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Telemedicine and Digital Health in the Future of Midwifery Care

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Abstract

Telemedicine and digital health have emerged as transformative midwifery and maternal healthcare technologies. This study employs a comprehensive bibliometric analysis to explore the current research landscape at the intersection of telemedicine, digital health, and midwifery. The methodology involves an initial search in the Dimensions database using the keywords "Telemedicine AND Digital Health AND Midwifery", followed by data filtration based on publication year, article type, article category, and citation count. Further refinement is carried out using the Publish or Perish tool, which extends the search to capture additional relevant publications. Data obtained from Publish or Perish is then imported into VoSViewer for bibliometric analysis, enabling the identification of research gaps, trends, and clustering of topics within the selected literature. The study reveals a significant body of research on telemedicine and digital health in the context of midwifery, with a growing interest in the field. Health Sciences, Health Services and Systems, and Biomedical and Clinical Sciences emerge as the dominant research categories. Articles constitute the majority of publications, followed by chapters and edited books. The citation count indicates the influence and relevance of the identified literature. This study provides valuable insights into telemedicine, digital health, and midwifery research, highlighting areas of focus, research gaps, and emerging trends. The findings contribute to a better understanding of the evolving landscape in maternal healthcare, offering opportunities for further exploration and innovation in this critical domain.

Keywords: *Digital health, Midwifery care, Telemedicine*

Introduction

Technological developments in health and healthcare have changed how we access and provide medical care. One major trend that has emerged in recent years is telemedicine and digital health. This issue has become increasingly relevant during the COVID-19 pandemic, where physical distancing and the need for safe medical care have driven accelerated adoption of telemedicine technology [1]–[4]. This introduction will explore these developments and their impact on prenatal care, particularly in maternity and obstetric care. Telemedicine involves long-distance communication technology to provide medical care and has become an essential means of delivering prenatal and perinatal care [5]. Pregnant mothers now have easier access to prenatal care through online consultations, remote monitoring, and communication with midwives and medical personnel [6]. This allows them to receive quality care without regularly visiting a brick-and-mortar medical facility.

Digital health apps have also become an essential tool in managing pregnancy. Expectant mothers can use the app to track the progress of their pregnancy, monitor fetal health, measure vital signs, and even receive nutritional and health advice tailored to their pregnancy [7]–[9]. This app provides valuable information, satisfaction, and comfort to pregnant women who want to be more involved in their care.

As technology develops, we can anticipate more developments in telemedicine and digital health that will support prenatal and perinatal care. This includes using intelligent medical devices, more advanced remote monitoring, better-integrating health systems and digital health applications [2], [10]. All of this aims to improve the care experience of pregnant women and provide better outcomes for the health of mothers and unborn babies.

This study explores further how developments in telemedicine and digital health technologies have influenced prenatal care, how these issues are discussed in different types of publications, and how various disciplines are involved in the research and implementation of these technologies. We will also explore the challenges and opportunities faced in adopting this technology more widely in the healthcare system. In doing so, this review will open a window into the rapidly evolving world of telemedicine and digital health in the context of prenatal and perinatal care and provide a holistic view of how these technologies will change how we give and receive medical care.

Method

This research is bibliometric research using secondary data. VoSViewer (Visualize Your Bibliometric Data) software was used as a valuable tool for analysing bibliometric data and generating visualisations. This method allowed us to conduct systematic and comprehensive research on telemedicine, digital health, and the role of midwives in maternal health care. Our analysis will help identify important research directions and opportunities for further development in this field. The stages in this bibliometric analysis were:

