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Review

Telemedicine in Obstetrics: Building Bridges in Reproductive Healthcare—A Literature Review

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Abstract

Telemedicine has emerged as a promising tool in obstetric and reproductive healthcare, offering new possibilities for patient-centered care delivery. This literature review explores its impact across key areas, including abortion, assisted reproduction, childbirth, contraception, gestational diabetes, mental health, opioid and smoking cessation, and perinatal care during the COVID-19 pandemic. A structured narrative approach was applied, with studies identified through PubMed and Scopus databases for screening, with selection based on predefined inclusion and exclusion criteria, and synthesized narratively with attention to clinical outcomes, access, satisfaction, and barriers to implementation. Perspectives on the acceptance of telemedicine among healthcare providers, technological advancements enhancing reproductive outcomes, and telemedicine's pivotal role in maintaining continuity of care during crises, such as the COVID-19 pandemic, are examined. The review also addresses challenges and barriers, including technological proficiency and patient acceptance, while emphasizing telemedicine's potential to improve accessibility, patient satisfaction, and healthcare outcomes across diverse reproductive health services.

Keywords: telemedicine; obstetrics; COVID-19; assisted reproduction; contraception; gestational diabetes; mental health; opioid cessation; smoking cessation; mental health

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1. Introduction

Throughout the years, pregnancy has increasingly become subject to medical intervention in contemporary societies [1], with expectant mothers requiring consistent monitoring of both, their health and that of their developing baby [2] along their journey. Additionally, preventive measures such as vaccinations, parasite treatments, and essential nutrient supplementation play a crucial role in pregnancy [3,4]. Managing common discomforts such as nausea, heartburn, cramps, back pain, and constipation, can contribute to a positive pregnancy experience and outcome [5]. However, lots of factors play an impeding role in conception and pregnancy processes, including limited physician consultation time, which may be as low as 2 min per patient [6], as well as efforts to conceive, or even abortion.

Telemedicine has seen a surge in adoption during the COVID-19 pandemic due to its ability to facilitate remote consultations and reduce the risk of virus transmission in healthcare settings [7]. In obstetrics, pregnant women can consult with their healthcare providers virtually, minimizing the need for in-person visits while ensuring continuity of care [8]. Other applications of telemedicine of benefit for pregnant women have been identified like providing a confidential and accessible platform for pregnant women struggling with substance use cessation. Through counseling and virtual appointments, healthcare providers can offer support, monitoring, and interventions to pregnant individuals struggling with smoking cessation [9] and opioid use [10], helping to improve maternal and fetal outcomes. Moreover, research indicates that abortion using telemedicine is safe, effective, and associated with high patient satisfaction levels via allowing for comprehensive counseling, assessment of eligibility, and support throughout the abortion process. This offers a convenient and accessible option for individuals seeking abortion care [11]. Also, telemedicine has the potential to expand access to contraception, particularly those in underserved or remote areas [12]. Through virtual consultations, healthcare providers can prescribe contraceptives, discuss family planning options, and address concerns or side effects, significantly empowering patients, especially young adults to make informed decisions about their reproductive health [13]. Furthermore, telemedicine enables remote monitoring and management of comorbidities such as gestational diabetes during pregnancy [14]. Pregnant individuals can upload glucose readings, dietary logs, and other relevant data to a secure online platform for review by healthcare providers. This real-time monitoring allows for timely adjustments to treatment plans and ensures optimal maternal and fetal health outcomes [15]. To add to its utility, telemedicine offers personalized support and guidance to pregnant women seeking healthier lifestyles [16]. Through virtual consultations, healthcare providers can provide advice on nutrition, exercise, stress management, and other lifestyle factors that contribute to a healthy pregnancy [17].

Despite its benefits, telemedicine raises important challenges, including concerns about data security, patient privacy, medico-legal accountability, and risks of misdiagnosis, all of which require careful consideration when applied to sensitive areas such as abortion, contraception, and opioid treatment, which will be touched upon further in the manuscript.

Existing reviews and studies have often focused on single domains, such as gestational diabetes or abortion, or have emphasized telemedicine mainly in the context of the COVID-19 pandemic. However, what remains lacking is a comprehensive synthesis that spans the full spectrum of obstetric and reproductive health services. Therefore, the aim of this review is to synthesize evidence on telemedicine in obstetrics and reproductive healthcare, focusing on its impact across key domains—including abortion, assisted reproduction, antenatal and intrapartum care, contraception, gestational diabetes, substance use, perinatal mental health, and perinatal care during crises. This review seeks to provide a unified understanding of these elements in obstetrics in terms of clinical outcomes, access to care, patient–provider perspectives, and barriers to implementation, with the goal of identifying gaps for future research and informing policy development.

2. Methodology

This narrative review explored the evolving role of telemedicine in obstetrics, focusing on three components: search strategy, study selection, and data synthesis.

2.1. Search Strategy

We conducted a structured search in PubMed and Scopus. In PubMed, we used a combination of MeSH terms and free-text keywords related to telemedicine (e.g., “telemedicine,” “mHealth,” “eHealth,” “virtual care”) and obstetrics (e.g., “pregnancy,” “maternal health,”

"antenatal," "perinatal," "postpartum"). In Scopus, where MeSH terms are not available, we applied equivalent free-text keywords in the title, abstract, and keyword fields, combined with Boolean operators (e.g., telemedicine OR "virtual care" AND pregnancy OR obstetrics). Reference lists of key articles were also screened. Only English-language peer-reviewed studies published between January 2010 and December 2024 were included.

2.2. Study Selection

Eligible studies examined telemedicine applications in obstetrics and reported original data (observational studies, case reports/series, clinical trials). Excluded studies included articles unrelated to obstetrics, broad telemedicine studies, reviews, editorials, and abstracts without primary data (though some were consulted for background).

2.3. Data Extraction and Synthesis

Data were extracted on clinical outcomes (e.g., abortion safety, maternal/fetal outcomes, gestational diabetes management), access and process measures (time to care, adherence, travel saved), patient/clinician experiences (satisfaction, usability, privacy), equity considerations (age, geography, socioeconomic status), and implementation factors (technology, reimbursement, policy, workflow). Findings were synthesized narratively, highlighting patterns across domains such as antenatal, perinatal, postpartum, abortion, contraception, assisted reproduction, gestational diabetes, and perinatal mental health. Quantitative outcomes (e.g., utilization rates, cost-effectiveness, patient-reported scores) were reported where available.

3. Healthcare Professionals' Perspectives

As healthcare providers navigate this new technology or approach to obstetrics, midwives and physicians show variability in their contemplation and acceptance of telemedicine. In a systematic review conducted to showcase the perspectives of midwives who are playing an increasingly essential role in obstetrics, their opinions varied in regard to providing sexual and reproductive healthcare services via telehealth [18,19]. Some midwives view telehealth as advantageous on a personal level because it allowed them to keep working despite limiting circumstances such as the COVID-19 pandemic [20]. Moreover, telehealth provided them with the capacity to have a better work–life balance during that period [21]. On the other hand, some midwives perceive telemedicine in a more negative connotation, considering that they cherish physical presence, and have concerns about making errors or addressing health issues poorly via telehealth [22]. Being physically present during patient-midwife interactions and direct contact was highlighted as a crucial element of their traditional approach, contributing significant value to their practice [23]. In addition to hindering in the utility of telemedicine, some midwives face the financial challenge of having to cover internet costs, resulting in an inability to follow up with their patients properly [24]. Another concern among nurses and midwives who reject telemedicine is partly because of skepticism about their replacement by machines or intelligent algorithms, which makes the embracement of new technologies such as telehealth hard to accept [25]. Younger generations entering the profession typically exhibit greater proficiency in utilizing technology compared to those who came before them [26], and young doctors showcase more enthusiasm [25]. Yet, it is a new approach to the practice of obstetrics and some doctors show hesitancy and concern regarding the correctness and accuracy of diagnosis established from telemedicine [27].

Overall, the perspectives of healthcare professionals on telemedicine in obstetrics reflect a balance between opportunity and apprehension. While many midwives and physicians acknowledged telehealth as a tool that sustained practice during the pandemic

and even improved work–life balance, others remained concerned about the loss of physical presence, diagnostic accuracy, and the erosion of traditional patient–provider relationships. These divergent views appear to be shaped by generational differences, with younger professionals showing greater ease and enthusiasm for digital integration, whereas older practitioners often expressed resistance linked to technological challenges and fears of replacement by algorithms. Financial constraints, such as the burden of internet costs, further compounded barriers to acceptance in some contexts. Taken together, these findings suggest that successful implementation of telemedicine in obstetrics will require not only technical infrastructure but also targeted strategies to build provider confidence, protect the relational aspects of care, and ensure equitable support for practitioners adapting to this transition.

4. Assisted Reproduction Telemedicine

In recent years, reproductive medicine has undergone a notable development, especially in the field of integration with telemedicine. Although still in the early stages, the use of remote consultation and remote monitoring devices has proven to show high patient satisfaction. The use of telemedicine has been widely reported across several studies [28], such as a prospective cross-sectional which delves into the utilization of telemedicine with endocrinology, as well as infertility practices with findings revealing that the effectiveness of the use of telemedicine was comparable to inpatient clinical outcomes. Additional to effectiveness, its convenience and improved access to healthcare services, especially for patients who reside far from fertility clinics should be noted. As reported [28], 92.5% of participants stated that they were satisfied with telemedicine services, with telehealth improving 82.5% access to healthcare. Telemedicine has made a significant impact by significantly reducing travel time for patients, with an overwhelming 95% of patients reporting that it has made a positive difference in their travel time, ultimately leading to greater convenience and improved healthcare access. Furthermore, high patient satisfaction was also noted in the same study, where telemedicine was found to be ideal for patients who have psychosocial issues attending clinics, prefer privacy, or becoming more comfortable using technology for their assisted reproduction journey.

