REVIEW ARTICLE

Telehealth Improves Pregnancy Health Care: Literature Review

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ABSTRACT

In Southeast Asia, Indonesia has the highest maternal mortality rate. The Indonesian government has made a policy of limiting the visits of pregnant women during the COVID-19 pandemic. Telehealth is a solution that is widely used to facilitate health services during a pandemic and to develop applications that support prenatal health care. This research is a literature review. The electronic databases used are PubMed, Proquest, Cochrane Library, Clinical Key, and BJOG. Research topic: telehealth in pregnancy, publications 2017–2022, full text available. The MeSH terms "telehealth," "pregnancy apps," "mobile health," "mHealth," and "eHealth" were employed.. The results of database extraction were obtained for 12 articles from 396 articles. Telehealth improves antenatal care visits, compliance, knowledge, and readiness for childbirth. This review highlights the lack of evidence-based research in developing telehealth to prevent pregnancy complications.
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INTRODUCTION

The maternal mortality rate is very high in the world; in 2015 it reached 303 per 100,000 live births (1, 2). The maternal mortality rate in Indonesia ranks first in Southeast Asia; the maternal mortality rate reaches 235 per 100,000 live births. 100,000 live births (4). The maternal mortality rate in Indonesia is far from the global target of 70 per 100,000 live births in 2030 (4). Maternal death is the death of a mother during pregnancy or 42 days after delivery, regardless of the duration and location of the pregnancy, caused by something related to pregnancy or pregnancy management but not from accidental or incidental causes (3, 5). The most frequent causes of maternal mortality are hypertension, diabetes mellitus, bleeding, eclampsia, age, education, social support, perception, socioeconomic status, and health services (6–10).

All the countries aim to reduce maternal mortality so that the Sustainable Development Goals (SDGs) are prepared. The third objective of the SDGs is to ensure a healthy life and improve the well-being of the entire population of all ages (2). The health sector is responsible for addressing 38 SDGs.One of the focuses of the third SDG is to reduce maternal and infant mortality (2). For its management, the Indonesian government has established a three-pillar programme called Healthy Indonesia (11).The three pillars are a healthy paradigm, an approach that is promotive and preventive, health services that are carried out and directed to improve access and quality of health, and national health insurance. The government's efforts were hampered by the COVID-19 pandemic that entered Indonesia in March 2020.

The COVID-19 pandemic has caused public anxiety because of the large number of deaths due to the delta variant of the COVID-19 attack. To stop the spread of COVID-19, the government has made policies that include staying at home, physically separating people, using personal protective equipment, working from home, and turning on major social media sites to make policies fit into everyday life (12).

Antenatal services are health services received by mothers during their last pregnancy and provided by health workers, including doctors (general practitioners and/or obstetricians), midwives, and nurses (13). Pregnancy visits to primary health care aim to monitor the mother and infant's well-being.

The Indonesian government has made it a policy for pregnant women to visit the health centre at least four times during pregnancy (13). Schedule visits one time during pregnancy in the first trimester, once during pregnancy in the second trimester, and twice during pregnancy in the third trimester (13). There is an increase in mental health problems and domestic violence, a decrease in prenatal visits, and an increase in the need for care during the COVID-19 pandemic (14). Anxiety is related to pregnant women's visits (15). Telehealth is an option for pregnant women to receive health services remotely. Telemedicine is a diagnostic tool, screening tool, or device for globalising medicine (16). Many health applications for pregnant women have been developed; here, researchers want to know about telehealth for pregnant women. Researchers want to see if telehealth supports services for pregnant women. Objective of the study is to find out applications that support pregnancy health care.

METHODS

This research is a literature review. The electronic databases used are PubMed, Proquest, Cochrane Library, Clinical Key, and BJOG. Inclusion: research topic "telehealth in pregnancy," publication 2017–2022, and full text available. Exclusion: the results of the review. MeSH term for article search: "telehealth" or "pregnancy applications" or "mobile health" or "mHealth" or "eHealth." We identified 396 article titles that matched the search terms. We use the PRISMA flow diagram to select articles. We found no duplication. 12 articles were included in this review (Figure 1).