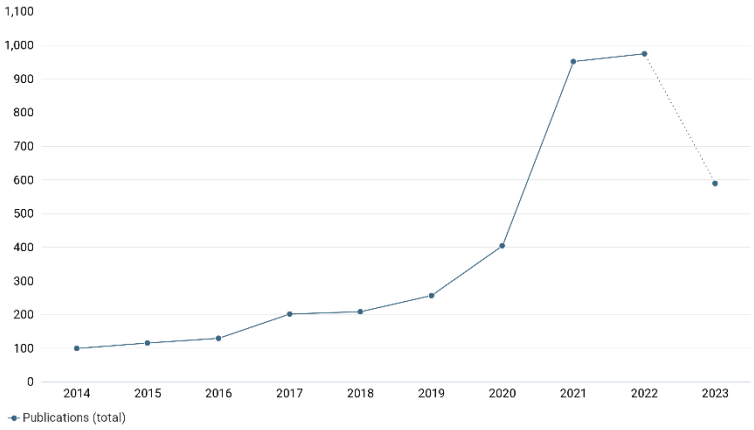
1. Initial Search with Dimension: To begin this research, we searched Dimension's scientific database using "Telemedicine AND Digital Health AND Midwifery". Dimension is a broad source of academic information covering various scientific publications.
2. Sorting by Filtering: After getting initial search results, we filtered the data to narrow the research focus. We use filters based on publication year, article type (such as Article, Chapter, Edited book, Monograph, Preprint, Proceedings), article category, and citations. This filter helped us select the articles that were most relevant and suited to the aims of this research.
3. Use of Bibliometric Data from Dimension in VoSViewer software: We imported the bibliometric data found in the previous step into the VoSViewer software, which allowed us to see research gaps, trends, and clustering in research on telemedicine, digital health, and midwifery fields.
4. Analysis at Each Stage: At each stage, we conducted data analysis to understand trends, patterns, and developments in this research. We identified gaps in the literature, evaluated research developments, and identified potential clusterization of relevant topics. Thus, we could present comprehensive findings in this study.

Results

The data analysis using Dimension.ai provides an overview of the potential of telemedicine and digital health especially in the field of obstetrics. Issues are grouped based on the clusters formed as follows.

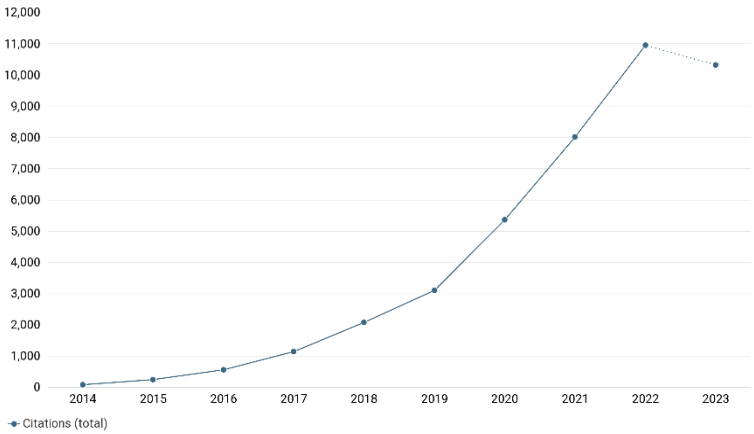
A. Number of publication and citation

For the last 10 years, the topics telemedicine, digital health, and midwifery have been widely discussed 3,926 articles in publications. The publication trends to increase year by year and dramatically increasing after the year 2020 (see Fig. 1). This could indicate that the issue of telemedicine and digital health in future obstetric care is essential and influences developments in the field. In this case, the number of citations were also sharply increased each year since 2014, from the total 41,866 citations (See Fig. 2). The number of citations received can best measure the level of development and significant attention in the scientific community of the topics. On the other hand, a huge number of publications has made the average citation for each paper dropped down from 32 in 2017 to 2 in 2022 (See Fig. 3). This situation may also reflect the research community's continued interest in delving deeper into the topic.