Moreover, the application of telemedicine had a significant impact on patient care in reproductive medicine during the COVID-19 pandemic. In the study [29], rates of patients receiving inpatient treatment versus telemedicine were compared, and thus demonstrated the ability of telemedicine to enable remote access to reproductive specialists, while concurrently ensuring patient satisfaction, improved healthcare access, and saving travel times.

Similarly, innovative technologies such as time-lapse systems and artificial intelligence algorithms have improved embryo assessment and selection during in vitro fertilization (IVF) treatments. The implementation of time-lapse systems in IVF has enabled continuous real-time monitoring of the development of embryos. This technology is invaluable for studying the growth of the embryo without disrupting the culture environment, which in turn provides predictive algorithms that can be applied to choose the best embryo to transfer [30]. Another study [31] also emphasizes the utility of time-lapse systems in providing real-time monitoring of embryo development, improving the selection of viable embryos for transfer. In addition, [30] AI algorithms play a valuable role in predicting embryo implantation potential, offering vital insights for optimizing treatment strategies. These advancements contribute to better treatment outcomes and empower patients to actively participate in their care.

Taken together, the findings indicate that telemedicine has rapidly emerged as a valuable adjunct in assisted reproduction, offering comparable effectiveness to in-person care while substantially improving convenience and access. Across studies, patient satisfaction

consistently remained high, with notable benefits for those living far from fertility centers or seeking greater privacy and comfort during their reproductive journey. The COVID-19 pandemic further underscored telemedicine's role in sustaining care delivery, with evidence demonstrating that remote consultations could maintain treatment continuity without compromising outcomes. At the same time, advances in technology such as time-lapse embryo monitoring and AI-driven embryo selection highlight how digital tools extend beyond consultations to directly influence clinical decision-making and treatment success. Collectively, these findings suggest that the integration of telemedicine and innovative technologies in reproductive medicine not only improves access and patient experience but also has the potential to enhance clinical outcomes and personalize fertility care.

5. Perinatal Care During COVID-19 Using Telemedicine

Readily available access to obstetric healthcare tremendously influences the well-being and quality of life of women while exerting a significantly positive influence on perinatal outcomes. Amid the COVID-19 pandemic, OB (Obstetrics) patients across the world were subjected to a plethora of challenges, including a substantial decrease in prenatal visits, heightened maternal mental health issues, increased domestic violence, greater economic vulnerability for women, and reduced social support [32]. If these challenges were to remain unaddressed, they may culminate into unfavorable health consequences, particularly among high-risk obstetric patients and marginalized female demographics. During these demanding periods, ACOG (The American College of Obstetricians and Gynecologists) advocated integrating telehealth models into obstetric services to guarantee seamless healthcare delivery and to ensure uninterrupted medical attention to OB patients [32].

Telehealth technology is not a recent introduction; however, its integration within obstetric practice has been suboptimal, with opportunities for further exploration and utilization remaining largely untapped. The COVID-19 pandemic highlighted the critical role of telemedicine in healthcare by enabling virtual interactions through various telecommunication technologies. Telehealth in OB has expanded to include remote observation of ultrasounds, blood pressure monitoring, childbirth education, fertility tracking, medication management, bladder diary tracking with apps, and virtual consultations [32]. These services played a pivotal role in decreasing disease exposure, facilitating social distancing, and mitigating the burden on healthcare facilities by conserving personal protective equipment for direct contact situations.

The use of telemedicine presented with barriers, including the acceptance and usage of telehealth which varied among patients. Younger adults demonstrated greater ease of use owing to their familiarity with modern technology; meanwhile, older patients frequently encountered technological challenges which necessitated basic training to adapt [33].

According to Khoshrounejad, F. et al. [34], in 28 studies, a total of 67 barriers to telemedicine were identified and categorized into 13 distinct groups. These include the adequacy and accuracy of subjective patient assessments and telemedicine tools, as well as changes in physician-patient communication. Other barriers involve technology acceptance and user adoption, data privacy and security, and system design challenges. Resource availability and accessibility, technical issues, and standards or legal considerations also present significant obstacles. Additional challenges are associated with insurance policies and reimbursement, data availability and accessibility, and system maintenance. The constantly evolving landscape of the COVID-19 pandemic, with frequent updates to guidelines and protocols, has further complicated efforts to sustain telehealth systems. Furthermore, the presence of parallel systems, diverse operational requirements across organizations, and a lack of widespread adoption all contribute to the complex barriers impacting telemedicine implementation.

Similarly, a study conducted among healthcare providers [24] revealed significant challenges associated with telemedicine adoption, particularly during the COVID-19 pandemic. Nearly half of the respondents cited various obstacles, with those newly adopting telemedicine during the pandemic facing more difficulties. Eight main challenges were identified: lack of infrastructure, technological illiteracy, remote monitoring limitations, financial barriers, absence of non-verbal feedback, limited bonding, language barriers, and distrust. Issues such as poor internet connectivity and device illiteracy were prevalent globally, affecting both low- and high-income countries. Financial constraints hindered both providers and patients, with reimbursement issues and equipment costs posing significant obstacles. Most importantly, the absence of physical examinations in teleconsultations posed a difficult challenge to the ability to provide high-quality care healthcare through telemedicine. Language barriers and distrust in telehealth services also emerged as a major concern, altering the patient-physician relationship. Another study [35] using a mixed-methods study was conducted across three metropolitan Sydney hospitals focusing on maternity care and highlighted the significant negative impact of the COVID-19 pandemic on various aspects of pregnancy care, particularly regarding screening for domestic and family violence (DFV) and mental health issues. The study suggests that changes in maternity care delivery, including reduced face-to-face visits, may exacerbate the impact of the pandemic on perinatal mental health and DFV, particularly affecting women from diverse backgrounds. Delays in screening and care were also noted, with concerns raised about missed screening opportunities and delayed care for affected women.

Despite these barriers, the pandemic forced the accelerated adoption of telehealth for many OB patients, with high satisfaction reported in many instances. Telehealth paved the way for patients to attend consultations from the safety of their homes while implementing the much-needed healthcare follow-up for pregnant women during the COVID-19 pandemic. However, it is important to note that many of these findings are pandemic-specific, reflecting rapid adaptations to COVID-19, and may not be fully generalizable to routine obstetric and reproductive care outside crisis contexts.

Collectively, the evidence underscores both the rapid innovation and persistent challenges of integrating telemedicine into obstetric care during the COVID-19 pandemic. While many studies reported high levels of patient satisfaction and highlighted the capacity of telehealth to maintain continuity of care, reduce infection risk, and provide essential follow-up, others pointed to critical barriers—including technological illiteracy, poor infrastructure, and financial constraints—that limited equitable access. Importantly, the absence of physical examination and reduced opportunities for sensitive screenings, such as those for domestic violence and perinatal mental health, were consistently identified as major shortcomings. Comparisons across settings suggest that while younger, technologically adept populations adapted more readily, older patients and women from diverse or vulnerable backgrounds faced greater obstacles. Taken together, these findings indicate that although the pandemic catalyzed a necessary and largely effective shift toward telemedicine in perinatal care, long-term implementation will require addressing disparities in access, safeguarding opportunities for sensitive screenings, and building more sustainable models that extend beyond crisis-driven contexts.

6. Health and Telemedicine

The field of mental healthcare, especially in the perinatal period, witnessed a noteworthy transformation due to the increasing adoption of telemedicine technologies. This shift represents a significant advancement in healthcare delivery, offering improved accessibility and effectiveness in addressing mental health needs. Low- and middle-income countries bear a significant burden of prenatal depression with rates that are much notably

higher than those in high-income countries [36]. However, although a drastic difference, studies show that in high- income countries there is still 10% of pregnant women and 13% of new mothers who suffer from some form of mental disorders [37]. For instance, in a study conducted in Germany (high-income), an examination of reimbursement data from German statutory health insurance revealed a prevalence of 9.3% for depression, 16.9% for anxiety disorder, 24.2% for somatoform/dissociative disorder, and 11.7% for acute stress reactions among pregnant women. Overall, 43.6% of 38,174 pregnant women experienced at least one mental disorder in 2008 [38]. Despite these statistics, it is well known that there is a significantly higher prevalence of mental disorders in lower to middle-income populations (19–25% vs. 7–15%) [39]. However, addressing perinatal depression in low and middle-outcome countries faces challenges such as limited resources for mental health services, prioritization of preventing obstetric complications and fetal anomalies, and fear of social stigma [40]. Therefore, offering cost-effective and accessible mental health services could serve as a significant approach to enhancing maternal and child health outcomes across generations, highlighting the need for more innovative approaches to address perinatal mental health challenges for all levels of income, especially in low and middle-outcome populations.

