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SYSTEMATIC REVIEW: COMPARISON OF TELEMEDICINE CONSULTATION WITH FACE-TO-FACE CONSULTATION IN HIGH-RISK PREGNANT WOMEN IN THE DIGITAL ERA

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ABSTRACT

In the digital age, telemedicine has emerged as a promising approach to healthcare delivery, particularly for high-risk pregnant women who require regular monitoring and consultation. The shift from traditional face-to-face consultations to telemedicine consultations requires evaluation of its effectiveness and impact on maternal health. The aim of this systematic review was to compare the effectiveness and impact of telemedicine consultation with face-to-face consultation on the health of high-risk pregnant women. This comparison includes aspects such as patient satisfaction, quality of service, health outcomes, and implementation barriers. A systematic review was conducted using databases including PubMed, Sage Journal, Science Direct, Wiley, and Cochrane. The search was limited to articles published in the last five years (2019-2024). Additional references were identified through manual searches. Studies were selected based on predefined inclusion criteria with a focus on high-risk pregnant women and comparison of telemedicine and face-to-face consultations. The review included studies that provided data on patient satisfaction, quality of care, health outcomes, and implementation barriers. Telemedical consultations are generally well received by patients as they offer convenience and flexibility. However, challenges such as technological barriers, internet connectivity issues, and the need for emotional support were also noted. In terms of health outcomes, telemedicine proved to be as effective as face-to-face consultations for most measures, although some aspects of the service, particularly those that require direct physical assessment, are still a challenge. Telemedical consultations offer a viable alternative to face-to-face consultations for high-risk pregnant women, providing comparable quality of care and patient satisfaction. However, successful implementation of telemedicine requires addressing technological and emotional support challenges. Further studies with larger sample sizes and longer follow-up periods are needed to understand the long-term impact of telemedicine on maternal health.

Keywords: Telemedicine, Face-to-face consultation, High-Risk Pregnant Women, Digital era

INTRODUCTION

Science, technology and innovation have been identified as the fulcrum for achieving the Sustainable Development Goals (SDGs) in the 2030 Agenda. In the women's health sector, mHealth technologies play an important role in achieving SDG target 3, which is to save the lives of women in vulnerable communities. More than 99% of maternal deaths among poor and rural women in developing countries are preventable. mHealth refers to technology-based platforms for improving patient care, monitoring and remote healthcare delivery. mHealth improves service delivery efficiency, quality and quantity of life. WHO recognises scientific applications as an important pillar of healthcare, with mHealth as a potential tool due to its widespread adoption and use by the public (Bekyieriya, Isang and Baguune, 2023).

Low- and middle-income countries (LMICs) have a long history of poor access to and quality of health services, particularly in maternal and child health (MCH). The main issues affecting the quality of MCH services are the lack of human and physical infrastructure, such as safe clinical facilities, diagnostic equipment, and treatment resources, and the lack of training programmes for health workers. These problems lead to poor quality of care, inadequate diagnosis and treatment, high infant mortality, many infections during pregnancy, increased risk of mother-to-child transmission of HIV, malnutrition, early childhood pneumonia, and various other health problems. Health inequalities at an early age can exacerbate social inequalities throughout life if not addressed and remedied(Till *et al.*, 2023).

The World Health Organisation (WHO) recognises prenatal care and infant mortality as important measures in assessing the quality of health services. Several new software and digital tools from the public and private sectors have been developed to address women's reproductive health needs, including menstrual cycle tracking apps, vital signs monitoring tools, as well as cervical cancer screening and pelvic floor strengthening medical devices. (Hod *et al.*, 2023).