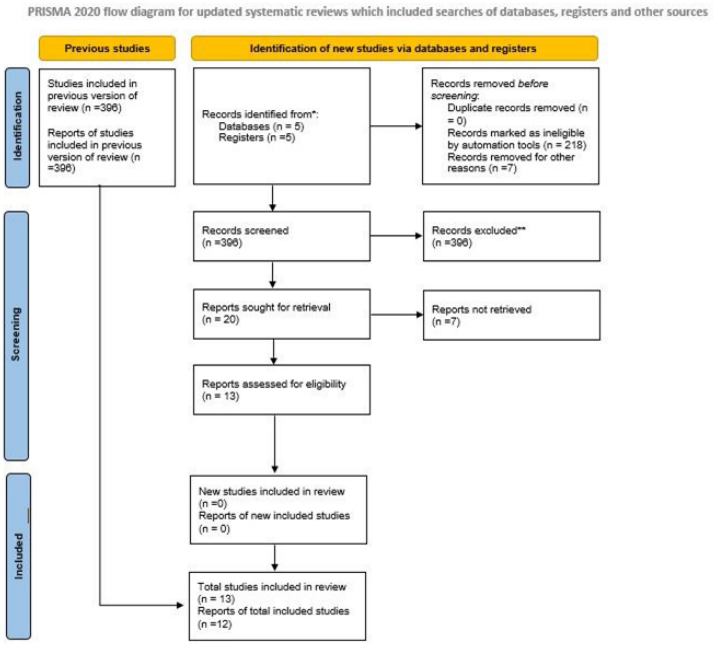

Figure 1 : Flow of Article Reviewed.

RESULTS

In total, we identified 396 articles. The databases obtained were PUBMED (95 articles), Proquest (258 articles), Cochrane Library (6 articles), Clinical Key (34 articles), and BJOG (3 articles). The results of the extraction of articles obtained (n = 12) were selected according to the research objectives and inclusion criteria. Inclusion criteria include topic pregnancy application, publication 2017-2022, and full text. Participants who had previously received the intervention are excluded 12 articles were obtained in English, German, and Portuguese. Articles were collected from various countries, namely the United States, Brazil, Tanzania, China, India, England, Portugal, South Africa, Iran, Germany, and Mississippi. A randomised control trial (RCT) was used in eight of the twelve articles, a quasi-experimental design was used in one, and a cohort was used in three.

DISCUSSION

A total of 292,331 pregnant women participated in this study. Participants are included in the interventional group and the control group. We have five groups of telehealth: mobile health (17, 22), telemedicine (20, 21), mobile applications (24), tele-educational (26), and mobile phones (18, 19), Telehealth was developed before the COVID-2019 pandemic, but its use has not been as widespread as during the COVID-2019 pandemic. Telehealth has grown all over the world. According to one of the study's findings, 92% of 162 pregnant women used the internet to find information about childbirth apps, while 58.1 used social media. 24.3% of women who received information from the internet decreased their network, and 14.8% increased it (29).

There have been studies with an RCT design, the sample of which was analysed in the study showing which education was included in their telehealth. Bush et al. (2017) developed the Wyhealth Due Date Plus, which contains about 70 pregnancy risk factors. This application aims to detect the danger as soon as possible (17). This app features detection tools and body reminders. Wyhealth Due Date Plus is statistically and clinically proven to increase visits by pregnant women, especially in the last 6 months before delivery. Weaknesses in the study were the small sample, previous pregnancy history, alcohol use, social support, and marital status. Oliveira-Ciabati et al. (2017) develop a two-way cellular-based shot massage service that could increase the coverage of antenatal care (ANC) recommended for syphilis and HIV (18). The PHCU intervention group registered, received prenatal SMS, received and read educational SMS, and did not stop service. The education consisted of 148 messages (4 messages each

