

REVIEW ARTICLE

The Effect of Mobile Application-based Antenatal Care Monitoring in Improving Knowledge, Antenatal Care Compliance, and Health Status of Pregnant Women: A Literature Review

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ABSTRACT

Antenatal care is a crucial aspect of maternal and child health, providing comprehensive services to pregnant women throughout their pregnancy to ensure a safe and healthy pregnancy and delivery. Method: The researcher used the PubMed database and Google Scholar to search for articles published between 2019 and 2023. With the assistance of the publish or perish application, the researcher searched for articles relevant to the research theme. The researcher then retrieved the details based on the criteria. This study strictly adhered to the reporting requirements outlined by PRISMA. Result: A total of 587 items were found from the two databases. Following the extraction process by the inclusion and exclusion criteria, seven articles that could be reviewed were obtained. The study's results revealed that mobile application-based antenatal care can improve pregnant women's health, increase knowledge, and increase compliance with antenatal care visits. This, in turn, affects decreases in maternal and infant mortality. Conclusion: Prenatal care has been revolutionized by mobile app-based health technologies, which have made it more accessible and provided pregnant women with the knowledge they need to better their health status to engage in prenatal care sessions actively.

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INTRODUCTION

For the foreseeable future, the perinatal period will continue to be one of the most significant areas of concentration in public policy globally. This is because, despite the tremendous progress that has been made and changes in the organization of health systems, there is still a persistent problem of high maternal mortality owing to preventable causes. It is becoming increasingly common for low- and middle-income countries (LMICs) to experience an increase in the rates of maternal mortality (1). As a result, The World Health Organization (WHO) recommends pregnant women undergo at least eight encounter pregnancy checks. This category of medical care includes a wide range of services, including physical examinations, laboratory tests, health education, and counseling. In addition to lowering the rates of maternal morbidity and death, the purpose of this suggestion is to help enhance the quality of care that is provided during pregnancy, labor, and the

postpartum period (2).

There are several reasons why Reducing maternal mortality has been set as a Sustainable Development Goal (SDG), has yet to be accomplished. The insufficient quality of services, the insufficient availability of family planning, the gaps in socioeconomic level and race/ethnicity, the insufficient distribution of national resources, and the insufficient infrastructure of the health system all fall into this category (11).

According to the findings of Souza et al (19), very many pregnant women in Brazil did not receive prenatal care. There are the least number of pregnant women who do not have access to prenatal services in the North East and North regions. Failure to detect the dangers of pregnancy can hurt the health of the mother and child, such as slowing fetal development, early birth, increasing the number of cesarean sections, preeclampsia, abortion, and increasing the number of deaths in both mothers and newborns.

It is thought that 94% of maternal deaths happen in low- and middle-income countries (LMICs), with South Asia and Sub-Saharan Africa having the most deaths. In low-

and middle-income countries, only 66% of pregnant women got the recommended number of prenatal screening visits, which is eight or more during the pregnancy. However, only 51% of pregnant women in India get all of their prenatal check-ups, even though the country has one of the highest rates of maternal death in the world (16) . This is true even though India has one of the highest rates of death among mothers. Most women who die during childbirth in low- and middle-income countries (LMICs) die from problems like pre-eclampsia, postpartum hemorrhage (PPH), and sepsis. One reason for the high rates of death and illness among mothers and babies in these countries is that women do not have easy access to adequate medical care during pregnancy (8).

As a direct result of this, there is an immediate requirement for the implementation of novel and practical strategies that will enhance the health of mothers and newborns as well as the rates of survival. Therefore, it is of the utmost need to design care techniques and technology that motivate pregnant women to adhere to prenatal care since it is essential (14). .During the pregnancy cycle, these technologies and procedures ought to be applied to identify and monitor risk factors that may become more obvious. As a means of health promotion, illness

prevention, and improved disease management, health technologies can expand access to medical care and improve treatment adherence. Additionally, medical technologies can aid decision-making, raise pregnant women's knowledge, and improve the management of diseases. As a result, implementing this intervention is of the utmost significance.

Objective

This research review aims to see the effect of mobile application-based antenatal care monitoring on improving knowledge, antenatal care compliance, and health status of pregnant women.

MATERIAL AND METHODS

Data Search Source Strategy

Data sources were gathered in the form of articles published in international journals that agreed with this research's theme. These articles were searched for between 2019 and 2023 using the PubMed database and Google Scholar with the assistance of the publish or perish application, which was modified to correspond with the research theme. The data search was refined by applying the inclusion and exclusion criteria outlined in Table I.