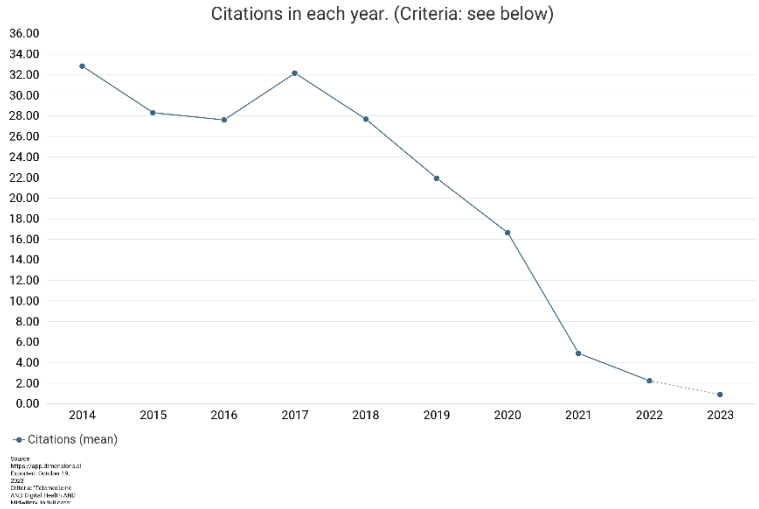
Source: Dimension.ai; Criteria: Telemedicine AND Digital Health AND Midwifery

Fig. 1. Publication trends in years



Source: Dimension.ai; Criteria: Telemedicine AND Digital Health AND Midwifery

Fig. 2. Citation trends in years



Source: Dimension.ai; Criteria: Telemedicine AND Digital Health AND Midwifery

Fig. 3. Average citation each year

B. Publication Type

Information regarding the publication type or Publication Type can provide further insight into how the research issue is published. This issue has been discussed in various publications and more than 50% are articles, see Fig. 4. With these different types of publications, the issue has received widespread attention in the scientific literature and may have been explored from different angles and in various formats.

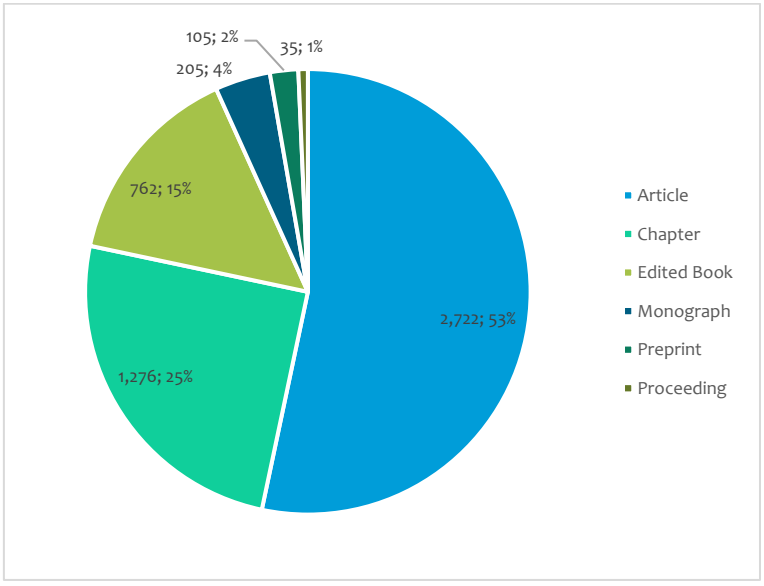


Fig. 4. Publication Type

C. Research Category

This information helps us understand the scientific disciplines involved in researching the issue. This issue is widely discussed in several major scientific fields based on the data, see Fig. 5. This shows that this issue has a broad and relevant impact in various fields of science where three main focuses are health sciences, health services and system, and biomedical and clinical sciences; reflecting its complexity and significant impact on multiple aspects of health and health services.