Table I : Identity of Analized Article

No.	Author	Methods	Sample	Applications/ Telehealth	Research Strengths and Weaknesses
1	Bush et all (17).	A Randomized, controlled	5.243 (85 intervention group and 5158 control group)	Mobile Health	The use of WY health Due Date Plus was linked to a modest but statistically significant improvement, which is the study's strength. There is a strong correlation between increased app usage and births with low birth weight. This study's weaknesses include its small sample size and the incompleteness of the demographic data it acquired from Medicaid app users.
2	Oliveira-Ciabati et al. (18).	A Randomized, controlled	1210 (770 intervention group and 440 control group)	PRENACEL (a bi-directional, mobile-phone-based, short text message service (SMS)	The strength of this study is that it demonstrates the potential benefit of a mobile phone-based two-way text messaging service to expand the application of recommended ANC practices, including testing for syphilis and HIV. Only one-fifth of the participants involved in this study had a weakness. The fact that eligible women expressed interest and joined PRENACEL shows that one of the main challenges to be overcome is inspiring pregnant women to enroll in the program.
3	Masoi & Kibusi (19).	A controlled quasi-experimental	450 (150 intervention group 300 control group)	an interactive mobile messaging alert system	The usefulness of the interactive message alert system was investigated through this study, and it was found to be effective in raising awareness of obstetric and neonatal danger signs, individual birth readiness, and complication readiness. A potential strategy in their settings to enhance the monitoring of pregnant women and boost the use of maternal health care services is the use of SMS technology to convey health information. The researchers did not add to the limitations of their research results.
4	Zhu et al. (20).	The study was retrospective.	228.349 (93.465 high-risk pregnancy group and 13.4884 telemedicine group)	Telemedicine	Researchers point out that the advantages of telemedicine combined with regular health care for high-risk pregnancies are important steps to ensure the health of pregnant women. They have applied the results of their research for a long time and are useful in pregnancy outcomes. The researchers did not mention the weaknesses of their study, but the study design was a retrospective cohort.

Continue....

No.	Author	Methods	Sample	Applications/ Telehealth	Research Strengths and Weaknesses
5	Ferrara et al (21).	A Randomized, controlled	394 (199 intervention group 394 control group)	Telehealth	The GLOW study has several advantages, including a high sample size, the capacity to enroll a population that is racially and culturally varied, including Asian women (a group that was underrepresented in prior studies), and the early identification and enrollment of potential participants. The use of telemedicine in the intervention, which has been demonstrated to be effective in a healthcare delivery environment, will enhance perinatal outcomes for pregnant women with gestational diabetes. The study group was not hidden from the participants, which might have influenced how they answered questions about their food and exercise habits. It is also impossible to determine whether the identified between-group differences in Gestational Weight Gain (GWG) were caused by increased contact time or by the intervention's actual content because women in the usual care group did not have any additional contact with research study intervention staff whereas women in the experiment got the extra meeting.
6	Murthy et al (22).	A pseudo-randomized controlled trial	1515 (1113 intervention group and 402 control group)	mHealth	The findings of this study are strong evidence that customized mobile phone voice messages sent by telephone can increase knowledge and behavior among women in low-resource environments. Women who received mMitra messages adopted more home and health-related behaviors. Practices are carried out in facilities that have a beneficial effect on maternal and child health outcomes. Their study relied primarily on self-reported data collected from surveys of women, who may be vulnerable to remember bias, including misleading or false reporting by women. The data reduction was due to the loss of follow-up variation and adherence between the intervention and control groups. This approach is subject to randomized, possible group misclassification. It is possible that this study is not as balanced as a conventional randomized controlled experiment.
7	Aiken et al. (23).	Cohort analysis.	52.142 (22158 intervention group and 29984 telemedicine hybrid group)	Telemedicine-hybrid model	They discovered that telemedicine without routine ultrasonography for no-test medical abortions up to 10 weeks gestation is an efficient, secure, and agreeable service model. Given that their sample encompassed 85% of all medical abortions performed in England and Wales during the study period, our findings' generalizability is the study's main strength. They were unable to actively follow up with patients after their abortions, which is the main limitation of this study. Due to many entrance points into the National Health Service (NHS), informal contact between the NHS and abortion providers, and some problems not clearing the bar for significant occurrences, there may be a gap in the consistency of reporting incidents. Even if it's likely that some patients visited other healthcare professionals but nothing substantial went wrong, the risk management and reporting processes in the NHS are clearly established, and critical occurrences are routinely discussed.