Hypertensive disorders in pregnancy cause complications in 5-10% of pregnancies and are a major cause of maternal morbidity and mortality in the United Kingdom. Women with hypertensive disorders in pregnancy require close management in the antenatal period and the first few weeks after delivery, A recent survey of pregnant women showed that around 20% of pregnant women in the UK self-monitor their blood pressure during pregnancy, with around 50% of pregnant women with hypertension undertaking monitoring. (Aoyama *et al.*, 2023)

As the COVID-19 pandemic accelerates, the integration of telemedicine in healthcare, particularly in antenatal care, is increasing. This change raises important questions about the effectiveness and acceptability of telemedicine consultations compared to traditional face-to-face interactions, especially for high-risk pregnant women. Various telemedicine methods include remote health monitoring and real-time virtual consultations. It is evident that these technologies can maintain patient satisfaction, even better, while potentially reducing healthcare costs. Several studies have shown that telehealth can effectively replace in-person visits

for routine check-ups, such as blood pressure and foetal heart rate monitoring, without negatively impacting maternal and infant health outcomes. A narrative review showed that telehealth did not lead to adverse clinical outcomes in mothers or babies during the pandemic, indicating that telehealth can be used as an alternative care model(Carvalho *et al.*, 2024).

The choice of face-to-face patients is very important, despite the advantages of telemedicine. Studies show that many pregnant women still prefer face-to-face consultations, mainly due to their concerns about the quality of care and emotional support they receive when consulting in person. A study found that many women experience anxiety and feelings of alienation associated with remote consultations, despite the reduced waiting and travelling time for remote consultations(Bird *et al.*, 2019).

A thorough analysis of telemedicine compared to face-to-face consultations in high-risk pregnant women shows a complicated situation. Although telehealth technology may improve the accessibility and effectiveness of antenatal care, issues of patient acceptance and emotional well-being also need to be considered. Further research is essential to evaluate the effect of telemedicine on long-term maternal and foetal health outcomes and to develop approaches that can address pregnant women's concerns about remote consultations. To gain a better understanding of the comparative effectiveness of these two modalities in today's computer and internet age, this review combines the existing literature (Esposito *et al.*, 2023).

With the lack of healthcare providers in primary healthcare, especially in rural areas, telemedicine is a suitable solution to address this challenge. Doctors in primary healthcare, as frontline healthcare providers, offer initial and ongoing medical care to patients of all ages. They serve as the first point of contact for medical care, diagnosing and treating various illnesses and injuries, managing chronic diseases, as well as promoting preventive health practices(Parthasarathi *et al.*, 2024).

Telemedicine itself is considered an excellent tool to support everyday and traditional healthcare practices, especially in the care and management of chronic patients. (Esposito *et al.*, 2023). Telemedicine is particularly valuable when speed and accessibility of medical services are of paramount importance to patients. However, telemedicine faces challenges in personal data protection. Patients transmit a lot of personal data to medical staff through apps, which must be handled in accordance with national laws. In order to integrate telemedicine into general healthcare services, privacy and protection of patient data must be guaranteed for telemedicine to be trusted by patients and healthcare professionals (Heřman *et al.*, 2022).

Developments in neonatal and paediatric care for complex medical conditions have improved the survival of children requiring chronic healthcare. Recent synchronous digital health technologies allow patients and families access to clinical teams in real-time from home, using audio, video and health information interfaces (Bird *et al.*, 2019).

Mobile-based telehealth, or mHealth, provides the potential to improve maternal and newborn health outcomes in developing countries with high mobile phone

subscription rates. Mobile phone consultations between pregnant women and nurses at obstetric call centres have been shown to be effective in providing triage for emergency cases, helping to manage non-urgent symptoms, and improving the efficiency of hospital emergency departments (Alam *et al.*, 2019).

Telehealth itself is a range of remote healthcare services that include patient consultation, diagnosis, therapeutic guidance, monitoring and referral. The use of the internet enables data storage, sharing of visual information, and recording of conversations via video conferencing, which reduces travelling costs and waiting times for urgent appointments (Achtschin *et al.*, 2023).

Several studies in developed countries show that telemedicine can provide care at a lower cost and provide greater convenience for patients. (Verma, Buch and Taralekar, 2023). From previous studies, this systematic review was conducted with the aim of finding out which is more effective between telemedicine consultation and face-to-face consultation in maternal and child health in the digital era. The research question was: Is telemedicine consultation more effective than face-to-face consultation for high-risk pregnant women in the digital era?

LITERATURE REVIEW

Telemedicine consultation for high-risk pregnant women refers to the use of communication technology, such as telephone or video calls, to provide health services to pregnant women who are at risk of complications during pregnancy(Bird *et al.*, 2019). This includes maternal and foetal health monitoring, medical consultation, as well as necessary antenatal education. With telemedicine, pregnant women can access healthcare services without having to travel to a health facility, which is especially important for those who live in remote areas or have limited mobility(Parthasarathi *et al.*, 2024).