Table I: Inclusion and Exclusion Criteria in Considering Review Studies

Criteria	Inclusion	Exclusion
Population	People who are pregnant throughout the first trimester, the third trimester, and postpartum, women who continue to get routine care through the use of mHealth interventions or mobile applications	Individuals who are not pregnant and who are not participating in an antenatal care intervention through the use of a mobile or mHealth application
Intervention	Any mHealth interventions or mobile applications to see the effectiveness of antenatal health interventions	Did not use mHealth interventions or mobile applications for pregnancy healthcare
Outcomes	The outcomes demonstrating gains in preventive maternal health services include the following critical outcomes for mothers: increased knowledge, increased adherence to antenatal care, improved health status of pregnant women, and decreased death rates for both mothers and infants.	The outcomes are not intended to show improvements in health services for pregnant women and are not the result of a reduction in maternal and infant mortality rates.
Study Design	Original research, case studies, cross-sectional studies, case-control studies, randomized controlled trials, quasi-experimental studies, pre-post investigations, qualitative formative studies, and clinical control trials	Editorial, perspective, symposium proceedings, conference abstract, commentary, meta-analysis, systematic review, literature review
Language	In English	Not in English
Period	Publications of studies that were made between January 2019 and December 2023	Published below 2019

Two authors each conducted their independent review of the publications that were retrieved. If disagreements were due to the selection process, they were resolved through conversation with the third independent reviewer. This investigation was carried out in a manner that was consistent with the reporting standards for Systematic Reviews and Meta-analyses (PRISMA).

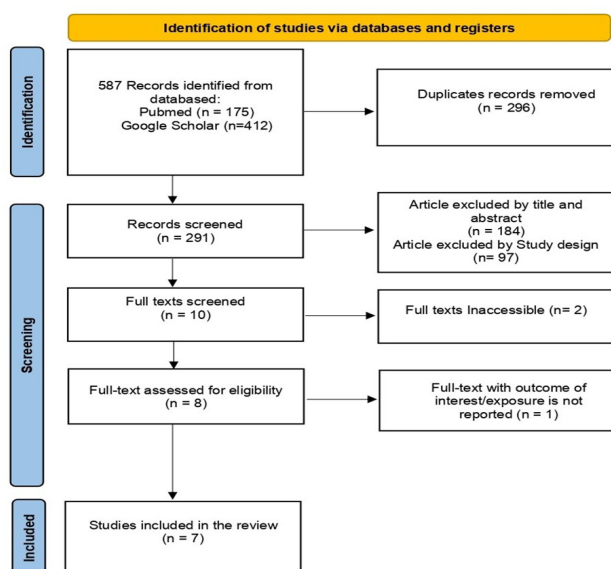


Figure 1: Results of a Systematic Review and Meta-analysis (PRISMA) (Haddaway et al., 2022)

RESULTS

A comprehensive electronic search of various databases yielded a total of 587 articles. It then removed duplicate articles (n=296), articles excluded based on title and abstract (n=184), articles excluded based on study design (n=97), inaccessible full text (n=2), full text with unreported results (n=1), total studies included in the review (n=7). The summary can be seen in Figure 1, Systematic Review and Meta-analysis (PRISMA).

Type of Study

Of the seven studies that were included, four of them were randomized controlled trials (19,13,17, 5) Two articles were observational studies, qualitative, study, cross-sectional study (2 12) A pre-post design study is included in one of the articles (15).

Type of Intervention

Research *Souza et al* (19) Use the Healthy Gestation application, *Benski et al* (2) using the PANDA mHealth system, *Masoi et al* (13) using The interactive mobile health system, Musiimenta et al (17) using the MatHealth App, Dieteren et al (5), using the Together for Her (TFH) smartphone application, *Misago et al* (15) using the Mobile Platform for Maternal Health/android mobile-based applications, and research Liu and Wang (12) using the smartphone mobile terminal app.

Population, Sample and Type of Results Obtained

The Healthy Gestation application was shown to help comply with prenatal care, making a significant contribution to women's care during pregnancy, according to research conducted (19) on 98 pregnant women. The findings of this research were observed to be statistically significant ($p < 0.05$). In the research that 2 conducted on 1446 pregnant women, the study demonstrates that the mHealth Panda system has the potential to improve the quality of antenatal care, change the behavior of service providers by standardizing ANC visits. According to research conducted (13) with a population of 450 pregnant women, the current study indicated that the interactive mobile health system was beneficial in enhancing the use of antenatal care services.

An application called MatHealth, was found to affect increasing knowledge and practices related to maternal health, with a population of eighty pregnant women (17). The study conducted (5) involved a sample of 179 pregnant women. Throughout the trial period of twelve weeks, the study's findings demonstrated that the intervention group showed a more substantial improvement in their level of knowledge. A total of 13.4 percentage points ($P < 0.001$) resulted in a knowledge increase across the board.

The research conducted (15) with a sample size of 132 pregnant women concluded that, based on the fundamental data of 23%, around 73.7% of mothers attended the subsequent ANC visit after the intervention was initiated. Around eighty percent of moms have been attending their antenatal care appointments regularly since the third month of the intervention, equivalent to an increase of more than two hundred percent from the initial figure. There were statistically significant differences ($p < 0.01$) between the observation and control groups regarding knowledge about health services during pregnancy and the perinatal period, average birth rate, pregnancy check compliance rate, and follow-up rates. The research conducted (12) involved a total of 200 pregnant women. The findings revealed that the observation group exhibited a significantly higher level of knowledge than the control group.