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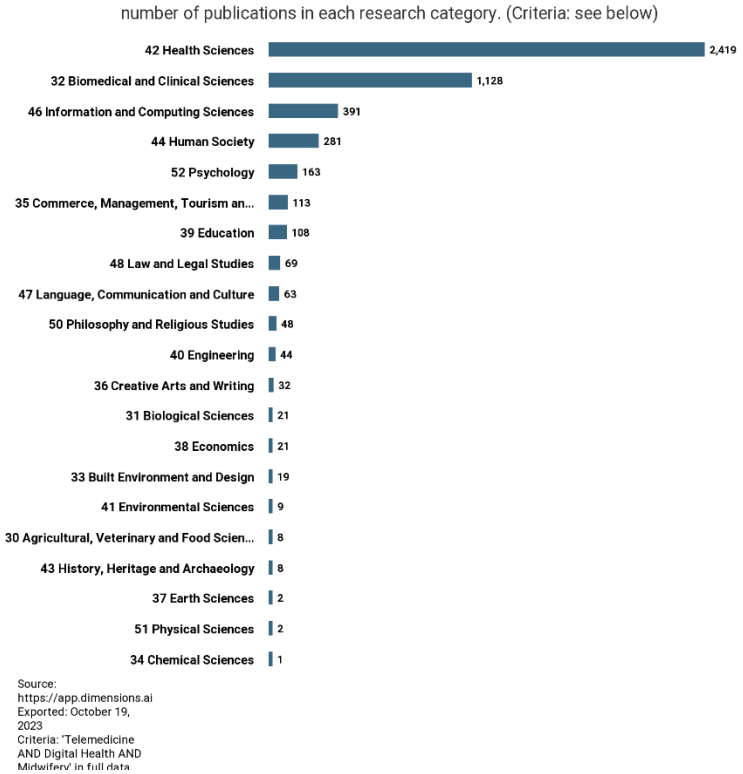


Fig. 5. The scientific disciplines based on Dimensioan.ai data

D. Research Cluster

Publication articles obtained from Dimension.ai are then analyzed using VoS Viewer. There are four clusters formed. Fig. 6 shows a graph of such clusters. Analysis of network visualization with weight criteria on total link strength (Figure 7) shows 5 clusters formed. The 3 largest clusters, the central keywords are covid, outcome, and questionnaire.

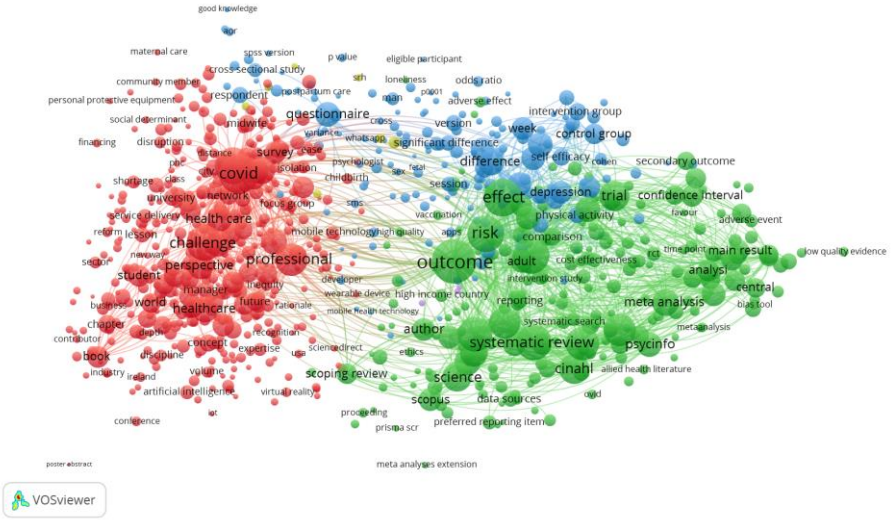


Fig. 6. Research Cluster

E. Research Trends on Topics

Analysis of the visualization overlay with the weighting criteria for total link strength and the average number of citations (Fig. 7) shows that the most frequently cited issues are related to research methods. However, if the average number of publications is used as a criterion, the issue of covid and the pandemic has still dominated in recent years (Fig. 8).