One of the key advantages of telemedicine consultations is its ability to improve healthcare accessibility. High-risk pregnant women often require more intensive monitoring and regular consultations with medical personnel(Carvalho *et al.*, 2024). With telemedicine, they can have routine check-ups, such as blood pressure monitoring and foetal heart rate, without having to face the gruelling journey to the hospital(Bird *et al.*, 2019). This not only saves time and money, but also reduces the risk of exposure to infections, especially in situations such as a pandemic(Alam *et al.*, 2019).

In addition, telemedicine also allows for more flexible interactions between patients and healthcare providers. Expectant mothers can ask questions and get emotional support from medical personnel directly, despite not being face-to-face(Achtschin *et al.*, 2023). This is very important, as emotional support can contribute to the mental health of pregnant women, who are often affected by stress and anxiety during pregnancy. However, while telemedicine offers many benefits, it is important to remember that face-to-face interactions still have an important role to play in providing deeper support and more comprehensive education(Till *et al.*, 2023).

Although telemedicine shows great potential in improving care for high-risk pregnant women, there are challenges that need to be overcome, such as the need for adequate technological

infrastructure and training for medical personnel(Heřman *et al.*, 2022). Further research is needed to evaluate the long-term impact of telemedicine on maternal health and to ensure that all pregnant women, especially those at high risk, can receive quality care.

RESEARCH METHODS

Proses Systematic Review ini disusun sesuai dengan Pedoman Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) tahun 2020 (Page et al., 2021). This study used the PICO framework with P (Population): High-risk pregnant women, I (Intervention): Telemedicine consultation, C (Comparison): Face-to-face consultation, and O (Outcame): Effectiveness in terms of maternal and infant health, maternal satisfaction, and ease of access. Based on the PICO framework above, there is a review question, namely: Is telemedicine consultation more effective than face-to-face consultation for high-risk pregnant women in the digital era?

Inclusion criteria include 1) Primary research and original search articles on 'Comparison of Telemedicine Consultation with Face-to-Face Consultation in Pregnant Women with Resting in the Digital Era', 2) Published in the last 5 years (2019-2024), 3) English language, 4) Open access and full text. Review articles such as literature, systematic, and protocol as well as books, theses, and theses are excluded from this systematic review.

The article search process used 5 databases namely PubMed, Sage Journal, Science Direct, Wiley, and Cochrane as well as search engines namely Google Scholar and Taylor & Francis to find articles relevant to the topic/theme. The search was conducted using keywords: Comparison AND ("Telemedicine" OR "Telehealth") AND ("High-risk Pregnancy" OR "High-risk Pregnant Women") AND ("Digital Era" OR "Digital Healthcare")

To identify studies that met the inclusion and exclusion criteria, articles were screened independently by two reviewers to ensure the suitability of the articles (WI and RN). If there was a difference of opinion between the two reviewers, it was resolved by discussion and review between reviewers. We extracted article data in the form of article characteristics (author and year of publication, country, study design, participants, results), participant characteristics, interventions, and results of studies related to the use of telemedicine and face-to-face consultations in mothers with high-risk pregnancies.

The quality assessment of non-randomised control trial articles was carried out using the Cochrane tools to assess the risk of bias in non-randomised control trials or the Risk of Bias Non-Randomised Studies of Exposure (ROBINS-E) tool for observational studies with 7 assessments, namely confounding, selection of research participants, classification of exposure, deviation of expected exposure, missing data, measurement of outcomes and selection of reported results. This assessment was carried out by two reviewers independently and if there were differences in results, a joint discussion was held.