Smartphone-based interventions have emerged as promising solutions to bridge this gap in mental healthcare, by providing an adaptable and cost-effective platform for delivering mental health support to all populations, especially to those who have limited access to traditional services [40]. However, while there is a significant protentional for smartphone-based interventions, there are persisting obstacles. Concerns such as dropout rates and difficulty accessing these interventions hinder their widespread adoption [40]. While prior research has established the comparability of telemedicine-based mental healthcare to traditional in-person methods, there remains limited evidence regarding its effectiveness among perinatal populations. Studies often feature small sample sizes and a lack of integration into real-world settings. Large-scale randomized controlled trials are necessary to address clinically relevant questions impacting treatment uptake and fidelity. These questions include determining whether telemedicine-delivered mental health interventions are as effective as in-person interventions, identifying populations that may benefit more from one modality over another, and understanding the barriers and facilitators influencing the integration and adaptability of effective mental healthcare services [41]. Most evidence in this section is observational or pilot-scale, with limited large-scale RCTs, which, along with small sample sizes and lack of real-world integration, weakens confidence in generalizability.

Overall, the literature points to a consistent recognition of perinatal mental health needs across both high- and low-income settings, but the strategies and challenges differ markedly. High-income countries provide more robust prevalence data and demonstrate the feasibility of telemedicine as a comparable alternative to in-person care, while low- and middle-income settings underscore the urgency of scalable, cost-effective interventions in the face of limited mental health infrastructure and stigma. Smartphone-based approaches offer a potential bridge between these contexts, yet their effectiveness remains constrained by small study sizes, high dropout rates, and limited integration into real-world care systems. Taken together, these findings suggest that while telemedicine holds considerable promise for addressing perinatal mental health globally, progress will depend on rigorous large-scale trials and implementation strategies that account for both systemic barriers and population-specific needs.

7. Childbirth in Telemedicine

The growing use of telemedicine and digital applications has profoundly influenced prenatal care and childbirth options, mirroring broader technological advancements in

healthcare. Telemedicine, supported by electronic devices like smartphones and tablets, has become essential for monitoring maternal and fetal health. The prevalence of internet and smartphone use among pregnant women is significant. In the United States, most women own smartphones, and research suggests that over half of expectant mothers download apps focused on pregnancy, typically acquiring an average of three apps during the prenatal period. This trend underscores the increasing incorporation of technology into healthcare, especially in the context of prenatal care, with the reduction in prenatal visits and maintained patient satisfaction [42]. These applications such as Amila Pregnancy App, are designed to enhance user satisfaction and provide accurate, evidence-based information, thereby supporting informed decision-making among expectant mothers [43]. The Amila app stands out with the highest user satisfaction and superior precision compared to other similar apps. This mobile application has enhanced healthcare delivery for pregnant women globally, offering significant daily life benefits. Despite the scarcity of digital interventions tailored for pregnant women, Amila has emerged as a remarkable solution in this domain [43].

The role of such digital tools extends to addressing the high cesarean section rates that are observed in various countries. The surge in cesarean deliveries is observed globally, spanning both developed and developing countries. Notably, in regions like Asia and China, cesarean sections exceed 50% of all births. Iran, for instance, reports nearly 40% of deliveries in public hospitals and a striking 90% in private hospitals as cesarean [43]. According to the World Health Organization, cesarean rates ideally should range between 5 and 15% of all births. In such countries, educational interventions via apps have proven effective in promoting natural childbirth over cesarean delivery [43]. Notably, these interventions have included grading the apps based on the credibility of the information they provide and user satisfaction, which directly influences how effectively they change pregnant women's perceptions and decisions about childbirth. For instance, women who used these apps demonstrated a significant increase in knowledge about the risks and benefits of different childbirth methods, leading to more informed decisions favoring natural births [43].

Taken together, these findings highlight both the opportunities and challenges of integrating telemedicine into childbirth and prenatal care. While evidence from the United States emphasizes high smartphone penetration and app use as a means to sustain satisfaction despite fewer in-person visits, studies from regions with elevated cesarean section rates demonstrate the potential of targeted educational apps to modify maternal decision-making and encourage natural delivery. The comparative success of tools such as the Amila Pregnancy App underscores the importance of content quality, credibility, and user satisfaction in determining impact. Collectively, this body of evidence suggests that although digital applications are not yet uniformly developed or adopted, those that are evidence-based and user-centered can play a meaningful role in addressing global concerns such as unnecessary cesarean delivery, while simultaneously enhancing maternal autonomy and prenatal care experiences.

8. Gestational Diabetes Mellitus (GDM)

The rising incidence of GDM, particularly among overweight and obese women, poses a global health challenge due to its association with serious maternal and neonatal complications. While healthy lifestyle adherence can mitigate GDM risk, the effectiveness of mHealth and WBIs (Web-Based Interventions) remains unclear. A study [44] conducted a scoping review of app-supported lifestyle interventions during pregnancy, focusing on their role in managing GWG (Gestational Weight Gain) and preventing GDM. Despite numerous studies, including many randomized controlled trials, the effectiveness of these interventions is

uncertain due to varied methodologies. It is essential to rely on standardized reporting, rigorous evaluation, inclusivity in study populations, and individualized interventions.

8.1. Patient Satisfaction and Cost-Effectiveness of Telemedicine in GDM

One of the important aspects of establishing medical care through telemedicine is patient satisfaction and acceptance of this approach. A study has investigated patient satisfaction and the feasibility of telemedicine for prenatal care among women with GDM within Kaiser Permanente Southern California [45]. The study, involving surveys of 70 women and qualitative interviews with 10 participants, found high acceptability for virtual visits due to reduced work absences, less need for childcare, and decreased travel time. Participants were comfortable with telemedicine, especially when maintaining continuity with the same clinician. However, concerns included technical challenges and limitations in conducting certain examinations virtually. Overall, virtual prenatal visits were seen as a convenient supplement to traditional care for GDM, enhancing patient convenience without compromising care quality. Few studies have explored the cost-effectiveness of mHealth preferences among pregnant women with diabetes mellitus (DM) with barriers to care such as low income. mHealth preferences among pregnant women with DM, especially those facing socioeconomic barriers was investigated. In both studies, patients preferred mHealth apps, emphasizing educational content, user-friendly interfaces, and integrated functionalities [15,46]. Key features include clear data presentation, multilingual support, and simplified input methods, aiming to improve accessibility and reduce healthcare provider visits.

Notably, personalized mHealth apps have the potential to improve patient engagement and perinatal care, with a focus on blood glucose monitoring, meal planning, and weight tracking. Challenges such as technical issues and digital literacy disparities need to be addressed to maximize the benefits of mHealth interventions for managing diabetes during pregnancy. To explore additional advantages to telemedicine, a study has evaluated the cost-effectiveness of a telehomecare (THCa) program compared to traditional in-person care for managing GDM and found that the THCa program led to a 56% reduction in medical visits and a 16% reduction in direct costs associated with GDM management [47].

Collectively, the evidence suggests that telemedicine for gestational diabetes management offers high patient satisfaction and meaningful cost benefits, while also highlighting areas for improvement. Studies consistently show that women value the convenience of reduced travel, fewer work absences, and less reliance on childcare, particularly when continuity with the same clinician is maintained. mHealth applications further enhance engagement by integrating features such as glucose monitoring, nutrition support, and multilingual accessibility, which are especially important for women facing socioeconomic barriers. At the same time, concerns over technical issues and disparities in digital literacy underscore persistent challenges to equitable use. Importantly, cost-effectiveness analyses demonstrate substantial reductions in both medical visits and direct healthcare costs, suggesting that telemedicine can simultaneously improve patient experience and reduce system burden. Taken together, these findings indicate that with appropriate design and support, telemedicine and mHealth can play a central role in improving both clinical and economic outcomes in GDM care.

8.2. Efficacy of Telemedicine on GDM Control

It is important to investigate the efficacy of telemedicine in controlling GDM. The results of the controlled clinical trial assessing THCa showed that there were no significant differences in GDM control, with hypoglycemia rates (means: 1.4 vs. 1.5 episodes) and hyperglycemia rates (means: 17.7 vs. 22.8 episodes) similar between the THCa and control

groups. Mean plasma glucose levels were nearly identical (5.4 mmol/L for THCa vs. 5.5 mmol/L for control). Overall satisfaction scores were similar (8.9/10 for THCa vs. 8.5/10 for control, $p = 0.128$), with higher satisfaction for educational support in the THCa group (9.0/10 vs. 8.5/10, $p = 0.028$). The study suggests that tele-homecare is a cost-effective, efficient, and satisfactory alternative to traditional care for managing GDM, providing similar health outcomes while reducing healthcare resource burden [47].

This conclusion was also highlighted by another study, comparing the GDm-health mobile phone-based blood glucose management system with standard clinic care for women with GDM [48]. The intervention group showed no significant difference in blood glucose levels (mean change of −0.16 mmol/L per 28 days) compared to the control group (mean change of −0.14 mmol/L per 28 days). Also, the intervention group reported higher satisfaction ($p = 0.049$), fewer preterm births (5.0% vs. 12.7% in the control group) with an odds ratio of 0.36 (95% CI 0.12–1.01), and fewer cesarean deliveries (26.7% vs. 46.1% in the control group) with a significant p-value of 0.005. This study emphasizes again that digital health solutions like GDm-health are safe and acceptable for managing GDM, potentially reducing clinical visits while maintaining effective glycemic control. RCT's such as Mackillop et al. [48] provide higher internal validity compared to observational cohorts like Harrison et al. [45], which are more prone to bias but offer real-world insights. Three systematic reviews and meta-analysis also investigated the efficacy of telemedicine in controlling GDM. Study 1, by Guo et al. (2023) analyzing 21 randomized controlled trials, found WBIs significantly improved fasting blood glucose ($p = 0.004$) and 2 h postprandial blood glucose ($p = 0.01$) [49]. Nonetheless, study 2 by He et al. (2024), encompassing 16 trials, demonstrated that mHealth-based lifestyle interventions significantly reduced GDM incidence ($p = 0.03$) and adverse pregnancy outcomes such as preterm birth ($p = 0.004$), macrosomia ($p = 0.008$), and GWG ($p < 0.001$) [40]. Similarly, Study 3 by Wei et al. (2023), involving 27 trials, showed that mHealth interventions (particularly those combining WeChat and phone call communication) significantly improved glycemic control and reduced adverse pregnancy outcomes, highlighting mHealth's potential to enhance GDM management across multiple parameters [50]. Despite differences in intervention types, all studies highlighted mHealth's potential to enhance GDM management, emphasizing improvements in glycemic control and reductions in adverse pregnancy outcomes.