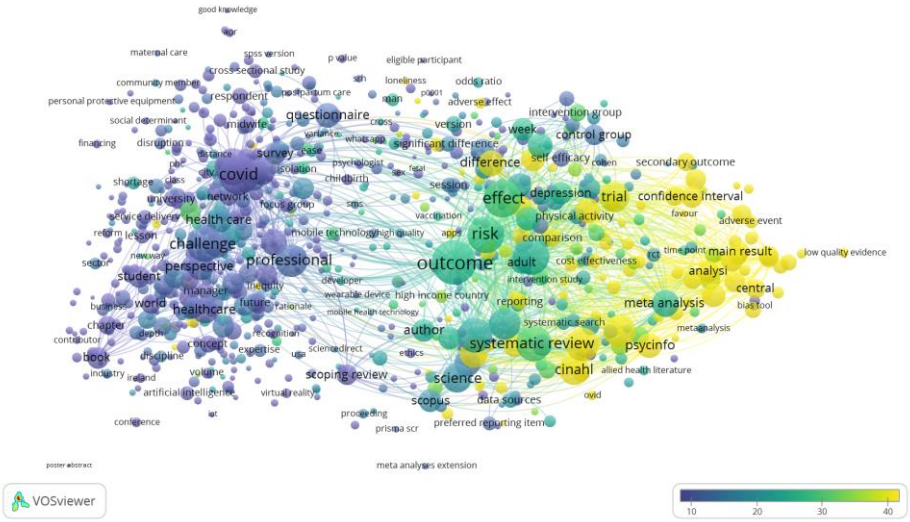


Fig. 7. Research Overlay based on citation number

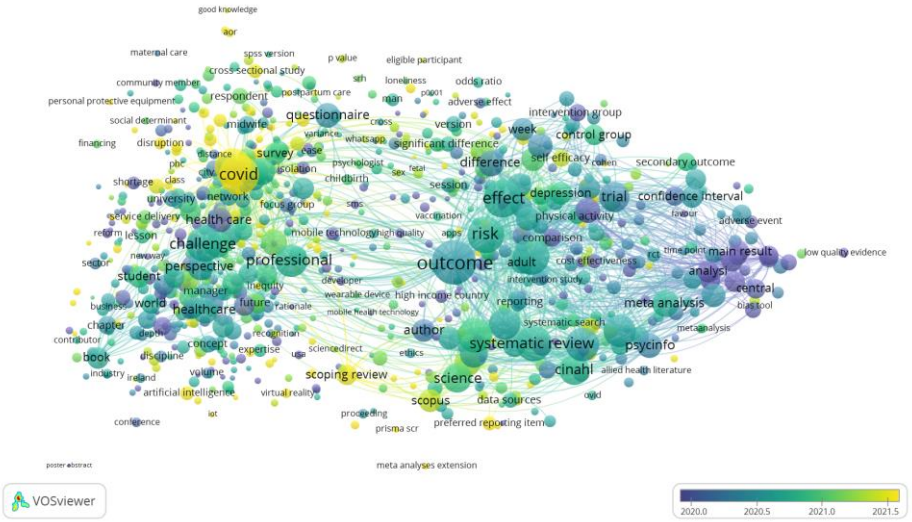


Fig. 8. Research Trends on Topics

F. Research Magnitude/ Density

Analysis of density visualization with weighting criteria for total link strength (Figure 9) shows that the issues most researched are related to the keywords covid, outcome, challenge, professional, and systematic review.