RESEARCH RESULTS

Article Selection

A total of 500 articles were entered into the Mendeley Referrence Management Tool for identification, 9 articles were detected as duplicates then

excluded so that 491 articles remained, then the articles were filtered again based on the title and abstract related to 'Comparison of Telemedicine Consultation with Face-to-Face Consultation in Pregnant Women with Resting in the Digital Era', until 20 articles were obtained. Furthermore, the 20 articles were filtered again by reading the entire contents of each article thoroughly and adjusted to the inclusion criteria and exclusion criteria. Then the results obtained were 6 articles that were included in this systematic review. Of the six articles, two were Quasi-Experimental studies, three were Randomised Controlled Trial (RCT), and one was a Mixed Method study. According to country of origin, two articles were from the United States, two articles from the Netherlands, one article from Brazil, and one article from Australia.

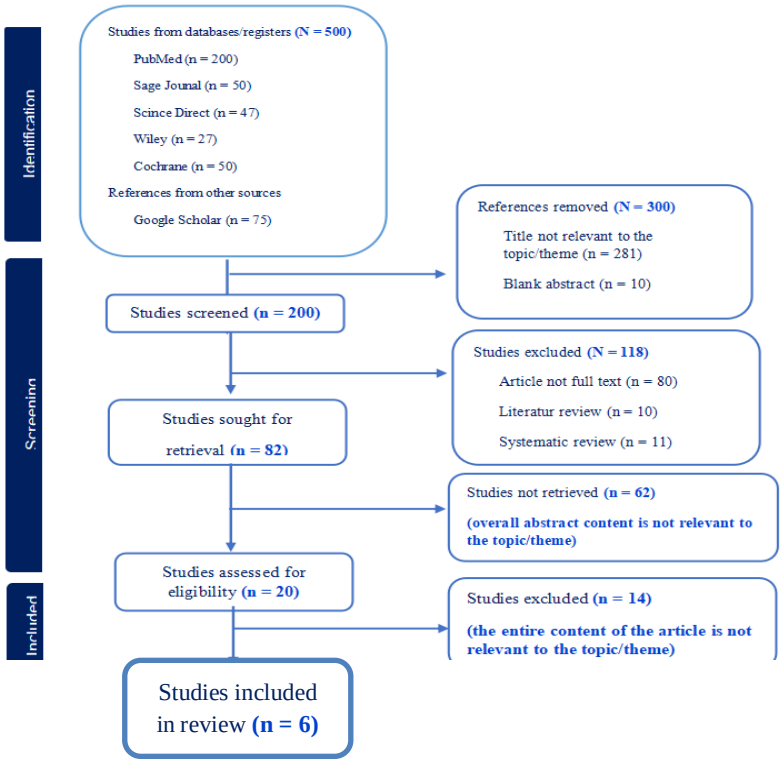

Figure 1. PRISMA-ScR Flowchart

Tabel 1. Data Charting

No	Author, Year	Country	Study Design	Participants background	Intervention/ Exposures	Outcome Measurement	Result
1.	(Thomas *et al.*, 2022)	California, Amerika Serikat	*Randomized Controlled*	Patients less than 12 weeks pregnan	Participants were randomly divided into	Physical activity (PA) and weight gain during	The mHealth intervention increased

			Trial (RCT)	t, 21 years of age or older, pre-pregnancy BMI 25-40 kg/m², and singleton pregnancy	mHealth intervention group or usual care control, Health intervention including physical activity tracker, digital scale, and coach call, added to usual care	pregnancy (GWG), measured by web-based surveys, group discussions, PA trackers, and digital scales	physical activity and motivation. There were no significant differences in weight gain or perinatal outcomes between the intervention and control groups. Participants found the mHealth intervention helpful, but wanted additional nutrition information and a more mobile-friendly app.
2.	(Jongsma *et al.*, 2020)	Belanda	Mixed Methods Studies	103 participants were invited via email, 51 participated after meeting the inclusion	mHealth technology combined with face-to-face care for remote monitoring of blood pressure and preeclam	• Questionnaires to measure ease of use of mHealth technologies (5-point Likert scale)	88% of participants were satisfied with mHealth, which was perceived as convenient and efficient and reduced hospital