The collective evidence indicates that telemedicine is a safe and effective alternative to standard care for gestational diabetes, offering comparable glycemic control while enhancing patient satisfaction and reducing healthcare resource use. Findings from RCTs demonstrate that outcomes such as mean glucose levels, hypoglycemia, and hyperglycemia rates remain similar to in-person care, with some studies even reporting reductions in preterm birth and cesarean delivery rates in telemedicine groups. Importantly, systematic reviews and meta-analyses strengthen these observations, consistently showing improvements in fasting and postprandial glucose, reductions in adverse pregnancy outcomes, and lower gestational weight gain with mHealth-based interventions. The convergence of trial and pooled evidence suggests that while individual studies may differ in intervention type or design, telemedicine consistently provides equivalent or superior outcomes compared to traditional models. Together, these results highlight telemedicine as a viable, cost-effective, and scalable strategy for optimizing GDM management, with the added advantage of improving patient-centered care.

9. Healthy Lifestyle and Self-Care

Maternal obesity is on the rise globally, mirroring the increase in general obesity rates. Short-term risks associated with maternal obesity include increased rates of maternal and fetal complications such as mortality, miscarriages, GDM, pregnancy-induced hypertensive

disorders, macrosomia, and cesarean sections. Long-term risks include juvenile obesity and metabolic syndrome in children, independent of whether GDM is present or not [51].

Knowing the risk of obesity especially during pregnancy, lifestyle interventions could be implemented. A randomized control trial involved obese pregnant women (age: 29 ± 4 years; BMI: 33.6 ± 4.2 kg/m^2) who received a nutritional brochure, brochure plus education, or no intervention. Both intervention groups improved dietary habits, but physical activity declined in all groups during the third semester, and there were no significant differences in GWG or pregnancy outcomes [51]. These results suggest that stronger interventions are needed to affect GWG and to fight obesity in pregnant women.

With the emergent technological advances, health-related information can be accessed online and may affect health-related behaviors. A systematic review of 39 RCTs with 14,966 participants, found that 52% of smartphone-based interventions and all web-based apps effectively promoted healthy eating, particularly in chronically ill patients and pregnant women [52]. The findings suggest that mobile apps can effectively encourage long-term healthy eating habits, recommending their use by policymakers to support sustainable dietary behaviors.

Moreover, several factors influence the effectiveness of online-based information on health-related behaviors. A systematic review and meta-analysis investigated whether eHealth literacy affects health-related behaviors. The meta-analysis of 14 studies showed a moderate overall correlation (95% CI 0.25–0.34) between eHealth literacy and health-related behaviors [53]. Also, a cross-sectional study in Turkey also examined the link between eHealth literacy and healthy lifestyle behaviors with a focus on pregnant women [54]. Multiple linear regression indicated that eHealth literacy and internet use for health information significantly predicted healthy lifestyle behaviors. The findings highlight the crucial role of eHealth literacy in encouraging healthy behaviors among pregnant women.

On the contrary, three studies examined the effectiveness of smartphone applications in promoting healthy behaviors during pregnancy. In a randomized clinical trial by Dodd et al. (2018), involving 162 pregnant women, a smartphone app did not significantly improve healthy eating index (HEI) scores at 28 and 36 weeks' gestation compared to the control group ($p = 0.452$), despite overall dietary quality improvements [55]. Moreover, a randomized clinical trial by Kenelly et al. (2018), with 565 participants, found no significant difference in GDM incidence between the intervention and control groups (15.4% vs. 14.1%, respectively; $p = 0.71$) [56]. Similarly, a randomized clinical trial by Garnweidner-Holme et al. (2020), which included 238 women with gestational diabetes, showed no significant effect of the smartphone app on dietary behavior ($p = 0.05$) [57]. These findings collectively suggest that while smartphone apps may lead to improved dietary quality, they do not significantly impact HEI scores or GDM incidence during pregnancy, indicating limited additional benefit compared to standard care.

While these studies indicated no positive impact of smartphone apps on lifestyle changes in pregnant women, contrasting findings were observed in other studies. Two randomized controlled trials explored the effectiveness of mHealth interventions in improving pregnancy outcomes. The first trial by Persis et al. (2023), involving 150 pregnant women in northern India, compared the impact of a mobile application versus WhatsApp versus standard care on pregnancy self-care knowledge and practices [16]. Both intervention groups showed significant improvements in knowledge, attitude, and practice (KAP) regarding pregnancy self-care compared to the control ($p < 0.001$), with higher participant satisfaction in the WhatsApp group ($p < 0.001$). In the second trial by Sandborg et al. (2021) with 305 pregnant women across various BMI categories, the Healthy mom's smartphone app was evaluated for promoting healthy GWG and related outcomes [58]. While the overall effect on GWG was not statistically significant, subgroup analyses revealed reduced weight

gain among women with overweight and obesity before pregnancy in the intervention group compared to the control ($p < 0.05$). Additionally, the intervention group exhibited improved dietary habits, as indicated by higher scores on the Swedish HEI at follow-up ($p < 0.05$). However, no significant differences were found in body fatness, physical activity levels, glycemia, or insulin resistance between the intervention and control groups. These studies highlight the potential of mHealth interventions in enhancing pregnancy self-care and addressing excessive weight gain during pregnancy, especially among women with overweight and obesity, while also emphasizing the need for further research to optimize digital interventions for broader effectiveness.

The evidence on lifestyle interventions during pregnancy shows mixed outcomes, highlighting both the promise and limitations of traditional and digital approaches. Conventional education-based interventions improved dietary habits but had little impact on GWG or pregnancy outcomes, suggesting that more intensive strategies may be needed to counteract the physiological and behavioral challenges of pregnancy [51]. In contrast, digital interventions—particularly web-based and smartphone applications—demonstrated stronger potential in promoting healthy eating behaviors, with systematic reviews confirming their effectiveness across chronic illness and pregnancy populations [52]. However, the role of eHealth literacy emerged as a critical determinant of success, with higher literacy correlating with healthier behaviors [53,54].

Despite this promise, several RCTs reported no significant improvements in dietary indices, GDM incidence, or physical activity when smartphone apps were used as standalone tools [55–57]. These neutral findings contrast with trials such as those by Persis et al. and Sandborg et al., which demonstrated significant gains in self-care knowledge, dietary habits, and subgroup-specific reductions in GWG, particularly among women with overweight and obesity [16,58]. This suggests that intervention design, delivery mode (e.g., WhatsApp vs. standalone apps), and tailoring to at-risk populations may critically influence efficacy. Collectively, the literature underscores that while digital health tools offer a scalable avenue to promote healthier lifestyles during pregnancy, their effectiveness likely depends on personalization, integration with existing care models, and consideration of maternal characteristics such as BMI and digital literacy.

10. Smoking Cessation During Pregnancy

Smoking cessation is essential for the health of both mother and baby, and several factors influencing smoking behavior can be targeted in cessation strategies. E-Health interventions, using smartphones, text messages, and computers, can aid in smoking cessation with varying effectiveness. Strategies should be tailored to the specific needs of pregnant women, with a strong emphasis on motivation to quit. Despite recognizing the risks of smoking for both maternal and fetal health, some expectant mothers face obstacles to quitting. So, electronic interventions, such as smartphone apps and text messaging programs may offer support to pregnant women in their quit attempts. It is hence wise to discuss if these interventions represent effective strategies to help women overcome barriers to smoking cessation, ultimately leading to improved maternal and fetal outcomes. Understanding these barriers and facilitators to smoking cessation during and after pregnancy is crucial.

Flemming et al. (2014) conducted a systematic review to explore these factors in which various barriers were identified, including nicotine addiction, social influences, stress, lack of support, and socioeconomic factors [59]. Conversely, facilitators included personalized healthcare support, access to cessation resources, positive social networks, pregnancy motivation, and concern for the baby's health. These findings emphasize the complexity of smoking cessation for pregnant and postpartum women, highlighting the need for tailored

interventions and support strategies to overcome barriers and promote successful cessation, prioritizing the health of both mother and child.

As for accessibility, It is important to assess the prevalence of digital communication usage in pregnant smoker women and their access to such technologies to be able to discuss if digital interventions have an impact on smoking cessation. Kurti et al. (2019) explored the potential of mHealth interventions for smoking cessation among women, including pregnant women, by analyzing data from the Population Assessment of Tobacco and Health (PATH) study [60]. They found that 80% of women, including pregnant smokers, use digital communication forms such as social media and text messaging, indicating the potential for utilizing technology to expand smoking prevention and treatment resources. However, smokers and those with lower education levels were less likely to use these technologies, suggesting the need to improve access to smoking cessation resources through community locations and programs providing free mobile phones. Tailoring smoking cessation programs to pregnant women, with pregnancy-specific content, could also enhance effectiveness. The study highlights the importance of addressing accessibility and tailoring content to specific audiences to maximize the effectiveness of digital smoking cessation interventions.