No.	Author	Methods	Sample	Applications/ Telehealth	Research Strengths and Weaknesses
8	Lucia (24)	A randomized controlled clinical trial	88 (36 intervention group and 39 control group)	mobile applications	The strength of this app, they use Instagram to develop apps that are made with discussion. This fact can be explained by the availability of information to explain questions that may arise during pregnancy. To ensure that pregnant women attend prenatal care, it also offers an alarm function to remind them of the exact day and time of their appointment. Weaknesses of this study include the number of Family Health Units employed to conduct the study and the length of the intervention, which increases the likelihood of harming the sample during data collection.
9	Endler et al. (25).	A Randomized, controlled	900 (450 intervention group and 450 control group)	Telemedicine	They discovered that their telemedicine abortion model, with the only part that was done in person, was uterine palpation, as a comparison to regular treatment, non-inferior in terms of full-scale abortion. They discovered a notable variation in the frequencies of continued pregnancies, urgent clinical consultations, adherence, or contentment. Groups stated that they preferred a telemedicine strategy or a hybrid care model. This type of care is based on environments where there is a shortage of access to the limitations of ultrasonography and nearby abortion clinics' easy access to safe abortion. The study's participants might not fully represent the population the intervention is intended to help. Although the data app's file size was intentionally kept low, some women were not permitted to participate in the study because they lacked a smartphone or sufficient space on their phones for it. Online accessibility is a hindrance to telemedicine for abortion implementation in low-resource settings and may make it difficult for women to contact and follow up with an online provider
10	Khoddam et al. (26).	A randomized controlled trial	82 (41 intervention group and 41 control group)	tele-educational	This study's strength shows that tele-education can successfully alter second-trimester pregnant women's confidence regarding sexual dysfunction. Only female volunteers and expectant mothers between the ages of 14 and 31 weeks are recruited for this study, which is one of its weaknesses.
11	Potzel et al. (27).	A randomized controlled trial	64 (27 intervention groups and 27 control groups).	smartphone app	The Test TRIANGLE Study was the first clinical trial of a smartphone app-based intervention in the post-GDM context. It permitted an initial assessment of likely clinical effects and feasibility of the TRIANGLE intervention via both objective (clinical parameters, user logs) and subjective data (questionnaires, nutrition protocols). User logs in the intervention arm gave insights into the use of program components. This study's shortcomings include a lack of personnel because of calculations' assumptions. This study's homogeneous group, potential socioeconomic bias, higher education level, and predominance of native speakers are its other potential weaknesses.

No.	Author	Methods	Sample	Applications/ Telehealth	Research Strengths and Weaknesses
12	Reneker et al. (28).	a retrospective historical cohort study	1894	Telehealth Services	The advantages of this study come from studies that have demonstrated the need for telehealth during the COVID-19 pandemic for the medical care of pregnant women. The possibility of a retrospective cohort research design is a drawback of this study since pregnant women are in danger from direct contact with the pandemic.

week) sent to pregnant women about the physiology of pregnancy, childbirth, ANC, elements, postnatal care, contraception, and the psychosocial aspects of pregnancy and postpartum.

Researchers developed 150 voice messages translated into Hindi and Marathi. A fetal developmental stage, nutrition, iron/folic acid supplement, ANC reminders, anemia, rest during pregnancy, HIV testing, sonography, pregnancy danger signs, birth preparation, the onset of labour pain, umbilical cord severance, and contraception (22) are all included in audio announcements. Souza, F., et al. (2021) state that if the health application increases pregnant women's compliance, 31 (81,1%) are satisfied (30). This application, called "Healthy Gestation," has been proven to increase the adherence of pregnant women to prenatal care. The applications contain an antenatal assessment, birth orientation, breastfeeding, postpartum recovery period, medical appointments, and a "talk to us" menu, making the applications user-friendly. Users can contact the administration if they have problems or something they did not understand in the application (22); The drawback of this application is the limited number of samples. This research recommends that this research be carried out on a wider scale so that it can be generalized.

The present model is different from the telehealth developed before; the present research develops telehealth to reduce weight in pregnant women who are obese (21). Pregnant women in the intervention group were given 150 minutes per week of physical activity ranging from moderate to vigorous, knowledge of healthy foods, and stress management. The first and last sessions were conducted in person, while the middle 11 sessions were conducted by telephone (21). GLOW intervention with telehealth has the potential to reduce female obesity.

Similar research was conducted (19). The investigator creates an Interactive Message Warning System (IMAS). IMAS increases knowledge and readiness for childbirth. The built-in warning system is integrated into the computer system. An interactive warning system is a system where health workers provide health services by sending educational messages via short messages (SMS) that include signs of pregnancy, danger signs, and postpartum, as well as danger signs for newborns (19).

