020–2025): barriers, facilitators, and clinical outcomes—a systematic review and meta-analysis. *Encyclopedia*. 2025 Dec 4;5(4):206. [Google Scholar]
15. Asadollahi F, Zagami SE, Eslami S, Roudsari RL. Barriers and facilitators for mHealth utilization in pregnancy care: a qualitative analysis of pregnant women and stakeholder's perspectives. *BMC pregnancy and childbirth*. 2025 Feb 11;25(1):141. [Google Scholar]
16. Wang J, Tang N, Jin C, Yang J, Zheng X, Jiang Q, Li S, Xiao N, Zhou X. Association of digital health interventions with maternal and neonatal outcomes: systematic review and meta-analysis. *Journal of Medical Internet Research*. 2025;27:e66580. [Google Scholar]
17. Brinson AK, Jahnke HR, Henrich N, Moss C, Shah N. Digital health as a mechanism to reduce neonatal intensive care unit admissions: retrospective cohort study. *JMIR Pediatrics and Parenting*. 2024 Oct 16;7:e56247. [Google Scholar]
18. Ming DK, Merriel A, Freeman DM, Kingdon C, Chimwaza Y, Islam MS, Cass A, Greenfield B, Hoque M, Saha S, Holmes AH. Advancing the management of maternal, fetal, and neonatal infection through harnessing digital health innovations. *The Lancet Digital Health*. 2024 Dec 1;6(12):e926-33. [Google Scholar]
19. Leblalta B, Kebaili H, Sim R, Lee SW. Digital health interventions for gestational diabetes mellitus: a systematic review and meta-analysis of randomised controlled trials. *PLOS digital health*. 2022 Feb 24;1(2):e0000015. [Google Scholar]
20. Frasch MG, Strong SB, Nilosek D, Leaverton J, Schiffrin BS. Detection of preventable fetal distress during labor from scanned cardiotocogram tracings using deep learning. *Frontiers in Pediatrics*. 2021 Dec 3;9:736834. [Google Scholar]
21. 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 and gynecology*. 2020 Jan 23;135(2):371. [Google Scholar]
22. Moise IK, Ivanova N, Wilson C, Wilson S, Halwindi H, Spika VM. Lessons from digital technology-enabled health interventions implemented during the coronavirus pandemic to improve maternal and birth outcomes: a global scoping review. *BMC pregnancy and childbirth*. 2023 Mar 20;23(1):195. [Google Scholar]
23. Güneş Öztürk G, Akyıldız D, Karacam Z. The impact of telehealth applications on pregnancy outcomes and costs in high-risk pregnancy: A systematic review and meta-analysis. *Journal of Telemedicine and Telecare*. 2024 Jun;30(4):607-30. [Google Scholar]
24. 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. [Google Scholar]
25. Lund S, Nielsen BB, Hemed M, Boas IM, Said A, Said K, Makungu MH, Rasch V. Mobile phones improve antenatal care attendance in Zanzibar: a cluster randomized controlled trial. *BMC pregnancy and childbirth*. 2014 Jan 17;14(1):29. [Google Scholar]
26. Hailemariam T, Atnafu A, Gezie LD, Tilahun B. Effect of short message service reminders in improving optimal antenatal care, skilled birth attendance and postnatal care in low-and middle-income countries: a systematic review and meta-analysis. *BMC Medical Informatics and Decision Making*. 2024 Dec 31;25(1):1. [Google Scholar]
27. Adusei-Mensah F, Muthelo L, Ngwenya MW, Mphasha MH, Kauhanen J. Digital health interventions for pregnant women and mothers with under 5-year-olds in low-and middle-income countries: a scoping review. *Global Health Journal*. 2025 Jun 1;9(2):113-23. [Google Scholar]
28. Shahil Feroz A, Afzal N, Seto E. Exploring digital health interventions for pregnant women at high risk for pre-eclampsia and eclampsia in low-income and-middle-income countries: a scoping review. *BMJ open*. 2022 Feb;12(2):e056130. [Google Scholar]
29. Kim S, Park M, Ahn S. Effects of digital health interventions in women with high-risk pregnancies: a systematic review. *Women's Health Nursing*. 2025 Feb 28;31(2):94-107. [Google Scholar]
30. Patel SY, Akileswaran C, Basu S. Early detection of high risk pregnancies using clinical and social data to

- improve health outcomes. *npj Digital Public Health*. 2026 Jan 21;1(1):3. [Google Scholar]
31. Kim JI, Lee JY, Park SH. Evaluating the effectiveness of digital interventions for stress management in pregnant women: Systematic review and meta-analysis. *JMIR mHealth and uHealth*. 2026 Jan 26;14(1):e66267. [Google Scholar]
 32. Nicoletti AE, Tonelli M, Purin B, Rizzi S. Digital Acceptance and Commitment Therapy for Lifestyle Change in Overweight Pregnant Women: A Feasibility Pilot Study. *Behavioral Sciences*. 2026 Apr 14;16(4):585. [Google Scholar]
 33. Kim JI, Lee JY, Park SH. Evaluating the effectiveness of digital interventions for stress management in pregnant women: Systematic review and meta-analysis. *JMIR mHealth and uHealth*. 2026 Jan 26;14(1):e66267. [Google Scholar]