Moreover, a systematic review and meta-analysis led by Griffiths et al. (2018) explores digital interventions targeting smoking cessation during pregnancy, revealing an evolution in technological approaches over time [61]. These interventions, including mobile apps, websites, and text messaging programs, demonstrate promising efficacy in promoting smoking cessation during pregnancy. Text message interventions are particularly effective, displaying comparable efficacy across pregnant and non-pregnant populations. However, computer-based interventions, integrated with routine prenatal care, show slightly reduced effectiveness. Accessibility disparities in digital interventions are noted, with 90% of studies originating from high-income countries, potentially limiting intervention accessibility, particularly among disadvantaged pregnant women. Despite promising results, the review emphasized the need for further research with the inclusion of women from different geographical locations and socioeconomic levels to determine the global effectiveness and inclusivity of digital interventions in facilitating smoking cessation among pregnant women. In addition, one of the potential strategies to support women in smoking cessation is to target stress that incites some of their smoking habits. A randomized controlled study by van Dijk et al. (2021) currently investigating the effectiveness of an eHealth intervention, called the Stress- and Smoke-Free Start of Life (SSFSL) study, aims at helping smoker pregnant women who are over 18 years old and less than 28 weeks pregnant [62].

Overall, the literature suggests that digital interventions hold promise for supporting smoking cessation during pregnancy, yet their effectiveness varies and depends on factors such as accessibility, personalization, and the modality used. Systematic reviews indicate that mobile apps, websites, and particularly text messaging programs can be effective, with tailored pregnancy-specific content and motivational support enhancing outcomes [61]. However, disparities in access—especially among women with lower education levels or in low-income settings—remain a critical barrier, underscoring the importance of equitable implementation strategies [60]. Barriers such as nicotine addiction, stress, and lack of social support further highlight the complexity of smoking cessation in this population [59]. Comparatively, interventions integrated with routine prenatal care and those addressing psychosocial factors appear to offer the greatest potential. Taken together, these findings indicate that while eHealth strategies can be an important tool in promoting smoking cessation during pregnancy, their success will depend on targeted, accessible, and context-sensitive designs that address both behavioral and structural barriers.

11. Opioid Cessation Using Telemedicine in Pregnancy

11.1. Traditional Opioid Treatment and Its Challenges

Pharmacotherapy, utilizing methadone or buprenorphine, stands as the primary approach for addressing opioid use disorders, whether during pregnancy or otherwise. These medications have been linked to significant benefits, including reduced mortality from overdose, and enhanced outcomes for both obstetric and neonatal health. These pharmacotherapies are highly regulated which leads to more difficult access for patients that need it. Methadone distribution and prescription are restricted to accredited Opioid Treatment Programs, mandated to adhere to federal and state regulations. These restrictions demand in-person visits for daily methadone doses, with take-home doses being under rigorous control. Office-based buprenorphine therapy, designed to mitigate these barriers, requires practitioners to obtain an X-waiver following comprehensive training. However, a practitioner can only treat a limited number of patients and some states still require regular in-person evaluations and drug screens. Reports have revealed that 40% of counties lack X-waivered providers altogether. Furthermore, even in counties with such providers, the capacity for treatment remains insufficient, with nearly half of all counties lacking publicly accessible medication providers. Pregnant women encounter even greater obstacles, with only 1.8% of obstetrician-gynecologists holding an X-waiver in 2020. Moreover, the requirement for daily visits to receive methadone doses imposes a significant logistical and financial strain. Transportation costs and time investments for clinic visits can affect patients' ability to maintain employment and fulfill daily responsibilities. As such, patients suffering from opioid use disorders often face heavy burdens in accessing treatment [63]. Also, further complicating access, opioid treatment in pregnancy carries ethical dilemmas, regulatory challenges, and cultural stigma, all of which can impact the acceptance and implementation of telemedicine-based care. In this section, most evidence comes from cohort or non-randomized controlled trials with small sample sizes, indicating a lower strength of evidence compared to GDM or abortion, where multiple RCTs are available.

The literature consistently illustrates that while methadone and buprenorphine remain effective cornerstones of opioid use disorder treatment, significant systemic, regulatory, and logistical barriers limit access—particularly for pregnant women. Regulatory constraints, such as daily dosing requirements and limited availability of X-waivered providers, exacerbate inequities in care access, with some regions lacking any authorized providers altogether [63]. These challenges are compounded by ethical considerations and cultural stigma, which can further hinder uptake. Compared to other areas of telemedicine in obstetrics, evidence in opioid use disorder treatment remains limited, with most studies relying on smaller cohorts and non-randomized designs, reducing generalizability. Taken together, these findings underscore the need for innovative strategies, including telemedicine, to improve access while addressing regulatory, logistical, and social barriers, thereby enhancing both maternal and neonatal outcomes.

11.2. Opioid Dependence in Rural and Remote Settings

Opioid dependence is a significant issue in rural and remote areas, where access to healthcare services is often limited. These regions face unique challenges in addressing opioid use, with higher prevalence rates and distinct patterns of nonmedical prescription opioid use compared to urban areas. In Canada, Aboriginal communities in these remote locations are particularly affected, experiencing disproportionately high rates of opioid dependence, ranging from 50% to 80%. Nonmedical use of prescription opioids is more prevalent than heroin use, with oral administration being more common than intravenous. The incidence of NAS (Neonatal abstinence syndrome) was 30% overall, rising to 66% among infants born to daily opioid users [64]. Considering these challenges, telemedicine

emerges as a potential solution. By taking advantage of information and communication technologies, telemedicine seeks to bridge geographical barriers and enhance access to care. Remote evaluation, prescription, and counseling services hold promise for improving treatment accessibility.

The evidence highlights that opioid dependence in rural and remote settings represents a substantial public health challenge, driven by higher prevalence rates, unique patterns of opioid use, and limited access to treatment. Populations in these areas—particularly Aboriginal communities in Canada—face disproportionately high rates of dependence and neonatal abstinence syndrome, emphasizing the urgency of targeted interventions [64]. Compared to urban contexts, geographic isolation and resource scarcity magnify barriers to effective care, making traditional treatment models difficult to sustain. Telemedicine offers a promising avenue to overcome these challenges by facilitating remote evaluation, prescription, and counseling, thereby bridging gaps in access and continuity of care. While preliminary findings underscore telemedicine's potential, further high-quality evidence is needed to validate its effectiveness and address logistical, regulatory, and cultural considerations unique to rural and remote populations.

11.3. Efficacy and Reliability

Assessing the efficacy and reliability of telemedicine for delivering opioid treatment to pregnant women is crucial for ensuring effective and accessible care. In 2024, a cohort study was conducted in the United States to evaluate opioid use disorder treatment and pregnancy outcomes through telemedicine programs. Patients were either on buprenorphine only or buprenorphine and naloxone. Results were promising, as they showed the majority received continuous care throughout pregnancy (79.8%) and chose to remain within the telemedicine program over transfer of care to a prenatal provider (92%). Although the results of this cohort study were positive, they were based on a small sample size [65].

A non-randomized controlled trial in 2020 compared and analyzed 2 groups of pregnant women who received opioid use disorder treatment either through telemedicine or in-person. There was a variation in the retention rates for women undergoing opioid use disorder treatment, whether through telemedicine or in-person sessions (80.4% compared to 92.7%). This was also observed in newborns diagnosed with NAS with 45.4% for telemedicine versus 63.2% for in-person treatment. These study findings highlight the potential of telemedicine to significantly benefit pregnant women with OUD (Opioid use disorder) by increasing access to treatment. These benefits include reducing maternal mortality rates and the risk of children being orphaned on a national scale [66].

The available evidence suggests that telemedicine is a promising and reliable modality for delivering opioid use disorder treatment to pregnant women, particularly in improving access and retention in care. Cohort and controlled studies indicate high rates of patient engagement, with the majority of participants maintaining continuous care throughout pregnancy and preferring telemedicine over transferring to in-person care [65,66]. Although retention rates in telemedicine programs were slightly lower compared to in-person treatment in some studies, outcomes such as reduced incidence of neonatal abstinence syndrome and sustained treatment engagement suggest meaningful clinical benefits [66]. While these findings are encouraging, they remain constrained by small sample sizes and non-randomized designs, limiting generalizability. Overall, the emerging evidence supports telemedicine as a viable alternative or complement to traditional care, though further large-scale, rigorous trials are needed to confirm efficacy and optimize program design for diverse patient populations.

11.4. Racial Disparities in Opioid Treatment and Telemedicine

It is crucial to highlight that the expansions of opioid treatment using telemedicine should aim to reduce health inequities and address persistent racial disparities in care, which are evident in the current system. Studies have shown that patients of African descent are less likely to receive buprenorphine in office-based care. Therefore, it is essential to ensure that telemedicine interventions do not unintentionally exacerbate these disparities [10].