DISCUSSION

Antenatal care is a healthcare service delivered by medical professionals to expectant women throughout their pregnancy. This is conducted to oversee the physical and psychological well-being, encompassing the growth and progress of the fetus, and to make preparations for labor and childbirth. App-based healthcare interventions have become increasingly recognized as a valuable method for enhancing the health of mothers and children in low- and middle-income countries (LMICs) in recent years. The advent of mobile application-based health

technology has facilitated enhanced prenatal services. This leads to decreased obstetric emergency referrals, fosters cooperation among healthcare professionals, and enhances the overall provision of services (9).

In addition to that, health services that are based on mobile applications have the potential to improve services by promoting antenatal services in a widespread manner. Revolutionize prenatal care by enhancing accessibility and equipping pregnant women with the necessary information and tools to actively engage in their prenatal care. Not only does this enhance the outcomes for individuals, but it also positively affects the health and well-being of society. This is because healthier pregnancies lead to a healthier population 3. Several pieces of evidence suggest that mobile application-based antenatal care interventions have the potential to significantly contribute to improving a variety of health outcomes for pregnant women, as indicated by the findings of the review. Most of the research was carried out in East Asia and Sub-Saharan Africa, but a few studies were conducted in South Asia and the Middle East. It is becoming increasingly common to adopt antenatal care solutions based on mobile apps to enhance the quality of care provided both before and after pregnancy, as well as to collect data regarding pregnancy (6).

Research by Souza et al (19), adopting the "Healthy Pregnancy" application made it possible for pregnant women to participate in prenatal consultations to a greater extent, with the results being statistically significant. Furthermore, it has been demonstrated to boost mothers' knowledge about pregnancy. This is in addition to clarifying any uncertainties regarding the pregnancy (17,5,12). According to Osei and Mashamba-Thompson (18), mobile application-based health applications have supported enhanced user accessibility to information with better speed and accuracy. This is in line with the review that was conducted. This can also be accomplished by bringing the patient closer to the nurse, contributing to compliance with self-care and therapy.

Mobile application-based antenatal care can increase compliance with prenatal care (19,2,13,1,1,12). In addition to more stringent monitoring of pregnant women in a range of circumstances, such as elevated blood pressure, the danger of premature birth is also increased, and nutrition in the process of supporting breastfeeding (12,5). Thus, it is considered a practical tool in promoting health and preventing illness, with additional benefits in healthcare that have been proven via scientific evidence.

Research by Konje et al (10), a poor level of compliance with prenatal care is associated with an increased risk of obstetric complications as well as an increase in the number of deaths that occur in both mothers and

babies. As a direct consequence of the absence of diagnosis and treatment for problems during pregnancy, these results have been established. When it comes to pregnant women, antenatal care that is based on mobile applications helps to clarify uncertainties and provides quality information. Additionally, the fact that the guidance provided by this tool contributes during pregnancy is related to satisfaction with utilizing this technology.

Pregnant women can detect non-physiological signs and symptoms of pregnancy through the use of mobile applications that are offered during the prenatal period. This information contributes to early diagnosis and management, which helps minimize difficulties and reduce morbidity and mortality (7). Suppose this is made accessible to pregnant women through information and communication technology. In that case, it could be a practical and helpful instrument, thereby consolidating the objective of the application.

According to the findings of the review, there is evidence indicating that the utilization of applications geared toward women during pregnancy improves the quality of services and positively impacts the health of both mothers and children. Additionally, using these applications improves health indicators and reduces the number of maternal deaths, which is beneficial to the practice of nurses in primary health care. A viable alternative to increase behavior change for the better, increase compliance of pregnant women in ANC visits, and increase knowledge of pregnant women regarding pregnancy is the use of mobile application-based antenatal care, also known as mHealth. This type of care expands access to information related to health, disease, and services and allows for sharing information. Until the end of the pregnancy, it can potentially improve mothers' health status.

CONCLUSION

The proliferation of health technology that is based on mobile applications has made it feasible to facilitate the enhancement of prenatal services and the empowerment of pregnant women. By doing so, obstetric emergency referrals are decreased, mother and infant mortality rates are decreased, knowledge is increased, antenatal visits are increased, and collaboration between health workers is encouraged, all of which contribute to improving the overall delivery of services. Mobile application-based health technology can enhance preventive services by widely promoting antenatal services. Mobile application-based health technologies have significantly transformed prenatal care, enhancing its accessibility and empowering pregnant women with the necessary information and tools to engage in their prenatal care actively. Enhancing individual outcomes yields personal improvements and contributes to society's overall health and well-being.

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