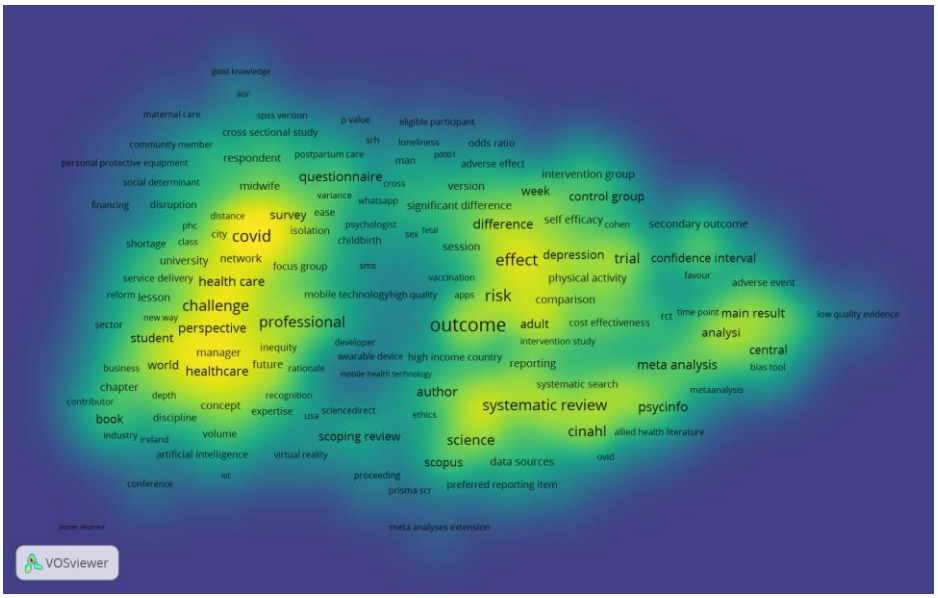


Fig. 9. Research Magnitude/ Density

Discussion

Telemedicine and digital health are essential issues in the future of obstetric care. This issue reflects how information and communication technology development have changed; how prenatal and pregnancy care can be accessed, monitored, and managed. In this discussion, the grouping of discussions is based on the issues of Covid (easier access), professional (better maternal health), and challenges (privacy and security). Each discussion will cite relevant sources sufficiently.

A. Easier Access to Midwifery Care

Telemedicine provides medical or health services remotely using communication technology, such as video conferencing, telephone, or digital health applications, to connect patients with healthcare providers [8], [11], [12]. In prenatal care and pregnant women's health, telemedicine allows pregnant women to receive medical care and consultations without coming to a physical medical facility, such as a hospital or health centre [13], [14]. The COVID-19 pandemic has accelerated the use of telemedicine, a tool that is transforming healthcare delivery. Several practices have shown usefulness in addressing patient care-related challenges during the pandemic. These benefits specific to different areas of medical practice, in the form of reported guidance and experience, should inspire health systems to work towards effective and comprehensive implementation of telemedicine in various fields [7], [15].

Telemedicine addresses accessibility issues, especially for women who live in remote or hard-to-reach areas. Medical facilities are often far from where people live in these areas, and travelling to them can be difficult and expensive [12]. Telemedicine allows pregnant women to connect with healthcare providers from home or closer to local health facilities. Based on the literature review, 90.1% of articles reported that eHealth interventions mostly yielded positive results. Articles cite reduced travel time, time/cost savings, and increased access to services as key health benefits [16].

Some pregnant women may have limited mobility for various reasons, such as health conditions that limit physical movement or high-risk pregnancies. Going to a brick-and-mortar medical facility can

be challenging in cases like these. Telemedicine provides a solution by allowing pregnant women to receive medical care without undertaking tiring or risky physical travel. A model practice guideline in Brazil shows that Brazil does not yet have a validated protocol for prenatal care via telemedicine. The included study found that pregnant women were satisfied with this form of service and outcomes, except for hypertension, were similar between groups receiving traditional and combined antenatal care services [17].