The integration of telemedicine into opioid treatment offers an important opportunity to address—but also risks perpetuating—existing racial disparities in care. Evidence shows that patients of African descent are less likely to receive office-based buprenorphine treatment, highlighting systemic inequities that digital health must actively confront [10]. While telemedicine has the potential to broaden access by reducing geographic and logistical barriers, disparities in digital literacy, access to technology, and trust in healthcare systems may limit its equitable impact. Thus, ensuring culturally sensitive program design, targeted outreach, and strategies to overcome structural barriers will be essential to prevent telemedicine from inadvertently widening existing gaps in opioid treatment access and outcomes.

12. Abortion via Telemedicine

Over the past decade, there has been a notable rise in the utilization of medication abortion in the United States, now constituting over half of all abortions. With the onset of the COVID-19 pandemic, the U.S. Food and Drug Administration waived the requirement for abortion pills to be provided exclusively at healthcare facilities. This adjustment allowed for the increased integration of telemedicine and mail-order medication delivery into the field of medication abortion services, in certain states where law permits. These adaptations aimed to enhance accessibility to abortion care, particularly in areas where traditional healthcare services may be limited. Additionally, in response to the pandemic, abortion providers adopted more flexible follow-up options to minimize COVID-19 exposure risk, including self-directed at-home pregnancy tests and symptom checklists, which have persisted beyond the pandemic era.

A systematic review was conducted to assess the efficacy, safety, and acceptability of telemedicine for abortion. For women $\leq$10 weeks' gestation, success rates were comparable to in-person medical abortion, with complete abortion rates ranging from 93.8% to 96.4% [67]. While the need for surgical evacuation varied (0.9% to 19.3%), it was influenced by local practices. Blood transfusion rates were low (0% to 0.7%), and satisfaction rates were high (64% to 100%). Qualitative studies found no negative impacts. However, follow-up challenges with telemedicine complicate risk interpretation.

For women >10 weeks, continuing pregnancy rates (1.3% to 2.3%) and surgical evacuation rates (8.5% to 20.9%) were higher than in-person procedures, indicating telemedicine might not be ideal, especially >12 weeks. Despite positive findings, evidence quality was low due to observational studies and high loss to follow-up (5% to 57%). Additionally, no studies focused on low-income settings [67].

Aiken et al. (2021) conducted a national cohort study in England comparing two models: traditional (in-person with ultrasound) and telemedicine-hybrid (in-person or via telemedicine without ultrasound) [68]. Results showed promising outcomes, with the telemedicine-hybrid model reducing the average waiting time from referral to treatment by 4.2 days and increasing the percentage of abortions performed at $\leq$6 weeks' gestation. Importantly, there were no significant differences in treatment success, serious adverse events, or ectopic pregnancy incidence between the two models. These findings underscore the importance of minimizing the time elapsed from referral to treatment to enhance the safety

and effectiveness of abortion procedures, potentially reducing the risk of complications for women seeking abortion. Additionally, the study demonstrated that ultrasound is not universally necessary for all abortion procedures, although specific criteria must be met for treatment to exclude ultrasound, and telemedicine without ultrasound may not be suitable for every case [68].

Recently, Brown et al. (2023) conducted a comprehensive review encompassing 25 studies examining telemedicine's role in delivering abortion services in the United States, revealing robust support for its safety and efficacy [69]. Success rates, ranging from 92.5% to 99%, were accompanied by minimal adverse events, while patient satisfaction remained high, with a preference for recommending telemedicine services. Notably, telemedicine addressed accessibility barriers for rural and transportation-challenged patients, offering protection from legal restrictions and protesters. Subsequently, Koenig et al. (2024) investigated the experiences of 1600 patients undergoing telemedicine abortion treatment in a cohort study [70]. Results indicated significant patient trust (98%) in providers, with 96% affirming telehealth as the right choice and 92% feeling cared for, resulting in an overall satisfaction rate of 89%. Key benefits cited included privacy, timeliness, and the ability to remain at home, while initial concerns regarding legitimacy comprised the primary drawback.

Variations among racial groups were observed, with Asian, Native Hawaiian, and Pacific Islander patients exhibiting lower satisfaction rates compared to white patients (79% vs. 90%; $p = 0.008$). These shifts reflect a broader trend towards person-centered care, emphasizing not only patients' medical needs but also their individual preferences and socio-economic circumstances, such as work obligations, childcare needs, and travel constraints [71]. Systematic reviews mentioned do provide strong pooled evidence of safety, but many included studies are observational, limiting causal inference. In addition, measures integrated during a fast paced pandemic crisis, might prove not be efficient and safe to generalize, hence further studies are required.

The current evidence suggests that telemedicine for medication abortion is a safe, effective, and acceptable alternative to traditional in-person care, particularly for pregnancies $\leq$10 weeks' gestation. Systematic reviews and cohort studies consistently demonstrate comparable success rates to in-person procedures, alongside high patient satisfaction and enhanced accessibility—especially for patients facing geographic, logistical, or legal barriers [67–70]. Telemedicine models have also reduced waiting times for treatment, which may improve clinical outcomes and patient experience [68]. However, some evidence points to limitations for later gestations (>10 weeks), where surgical evacuation rates and continuing pregnancy rates appear higher, underscoring the need for careful patient selection and follow-up protocols [67]. Differences in satisfaction among racial groups further highlight the importance of tailoring telemedicine services to address diverse cultural and socioeconomic needs [71]. While these findings are promising, much of the evidence stems from observational studies with potential selection bias, high loss to follow-up, and context-specific adaptations during the COVID-19 pandemic. Thus, additional large-scale, randomized studies are needed to confirm safety, refine protocols—particularly for later gestations—and ensure equitable access to telemedicine abortion care across populations and legal contexts.

12.1. Main Telemedicine Models for Abortion Care

In the United States, accessing a medical abortion involves several steps typically conducted at a clinic. Later, the abortion process occurs when the patient takes misoprostol at home, with a final assessment of abortion completion conducted one to two weeks later. Telemedicine presents an additional avenue for making medical abortion more accessible by

offering services outside the clinic. However, access to medical abortion in the United States faces significant challenges due to regulatory, legal, and logistical barriers. These include restrictions imposed by the FDA's Risk Evaluation and Mitigation Strategy (REMS), which limits the distribution of mifepristone, legal constraints on medical abortion provision, and laws prohibiting the use of telemedicine in abortion care. Geographic barriers further compound access challenges, with some women having to travel long distances to reach abortion clinics, particularly in rural areas. Telemedicine holds promise in mitigating these challenges, especially concerning distance barriers, and could potentially improve access to medical abortion services [72]. There are currently 2 main models that telemedicine in abortion follows:

12.1.1. The Direct-to-Clinic Model

This model offers a unique approach to medical abortion, where patients seek care in local clinics and communicate with off-site providers via teleconference, eliminating the need for a physician on-site. This model is beneficial for rural regions with low provider-to-patient ratios. In this model, patients at satellite locations undergo ultrasound, lab testing, and screening and then have a video conference with a physician who remotely unlocks a drawer containing mifepristone and misoprostol for dispensation. Despite managing provider shortages and offering scheduling flexibility, the direct-to-clinic model does not alleviate the transportation, time, and cost burdens for patients, as they still need to visit a clinic to receive care [72].

12.1.2. The Direct-to-Consumer Model

This model allows women to engage directly with healthcare providers via video calls, and medications are sent to them through mail or prescription, bypassing the need for clinic visits. This model offers more flexibility, as there are no location requirements for either party. Direct-to-consumer models hold promise, particularly in areas with limited abortion access, where patients could undergo screening and testing with primary providers and receive abortion medications remotely. However, for this model to be widely viable, the dismantling of the REMS agreement would be necessary since mailing medications does not align with it [72].

The two primary telemedicine models for abortion care—the direct-to-clinic and direct-to-consumer approaches—illustrate different strategies to overcome barriers in accessing medical abortion. The direct-to-clinic model effectively addresses provider shortages and improves service availability in rural areas, but patients still face the logistical burdens of traveling to a clinic for testing and medication, limiting its convenience [72]. In contrast, the direct-to-consumer model offers greater flexibility and potentially wider access by allowing patients to receive care and medications remotely, which could be transformative for those in geographically underserved areas. However, significant regulatory barriers, such as the FDA's REMS requirements, currently restrict its scalability and limit its use in the United States [72]. These models highlight the promise of telemedicine to expand reproductive healthcare access while underscoring the need for regulatory reform and infrastructure support to ensure equitable, safe, and efficient delivery of abortion services. Future research should evaluate the safety, cost-effectiveness, and patient-centered outcomes of these models in diverse healthcare settings to inform policy and optimize implementation.

12.2. Geographical Barriers to Abortion

Geographical barriers have historically hindered access to abortion services in the United States, a challenge exacerbated by the Dobbs v. Jackson Women's Health Services ruling in July 2022, which led to abortion bans in 14 states. Consequently, more individuals seek care out of state, resulting in delays and increased travel distances. Research indicates that longer

travel distances decrease the likelihood of obtaining abortions, and recent anti-abortion laws have contributed to this trend, with around 20% of potential patients living over 43 miles from a provider as of 2019. Even in states where abortion remains legal, geographic barriers persist, worsening disparities in reproductive healthcare access. Koenig et al. (2023) conducted a geospatial analysis, finding that telehealth significantly reduced travel distances and time for patients, particularly benefiting younger individuals, rural residents, and those experiencing food insecurity [73]. Telehealth has emerged as a promising tool for promoting health equity, addressing logistical, privacy, and financial challenges faced by vulnerable demographics, while also potentially bridging geographical gaps in abortion access [73].