				criteria of Dutch or English language proficiency and willingness to be interviewed. A total of 11 selected pregnant women will be monitored for blood pressure and preeclampsia symptoms using mHealth technology.	psia symptoms	and Client-Centred Care Questionnaire (CCCQ) for care satisfaction • Semi-structured interviews to explore participants' experiences and perspectives with mHealth technologies.	visits. However, there was a mismatch between expectations and experiences regarding interactions with medical personnel. Although mHealth increases patient autonomy, face-to-face care remains important for direct support and medical decisions.
3.	(Heim and Makuch, 2024)	São Paulo, Brazil	*Quasi-Experimental Studies*	High-risk pregnant women at 36 weeks gestation, aged 18-35 years with a single foetus, without indicati	The intervention group received online consultation (telemedicine), while the control group received face-to-face	Measured using antenatal questionnaire, STAI, postpartum questionnaire, and Visual Analogue Scale (VAS) for labour pain. Statistical analyses	The intervention group reported lower fear of pain, less need for analgesia, and shorter duration of labour than the control group.

				on for labour were taken using purposive sampling.	consultation	included t-test, chi-squared, Fisher's exact test, ANOVA, and bivariate and multiple linear regression.	Labour satisfaction was higher in the intervention group. Regression analysis showed significant associations between delivery method and pain, as well as between labour satisfaction and good labour experience. Online consultation showed more positive outcomes than face-to-face consultation.
4.	(Bekker *et al.*, 2023)	Belanda	*Randomized Controlled Trial (RCT)*	Pregnant women aged ≥18 years with a singleton pregnancy (>26 weeks) who require matern	Participants were randomised into hospital care or telemonitoring groups (telemonitoring using the Sense4Baby and Microlife	Effectiveness, mental and physical well-being, patient satisfaction, and cost of antenatal care. Analyses were conducted	Telemonitoring had equivalent primary outcomes to hospital care, was slightly better at reducing the risk of adverse outcomes, provided

				al or fetal monitoring in hospital for reasons such as pre-eclampsia, rupture of membranes without contractions, retarded foetal growth, etc.	WatchBP systems, and daily monitoring by the telemonitoring team).	using logistic regression and costing.	better satisfaction and assessment of care, and reduced antenatal care costs by an average of €2,774.
5.	(Laurie *et al.*, 2023)	Queensland, Australia	*Quasi-Experimental Studies*	Women with a diagnosis of gestational diabetes (GDM) who met the criteria for participation in the study period.	The study used the CSIRO M♡THer smartphone app, a bluetooth blood glucose meter, educational videos via email, scheduled face-to-face visits with a midwife and dietitian, and a fetal health scan to monitor and	Comparisons before and after implementation of the care model included mode of birth, use of forceps, and birth weight, with analysis of categorical and continuous variables using appropriate statistical tests, as well as multivariate regression to assess the	There were no significant differences in treatment type, maternal age, BMI, gestational age, or onset of labour between pre- and post-implementation; forceps and vacuum use decreased after implementation; mean birth weight

					manage gestational diabetes.	association between the care model and birth weight.	increased in women on insulin, decreased in those on a diet, and did not change significantly in those on metformin; there were no significant differences in birth weight between pre- and post-implementation after adjustment.
6.	(Ferrara *et al.*, 2020)	California, Amerika Serikat	*Randomized Controlled Trial (RCT)*	All pregnant women with pre-pregnancy BMI between 25.0 kg/m² and 40.0 kg/m², age 18 years and above, and singleton pregnancy.	The control group received standard antenatal care, while the intervention group received standard antenatal care plus 13 lifestyle intervention sessions (1 face-to-face, 11 telephon	• Weight gain • Metabolic health (insulin levels, leptin, insulin resistance) • Physical activity and eating behavior • Birth outcomes • Session attend	The intervention group experienced lower weekly and total weight gain, as well as improvements in metabolic health, with smaller calorie and saturated fat gains and reduced sedentary

	e, 1 final face-to-face) for weight, diet, physical activity, and stress management, using workbooks, scales, and weight charts.	ance and fees	behaviour. There were no significant differences in birth outcomes. Average session attendance was 11.4 with the core intervention costing $277.00 and the maintenance phase $36.89.

Risk Of Bias

The results show the risk of bias assessment of six studies assessed using ROBINS-E obtained in the table show that two articles (Thomas et al., 2022 and Laurie et al., 2023) have a high risk of bias, especially in the first domain. Jongsma et al. (2020) showed concerns in some domains, while Heim and Makuch (2024) and Bekker et al. (2023) had a low risk of bias in all domains. Key issues included inadequate control of confounding variables and potential reverse causation bias in some articles. Future research is needed to improve the design and control variables to reduce the risk of bias and improve the quality of evidence.