Telemedicine also allows pregnant women to undergo regular consultations with their midwife or obstetrician without going to a clinic or hospital each time. This may include talks regarding the pregnancy's progress, monitoring the mother's and fetus's health, and discussing birth plans. This routine consultation is essential to monitor the pregnant mother's and fetus's health during pregnancy. In addition, telemedicine can also be used to monitor the health of pregnant women. Through appropriate medical devices, such as fetal heart rate monitors or blood pressure monitoring devices, healthcare providers can monitor the condition of pregnant women remotely. The results of this monitoring can be shared in real time, allowing for rapid intervention if problems arise.

Apart from medical care, telemedicine can also provide health education to pregnant women. This includes giving nutrition information during pregnancy, childbirth preparation, and post-natal care. This health education can help pregnant women make better decisions regarding their health and that of their unborn baby.

A combined study through the literature process, asking for patient perspectives, and soliciting expert insights in patient-centred care delivery resulted in two key principles guiding the redesign of antenatal care: (1) designing for the delivery of services that cannot be delivered remotely, by providing video visits for essential services in antenatal care, and (2) creating flexible early education and psychosocial support services that allow patients to tailor support to meet their needs through an opt-in program. In this study, we describe the experience of transitioning to a new prenatal care model with 4 face-to-face visits, 1 ultrasound, and 4 virtual visits (4-1-prenatal plan), then explore how insights from this app can inform the redesign of existing antenatal services. patient-centered during and after COVID-19 pandemic [18].

B. Better Maternal Health

Telemedicine and digital health play a critical role in increasing access and quality of maternal health care and improving maternal and pregnancy health outcomes. Telemedicine allows pregnant women to access quality prenatal care without visiting a physical medical facility. This is an essential step in improving the accessibility of care, especially for those living in remote or hard-to-reach areas. With easier access, pregnant women have a greater chance of getting the care they need in the early stages of pregnancy.

The research project is designed to provide valuable information regarding current access and use of mobile phones among women in rural area and their willingness to receive voice messages to improve prenatal care services [19]. This study also highlights demographic, sociocultural, and economic factors associated with women's willingness and availability to receive prenatal care-related voice messages. This information guides researchers on how mHealth programs can be adapted to local

contexts, through the development of culturally sensitive messages in local languages and adherence to community standards (sending messages at specific times), to ensure successful implementation of such programs. This information will help support decisions to introduce specially designed mHealth programs to improve antenatal care. Meanwhile, this mHealth program has been proven effective for various chronic diseases and public health problem. This is a new idea of supporting pregnant women with preventive maternal health services, with little previous research on the topic in this area.

Approaching technological services that take into account various aspects is important, because midwifery care has the principle of women-centered care, meaning that it suits the needs of each individual, considers each individual as unique, care is appropriate to each individual's case which of course cannot be the same and comprehensive midwifery care includes bio-psycho-social-spiritual aspects. Telemedicine allows pregnant women to receive care earlier in their pregnancy. Medical consultations can be started early, even early in pregnancy. This is important because early treatment allows for more effective identification and management of health problems. Early detection of pregnancy hypertension or gestational diabetes can help prevent more severe complications. Telemedicine also supports continuous and coordinated care during pregnancy. Pregnant women can regularly undergo routine consultations with their midwife or obstetrician without travelling long distances. This ensures that pregnant women's care is uninterrupted and their health conditions can be better monitored. Digital health, such as blood pressure or fetal heart rate monitoring devices, allows pregnant women to monitor their health independently with the support of a healthcare provider. Health data from these devices can be shared with healthcare providers in real time to identify potential problems early.

By combining telemedicine and digital health, pregnant women have greater access to quality prenatal care, better health monitoring, and relevant education. This contributes to improved maternal health outcomes and better pregnancy outcomes, including early detection of health problems, effective management, and better preparation for birth and post-natal care. Overall, this helps improve the quality of life of pregnant women and the well-being of the unborn baby. Telemedicine is a health revolution, starting with the Covid-19 Pandemic which has changed the health service system which can be done online through the telemedicine application, in 2020 there was a surge in visits to Telemedicine services. Therefore, the quality of services needs to be improved and developed well to meet the needs of the community, just like face-to-face health services [10], [20].