Geographical barriers have long been a major obstacle to timely abortion care in the United States, with recent legal changes such as the *Dobbs v. Jackson Women's Health Services* ruling amplifying these challenges [73]. Travel distances, especially in rural or restrictive states, pose logistical, financial, and emotional burdens, often delaying access to care or preventing it entirely. Telemedicine offers a powerful solution to mitigate these barriers by reducing the need for in-person visits, shortening travel distances, and expanding access for populations disproportionately affected—such as rural residents, younger individuals, and those facing economic hardship [73]. This potential is particularly significant in the current landscape of increasing abortion restrictions, where telehealth can play a critical role in preserving reproductive autonomy and health equity. However, structural and regulatory challenges remain, and ongoing research is needed to evaluate the long-term sustainability, safety, and equity of telemedicine abortion services.

12.3. Abortion Through Telemedicine in Low-Income Settings

In low-income settings, telemedicine for abortion services faces distinct challenges and opportunities due to limited healthcare infrastructure, technology access, and regulatory variations. However, recent studies have delved into its potential to enhance safe abortion care access. A pilot study in Ghana from July 2021 to July 2022 showcased promising results, with over 2500 calls discussing telemedicine for EMA, resulting in 40% of calls leading to booked consultations. Notably, 87% of these consultations proceeded successfully. Patient feedback was overwhelmingly positive, with 83% feeling very comfortable with medication management, and high rates of complete medical abortions (97%). Follow-up calls proved instrumental in identifying clinical incidents, with significantly fewer reported incidents compared to clinic settings. Satisfaction rates were high, with 85% of patients willing to reuse the service and 83% likely to recommend it. Critically, telemedicine did not diminish clinic attendance, indicating its ability to reach a new patient base, particularly benefiting students and young professionals for its discretion and convenience [74].

In 2022, Endler et al. conducted a randomized, controlled, non-inferiority trial in South Africa to compare the efficacy, adherence, safety, and acceptability of a modified telemedicine protocol for abortion with standard care. The study involved a standard care group (n = 350) and a telemedicine group (n = 372) utilizing asynchronous consultation. Results indicated that 95.4% of the telemedicine group achieved complete abortion compared to 96.6% in the standard care group, with an odds ratio of 0.74 [95% CI 0.35 to 1.57]. Despite the presence of abortion services in public health facilities, the country faces challenges, such as stigma and a scarcity of skilled practitioners, leading to a high rate of abortions by unlicensed providers. Addressing these barriers is crucial as unsafe abortions contribute significantly to preventable pregnancy-related deaths, especially with delayed access resulting in more second-trimester procedures. Thus, research and promotion of alternative methods like telemedicine are vital for minimizing such preventable deaths [75].

Telemedicine for abortion in low-income settings holds considerable promise but faces unique structural and sociocultural challenges. Studies in Ghana and South Africa demonstrate

that telemedicine can deliver safe, effective, and acceptable abortion care, with success rates comparable to standard clinic-based services and high patient satisfaction [74,75]. These models show particular value in addressing barriers such as stigma, provider shortages, and privacy concerns, offering a discreet and accessible option for underserved populations. However, challenges including limited healthcare infrastructure, unequal access to technology, regulatory constraints, and the risk of unsafe abortion practices remain critical hurdles. Expanding telemedicine abortion services in low-resource settings could improve access and reduce unsafe abortion rates, but requires investment in infrastructure, regulatory adaptation, and community engagement to ensure safety, equity, and sustainability.

13. Contraception in Telemedicine

Telemedicine has emerged as a promising tool in the realm of remote healthcare delivery, which is especially evident regarding contraception. As with other uses of telemedicine during the COVID-19 pandemic, there was a surge in its utilization observed among patients who required family planning in the USA. According to Yarger, J. et al. [13], only 17% of family planning providers used telemedicine for contraceptive consultation, however after the onset of the pandemic, these figures skyrocketed to over 50%. This dramatic shift demonstrates the significant usage implemented by telemedicine for contraception services. Various studies indicated that the quality that was provided for contraceptive counseling via the method of telehealth was comparable to that of in-clinic visits.

In accordance with [76], a high level of patient satisfaction was reported concerning the use of telehealth in New York, which was particularly evident in the early stages of the pandemic. Additionally, one of the primary advantages of telemedicine in contraceptive care is its high potential to enhance access to individuals in rural and underserved populations [77]. Through the elimination of barriers such as lack of transportation, childcare obligations, and time constraints, which are all obstacles associated with in-person visits, telehealth opened new avenues for women to be able to access contraceptive services more easily. However, such findings in a pandemic setting, needs further assessment and research to be able to generalize the use of contraceptives outside pandemic scenarios.

Although both physician and patient satisfaction were present, patients who opted for these services typically lacked subsequent clinical visits, which suggests that although telehealth services provide a great medium for initial patient contraceptive counseling, they should not entirely replace the imminent need for in-person care and clinical visits [78]. Several specific barriers were also identified including a need for in-person visits for specific contraceptive methods, as well as discomfort in using telemedicine technology and the absence of at-home privacy. Also, contraception delivered through telemedicine is often subject to ethical and cultural debates, as well as state- and country-specific legal restrictions, which may limit equitable adoption.

Additionally, there was a large proportion of participants who lacked knowledge regarding telemedicine services with many unaware if their healthcare providers offered remote services. Underserved populations and marginalized groups including Medicaid beneficiaries and those with low incomes were found to be less likely to use telemedicine services due to barriers such as low telehealth literacy, limited technology access, and financial constraints [77].

While telemedicine presents promising opportunities in improving remote access to high-quality contraceptive care and easy accessibility, significant challenges persist. Ongoing efforts are required to optimize telehealth platforms and to ensure they are integrated efficiently into the already existing healthcare system to maximize and uphold a top-tier contraceptive standard of care for patients of all backgrounds. Table 1 summarizes telemedicine applications in obstetrics.

Table 1. Summary of Telemedicine in Obstetrics.

Healthcare Professionals' Perspectives	• Healthcare providers, including midwives and physicians, show varying levels of acceptance and skepticism toward telemedicine in obstetrics. • A systematic review on midwives highlights diverse perspectives on delivering sexual and reproductive healthcare via telehealth. • Positive views among midwives include: ○ Ability to continue work during challenges like the COVID-19 pandemic. ○ Improved work–life balance. • Concerns raised by midwives include: ○ Lack of physical presence in patient care. ○ Potential errors in telehealth interactions. ○ Financial burden of internet costs limiting patient follow-up. ○ Skepticism about technology replacing human roles. ○ Generational differences in technology proficiency affecting adoption. • Some physicians express hesitancy regarding the accuracy of diagnoses via telemedicine, reflecting ongoing concerns in the medical community.
Assisted Reproduction Telemedicine	❖ Telemedicine has shown significant promise in assisted reproduction. ❖ High patient satisfaction has been reported, with telemedicine demonstrating: • Effectiveness comparable to in-clinic care. • Improved healthcare access. • Reduced travel time. ❖ Telemedicine benefits patients facing psychosocial challenges or those preferring privacy. ❖ It enhances patient involvement in clinical decision-making, particularly during the COVID-19 pandemic by facilitating remote access to reproductive specialists. ❖ Advanced telemedicine applications in assisted reproduction include: • Time-lapse systems: ○ Enable continuous embryo monitoring without disturbing the culture environment. ○ Improve selection of viable embryos for transfer. • AI algorithms: ○ Predict embryo implantation potential. ○ Optimize treatment strategies and outcomes. • Self-operated endovaginal telemonitoring devices: ○ Allow patients to perform sonograms at home. ○ Reduce the need for frequent clinic visits.
Perinatal Care During COVID-19 Using Telemedicine	• During the COVID-19 pandemic, telemedicine became a crucial tool in obstetric care. • It helped address challenges such as: ○ Reduced prenatal visits. ○ Increased maternal mental health issues. ○ Higher rates of domestic violence. • The American College of Obstetricians and Gynecologists (ACOG) advocated for telehealth integration to: ○ Ensure uninterrupted care for high-risk obstetric patients. ○ Provide access for marginalized populations. • Telemedicine enabled virtual interactions for: ○ Ultrasounds and monitoring. ○ Patient education. ○ Consultations. • Benefits of telemedicine included: ○ Reduced disease exposure. ○ Conservation of healthcare resources. ○ Safe and accessible care during isolation. • Barriers to adoption included: ○ Technological challenges. ○ Patient acceptance issues. • Despite obstacles, telehealth provided significant benefits for obstetric patients during the pandemic.