Other research develops telehealth with a cohort design. Researchers develop telehealth integrated with the hospital with the goal of facilitating the participant's consultation with a specialist or sub-specialist (20). Other studies have shown that intellectual messages can increase the sexual confidence of pregnant women in the second trimester (26). Researchers develop tele-education to overcome sexual problems during pregnancy. Tele-education, as referred to here, is education sent via SMS message. Messages are sent to pregnant women aged between 14 and 31 weeks, one message per week. Education contains the anatomy and physiology of female reproduction, the fetus, the amniotic sac, the correct sexual position during pregnancy, condom use, the physiological changes due to pregnancy, and the body image of pregnant women so that mothers are confident. This research has proven to increase knowledge by increasing access to education, reducing costs, and optimising time (26).

The advantage of telehealth that was developed is that almost all telehealth is equipped with a theme that can increase the knowledge of pregnant women and have an impact on increasing adherence to antenatal care (17, 18–24). Telehealth contains education about the physiology of pregnancy, danger signs and postpartum, managing weight during pregnancy, activities during pregnancy, danger signs for newborns, sexual education, improving the self-image of pregnant women, and home care education (17–19, 21–22, 24–26, 28). This study is based on the results of the meta-analysis by DeNicola et al. (2020), who stated that telehealth supports evidence-based obstetric and gynaecological interventions and text messages to improve the behaviour of pregnant women. Some of the articles we found show that telehealth is built around the general information needs of pregnant women (17–19, 21–22, 26–28). We have not found any articles on developing telehealth based on the

experiences of pregnant women, either with normal pregnancies or those who have experienced complications.

There are two articles about abortion. Online consultation and instructions for handling abortion at home with uterine palpation are not inferior to standard care (25). This application was created to facilitate unsafe abortions because 50% of deliveries are carried out outside public health facilities. The expectant mother will undergo an initial interview. If the woman is deemed eligible for a home abortion, they send her four messages containing instructions on how to take the medication, what symptoms to expect, what complications to look out for, and how to assess the completion of the abortion with the help of a pregnancy test. Patients will be instructed to take mifepristone (25). The study's weakness is that the services are only available online, making them inaccessible to women with low socioeconomic status. Pregnant women who are less than nine weeks pregnant can have a safe abortion using a telehealth hybrid (23). The incorporation of untested telemedicine into line medicine was no less effective than traditional ultrasound-based conforming methods in this study of 52142 medical abortions. Hybrid telemedicine is preferred by the community. After all, it is easier and safer because it is supervised by health workers. Telehealth speeds up services and reduces the abortion rate during pregnancy. Abortion is the expulsion of the products of conception before 20 weeks of age (32). The World Health Organization's (2022) Abortion Guidelines state that abortion can be performed in pregnancies of less than nine months of gestation. The study's findings are consistent with other studies, which show that telehealth can provide the same service as direct care in approximately 95% of cases (34). Another research group created a machine-learning tool that can be used to assess pregnant women's diabetic status (35).

Some studies did not explain in detail how to use a smartphone to prevent diabetes mellitus, but the results obtained included physical activity, fibre intake, fat, nutrition, and weight loss methods (27). The TRIANGEL intervention in pregnant women with gestational diabetes did not affect physical activity, fat intake, or blood sugar levels. Triangle has an impact on pregnant women's fibre intake. The failure of these interventions can be caused by a lack of samples and interventions that are not long enough to influence behavior. Large-scale studies prove a decrease in blood sugar levels in pregnant women and prevent complications (36). Based on the result of this meta-analysis, it is necessary to develop telehealth treatment for gestational diabetes and a large sample size to provide evidence-based results.

CONCLUSION

This study shows that telehealth improves antenatal care visits, adherence, knowledge, and readiness for delivery. The results of this study are inconclusive because of publication bias such as retrospective study designs, small sample sizes, and other factors that create bias. It is necessary to conduct studies with larger sample sizes and prospective or mixed-methods research designs. According to the findings of this meta-analysis, telemedicine therapy for gestational diabetes must be developed, and a large sample size must be used to provide results that are supported by evidence as large-scale research shows that pregnant women's blood sugar levels fall and issues are avoided.

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