DISSCUSION

Based on the review, it was found that six studies developed and evaluated mHealth interventions in the health care of high-risk pregnant women that focused on using mHealth technologies to increase physical activity, health condition monitoring, and antenatal education. The mHealth interventions were effective in increasing physical activity, health condition monitoring and antenatal education. In some studies, mHealth interventions showed equivalent outcomes to face-to-face care, but were cheaper and provided better satisfaction. Telemonitoring reduced antenatal care costs by an average of €2,774 compared to hospital care and mHealth provided high satisfaction for most participants, with 88% of participants satisfied with the technology and 85% of participants would recommend it to others. This is in line with research conducted by (Güneş Öztürk, 2022) examined the acceptance of telemedicine technology by high-risk pregnant women in the United States. The study results showed that 78% of the participants were comfortable using telemedicine for routine consultations, and 65% felt that the

technology helped reduce the stress associated with frequent hospital visits. The implementation of technology in the care of high-risk pregnant women is expected to improve health outcomes, such as reducing complication rates, increasing early detection of health problems, and improving pregnancy management. (Alam *et al.*, 2019). This is in line with a previous study evaluating the impact of using pregnancy monitoring apps on high-risk pregnant women in Australia. The study found that mothers who used the app had lower complication rates and reported more satisfaction with the care received compared to the control group. (Kabongo *et al.*, 2021).

These two studies describe a similar focus, comparing the effectiveness of telemedicine with face-to-face care in the context of high-risk maternal health (3,4). The telemedicine consultations in this study had more positive outcomes compared to the non-intervention group (who received face-to-face consultations) in terms of reducing fear of labour pain ($p<0.013$), reducing the need for analgesia (17/40) ($p<0.018$), and increasing labour satisfaction (36/50) ($p=0.014$). Telemonitoring showed equivalent results to hospital care, but was cheaper and provided better satisfaction. This is in line with previous research that mobile-based telehealth, or mHealth, provides the potential to improve maternal and newborn health outcomes in developing countries with high mobile phone subscription rates. Mobile phone consultations between pregnant women and nurses in obstetric call centres have been shown to be effective in triaging emergency cases, helping manage non-urgent symptoms, and improving the efficiency of hospital emergency departments (Alam *et al.*, 2019).

Three studies described effectiveness on maternal and infant well-being and one study reported equivalent hospital care for high-risk pregnant women. mHealth successfully increased physical activity in overweight or obese pregnant women and telemedicine helped reduce fear of labor pain with high satisfaction, with 88% of participants finding the technology comfortable and efficient. Although mHealth is effective in monitoring and education, face-to-face interaction remains important for in-depth emotional and educational support. Technologies that offer intuitive interfaces, responsive technical support, and efficient interaction with providers tend to result in higher levels of satisfaction (Liu et al., 2019). This is in line with research by (Greenhalgh et al, 2019) showed that user satisfaction with telehealth technology can be influenced by the ease of application navigation, system reliability, and quality of communication with healthcare providers. This study emphasized that positive user experience is closely related to ease of access and effectiveness of technology. Some challenges that can affect user satisfaction levels include technical issues, user-unfriendly interfaces, and limited technical support. Users who experience technical difficulties or feel that the application does not meet their needs tend to have lower levels of satisfaction (Shaw et al., 2018). This is in line with research by (Pelkowski, 2021) identified that technical issues and complex interfaces can reduce user satisfaction levels. This study shows that adequate technical support and user-friendly design are important to increase user satisfaction.

CONCLUSION

The findings of this review suggest that telemedicine is effective in the care of high-risk pregnant women, with health monitoring and antenatal education. However, there are several limitations that need to be addressed, including variation in implementation, limited focus of studies on groups with good access to technology, and technical challenges. Emotional support and in-depth education through face-to-face contact also remain important. To ensure the long-term benefits and sustainability of telemedicine, further research and improvements in technology infrastructure are needed, especially in areas with limited access.

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