Table 1. *Cont.*

Mental Health and Telemedicine	❖ Telemedicine in perinatal mental healthcare represents a significant advancement, improving mental healthcare globally. ❖ High-income countries report high rates of mental health disorders among pregnant patients, with even higher rates in low- and middle-income countries. ❖ Smartphone-based interventions show promising outcomes, particularly for underserved populations. ❖ Challenges include: • Maintaining intervention fidelity. • Ensuring access for all populations. ❖ Large-scale studies are needed to: • Further validate telemedicine's effectiveness in perinatal mental health. • Optimize its integration into healthcare settings.
Childbirth in Telemedicine	❖ Telemedicine and its applications are transforming prenatal care and childbirth, leveraging widespread smartphone and internet use among pregnant women. ❖ These technologies maintain patient satisfaction while enabling: • Remote monitoring of maternal and fetal health. • Reduced need for in-person visits. ❖ Apps like the Amila Pregnancy App: • Provide evidence-based information. • Support informed decision-making. • Enhance user satisfaction globally. ❖ Digital interventions also address high cesarean section rates by: • Delivering educational content on childbirth options. • Encouraging natural births.
Gestational Diabetes Mellitus (GDM)	❖ The rising incidence of gestational diabetes mellitus (GDM), especially among overweight and obese women, poses significant health risks for both mothers and newborns. ❖ Healthy lifestyle adherence can mitigate these risks. ❖ The effectiveness of mobile health (mHealth) and web-based interventions (WBIs) remains uncertain due to varied study methodologies. ❖ Telemedicine receives high patient satisfaction for: • Convenience. • Continuity of care. ❖ Challenges include: • Technical issues. • Digital literacy barriers. ❖ Studies indicate that mHealth and telemedicine can: • Be cost-effective. • Enhance patient engagement. ❖ However, their efficacy in improving GDM management and reducing adverse outcomes requires further standardized and inclusive research.
Healthy Lifestyle and Self-care	❖ Maternal obesity is increasing globally, associated with: • Short-term risks: maternal and fetal complications. • Long-term risks: juvenile obesity and metabolic syndrome in children. ❖ Lifestyle interventions in obese pregnant women: • Show some dietary improvements. • Do not significantly impact gestational weight gain (GWG) or pregnancy outcomes. ❖ Systematic reviews and trials of mHealth interventions (e.g., smartphone apps) show mixed results: • Some improve healthy eating and self-care, especially in overweight women. • Others show no significant effect on gestational diabetes incidence or weight gain. ❖ Effective use of behavior change techniques in apps is crucial. ❖ Further research is needed to: • Optimize app effectiveness. • Ensure broader health benefits.

Table 1. *Cont.*

Smoking Cessation during Pregnancy	• Smoking cessation during pregnancy is critical due to adverse effects on maternal and fetal health. • Barriers to quitting include: ○ Nicotine addiction. ○ Social influences. ○ Stress. • Digital interventions (e.g., smartphone apps, text messaging) show potential in supporting pregnant women to quit smoking. • Studies indicate: ○ Text messaging interventions can be particularly effective. ○ Accessibility remains a challenge, especially in low-income settings. • Tailored approaches that: ○ Address stress. ○ Incorporate social support. ○ Can enhance program success. • Effective digital interventions ultimately improve maternal and fetal health outcomes.
Opioid Cessation Using Telemedicine in Pregnancy	❖ Methadone and buprenorphine are primary treatments for opioid use disorders, providing: • Reduced overdose mortality. • Improved obstetric and neonatal outcomes. ❖ Access barriers: • Methadone requires daily in-person visits at accredited clinics. • Buprenorphine requires an X-waiver, with patient limits and state regulations. • Many areas lack X-waivered providers, creating treatment gaps, especially for pregnant women. ❖ Rural and remote areas (e.g., in Canada) face: • High rates of opioid dependence. • Limited healthcare access. ❖ Aboriginal communities are particularly affected, with: • High rates of nonmedical prescription opioid use. • Increased neonatal abstinence syndrome (NAS). ❖ Telemedicine for opioid treatment shows promise: • High rates of continuous care and term pregnancies. • Positive maternal and neonatal outcomes. • Reduction in maternal mortality and neonatal complications. ❖ Larger studies are needed for more reliable data on telemedicine efficacy. ❖ Equity considerations: • Patients of African descent are less likely to receive buprenorphine and face barriers to virtual care. • Expanding telemedicine must ensure equitable access to avoid worsening existing disparities.

Table 1. *Cont.*

Abortion via *Telemedicine*	❖ Traditional medical abortion requires multiple clinic visits for: • Screening. • Counseling. • Medication provision. • Follow-up. ❖ Access challenges include: • FDA restrictions on mifepristone distribution. • Legal constraints. • Travel burdens, especially for rural patients. ❖ Telemedicine offers remote alternatives with two main models: • Direct-to-clinic: ○ Patients visit local clinics for screening. ○ Communicate with off-site providers via teleconference. ○ Still requires clinic travel. • Direct-to-consumer: ○ Patients interact with providers via video calls. ○ Medications are mailed, eliminating clinic visits. ❖ Geographical barriers are worsened by the Dobbs v. Jackson decision, leading to abortion bans and increased travel distances. ❖ Telehealth benefits: • Reduces travel time. • Improves access for younger, rural, low-income, and food-insecure patients. • Reduces waiting times. • Shows effectiveness and safety comparable to in-person care. • High patient acceptability. ❖ Concerns: • Follow-up challenges. • Need for larger studies to confirm outcomes. ❖ Low-income settings: • Infrastructure challenges exist. • Pilot studies in Ghana and South Africa show high satisfaction, safety, and effectiveness. ❖ Overall impact: • Expands access to early medical abortion (EMA). • Reduces reliance on unlicensed providers. • Decreases frequency of late abortions and associated risks.
Contraception in Telemedicine	❖ Telemedicine in contraception has emerged as a promising tool for delivering services. ❖ Studies show telehealth consultations for contraception provide high-quality care comparable to in-clinic visits. ❖ Primary advantages: • Enhances access for rural and underserved populations. • Eliminates barriers such as transportation and time constraints. ❖ Challenges: • Certain contraceptive methods still require in-person visits. • Some patients experience discomfort using telemedicine technology.

Telemedicine represents a significant advancement in contraceptive care, particularly in improving access for rural and underserved populations by overcoming logistical barriers such as transportation, childcare, and time constraints [76,77]. The rapid adoption of telemedicine during the COVID-19 pandemic, with usage among family planning providers rising from 17% to over 50%, underscores its potential as a sustainable healthcare delivery model [13]. Patient satisfaction is generally high, and quality of contraceptive counseling via telehealth has been comparable to in-clinic visits. However, telemedicine

faces notable limitations. Certain contraceptive methods still require in-person visits, and technological, privacy, legal, and cultural barriers restrict broader adoption. Furthermore, marginalized groups—including Medicaid recipients and low-income populations—often face reduced access due to low telehealth literacy, limited internet access, and financial constraints [77]. While telemedicine holds promise for improving contraceptive accessibility and patient autonomy, its optimal implementation requires overcoming these barriers, integrating telehealth seamlessly into healthcare systems, and ensuring equitable access across diverse populations.

14. Conclusions

Telemedicine has been demonstrated as an emerging role to improve access, continuity, and patient satisfaction across multiple domains of obstetric and reproductive healthcare, including abortion, assisted reproduction, gestational diabetes, contraception, and perinatal mental health. While challenges remain—such as digital literacy, technological infrastructure, reimbursement, and equity of access—the accumulated evidence underscores telemedicine's pivotal role during the COVID-19 pandemic and its promise in routine obstetric care. Importantly, current findings support the consideration of hybrid care models that combine the strengths of in-person and telemedicine approaches, ensuring both safety and flexibility while addressing diverse patient needs. For policymakers, these findings highlight the need to develop regulatory frameworks, reimbursement models, and equity-focused strategies that facilitate telemedicine integration while addressing barriers faced by underserved populations. For clinicians, the evidence supports adopting hybrid care models that combine in-person and telemedicine approaches, ensuring safety, flexibility, and patient-centered care. For healthcare systems, investment in technological infrastructure, workforce training, and standardized outcome tracking is essential to optimize telemedicine delivery, monitor effectiveness, maintain quality of care, and avoid misdiagnosis errors. At the same time, significant evidence gaps in study design limit the strength of current conclusions. Much of the literature is based on observational studies, feasibility assessments, or pandemic-driven experiences, with a scarcity of large-scale randomized controlled trials, standardized outcome measures, and long-term follow-up data. These limitations highlight the urgent need for rigorous, methodologically robust studies to clarify telemedicine's effectiveness, cost-efficiency, and equity implications across diverse healthcare systems and populations. With appropriate research investment and policy frameworks, telemedicine can evolve from an emergency response to a sustainable pillar of obstetric and reproductive healthcare.

15. Limitations

This review is subject to several limitations. The included studies were heterogeneous in populations, telemedicine modalities, and outcome measures, which restricted direct comparability. Much of the evidence was based on observational or feasibility studies, with few large randomized controlled trials, limiting causal inference. Publication bias may also be present, as positive findings are more likely to be reported. Moreover, most data originated from high-income and urban settings, with limited representation from low-resource regions where telemedicine's impact may differ. Finally, many studies reflect practices during the COVID-19 pandemic or early adoption phases, which may not fully capture the long-term sustainability of telemedicine as technology and policies continue to evolve. Beyond methodological constraints, broader systemic challenges such as medico-legal uncertainty, data security and privacy risks, and unresolved ethical and cultural dilemmas in sensitive domains (e.g., abortion, contraception, and opioid treatment) remain persistent gaps. These factors may limit the generalizability and long-term integration of

telemedicine, underscoring the need for clearer legal frameworks, stronger safeguards, and culturally sensitive approaches.

16. Highlights

- Improved access and continuity: Telemedicine reduced delays and travel burdens, ensuring continuity of obstetric and reproductive care during COVID-19 and beyond.
- High acceptance: Both patients and providers reported strong satisfaction, especially with user-friendly, integrated platforms.
- Broad applications: Evidence supports its use in abortion care, assisted reproduction, gestational diabetes, contraception, and perinatal mental health.
- Key challenges: Barriers include digital literacy gaps, unequal access, privacy concerns, and limited reimbursement.
- Future potential: Telemedicine is a promising complementary model, but cautious implementation, sustained investment, supportive policies, and robust research are essential for long-term integration.

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