C. Challenges Related to Data Privacy and Security

Using technology in the context of maternal health care, such as telemedicine and digital health, dramatically improves accessibility and quality of care. However, along with these benefits, challenges must be overcome, including the privacy and security of health data. Pregnant women's health data collected via telemedicine and digital health devices includes medical history, examination results, and pregnancy progress. It is essential to understand that data privacy is a fundamental right of every individual [21], [22]. Therefore, it is necessary to guarantee that this data will only be used or accessed with proper permission.

Health technology carries the risk that unauthorised parties may access health data. This could involve hacking or breaching system security. In the case of pregnant women, the confidentiality of their data is of paramount importance, and breaches of privacy can have serious consequences [23], [24]. Various regulations and laws, such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States, regulate health data protection. Healthcare providers, including those using telemedicine technology, must comply with these regulations and maintain the privacy of patient data.

To face the challenges of health data privacy and security, it is necessary to implement strong protective measures. This includes data encryption, securing access to sensitive information, and training staff involved in data management to understand and implement best practices [7], [25]. Patients, including pregnant women, must clearly understand how their health data will be used, who will access it, and their rights regarding privacy. They must also provide permission or consent before their data is used for specific purposes. It is essential that there is a substantial oversight and audit system to monitor the use of health data. This involves tracking data access activity and responding quickly to indications of breaches.

By understanding and taking health data privacy and security challenges seriously, the use of technology in maternal health care can provide significant benefits without compromising the privacy and security of personal information. This ensures that pregnant women feel comfortable using telemedicine and digital health services without worrying about risks to the confidentiality of their data.

While telemedicine and digital health have great potential to improve obstetric and maternal health, it is also important to remember that not all obstetric care can be delivered virtually. More complex or emergency cases may still require direct interaction with medical personnel. In this case, good integration between conventional care and digital health technology is the key to providing comprehensive care.

Ethical and legal issues related to the practice of telehealth or telemedicine services still require standard and specific implementation rules to ensure equal access, quality of service, sustainable costs, professional responsibility, respect for patient privacy, data protection and confidentiality. Currently, telemedicine services can only be used as a complementary or additional tool to traditional health services. Several indications for medical providers are suggested [23]. In carrying out a midwifery practice, a Midwife must be able to maintain the privacy of her clients, patient data is a confidentiality that must be maintained, because if the data is leaked without the client's knowledge, then the Midwife can be sued legally because Midwives in their practice have responsibility and liability.

Conclusion

Improving access and quality of prenatal care is crucial in improving maternal health and pregnancy outcomes. Telemedicine and digital health technologies have opened the door to innovative solutions that meet these needs. We have investigated emerging trends and challenges in using this technology in maternal care through bibliometric analysis. Our search results and bibliometric analysis reveal a strong interest in this topic, as reflected in the significant number of publications and high citation rates. The continued increase in telemedicine, digital health, and prenatal care research indicates that the scientific and health practitioner communities are increasingly realising the potential

benefits of integrating these technologies. However, along with the help, several key challenges can be identified that must be addressed. One of them is the issue of health data privacy and security. It is essential to ensure that any developments in telemedicine and digital health are accompanied by robust measures to protect pregnant women's sensitive data. This includes compliance with health data privacy regulations, proper staff training, and implementation of advanced security technologies. In this context, collaboration between researchers, health practitioners, regulators and technology companies must be encouraged to ensure that health technology developments prioritise patient privacy and data security. Only with this approach can the full potential of telemedicine and digital health be achieved in improving prenatal care and maternal health. Maternal health care lies in the wise integration of technology and traditional care. In this way, sustainable improvements in maternal health and pregnancy outcomes can benefit society.

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