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Maternal-Fetal Care and Telehealth in the Context of COVID-19 Pandemic: A Narrative Review

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ABSTRACT

The COVID-19 pandemic has led to widespread fears and strains on healthcare systems. Healthcare personnel and the global community are continuously struggling to evolve through the ongoing pandemic and its challenges. The unexpected surge of infectious COVID-19 cases has led to the cancellations of non-essential hospital appointments and delays in various procedures in many healthcare settings. Nevertheless, the healthcare sector has recognized the importance of providing integrated patient care through telemedicine-based health delivery systems. The practical approach to restructuring the clinical practices for the functional telehealth-based healthcare systems is much-needed in the current times. This narrative literature review sheds some light on the substantial clinical impacts of COVID-19 on women with pregnancy, lactation, and infertility. The study also reflects research about telehealth-based obstetrics- and gynecology-related health delivery services in the COVID-19 crisis. Meanwhile, robust, well-constructed scientific research may help identify short- and long-term telehealth practice outcomes on health and healthcare systems.

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Introduction

COVID-19 has severely affected health delivery services, particularly in under-resourced healthcare settings[1,2]. Rapid transmission of the disease has significantly raised concerns in communities across the globe[3]. It has tested almost all healthcare systems, including those in resourceful countries[4]. The impact of the ongoing pandemic has led to the importance of more resilient health systems with the capability of accelerated provision of health services and access to patients, along with psychological support and counseling[5]. At this time, COVID-19 induced effects on pregnant women and infants are not entirely yet known. The medical community is still learning about the characteristics of a novel coronavirus, its new variants, and its impact on pregnant and breastfeeding women[2,6]. Various updated clinical guidelines and health information have become available by multiple national health authorities amidst the ongoing crisis[5,7–11].

Technology-enhanced health services have quickly become valuable tools in delivering health care as the COVID-19 has evolved since its origin[9,12,13]. Telehealth requires the application of telecommunications-based technologies for providing clinical care and health education services to the long-distance patient population apart from public health administration[14]. Telemedicine-based virtual care is an important mode of enhancing patient's access to the current standard of care[13,15,16]. These modalities can be utilized to deliver acute, chronic, primary, and specialty care during COVID-19 era[17,18].

WHO recommends strategies to optimize PPE (Personal Protective Equipment) availability in light of its surging demand during the ongoing pandemic globally. One such approach involves using telemedicine for evaluating suspected COVID-19 cases as an intervention to keep the need for PPE to a minimum in healthcare settings while preventing exposure of healthcare workers and other individuals to COVID-19[9,19]. Furthermore, besides improving healthcare governance, it is important to prioritize proper healthcare personnel training relating to infection prevention strategies to ensure adequate safety of health professionals.

Various health systems in developed countries, including the United States, offer telehealth options to the masses for COVID-19 screening via telehealth and telemedicine drive-thru option for testing COVID-19[20]. Health agencies in the United States, such as CDC, have recommended healthcare providers take advantage and expand the use of existing telehealth tools and their applications for directing patients to the right healthcare level for the required management during the COVID-19 pandemic[5,21]. The American Academy of Family Physicians (AAFP) encourages healthcare professionals to apply telehealth-based clinical practices during the COVID-19 pandemic[22]. In addition, the American College of Obstetrics and Gynecology (ACOG) has structured guidance to assist healthcare professionals in implementing telehealth

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practice strategies[23]. Similarly, the American Academy of Pediatrics (AAP) also recommends establishing such health delivery services[24,25]. This approach enables clinicians to implement the infection-control measures and stratifying patients into well-defined risk groups for subsequent evaluation and management[24]. Moreover, pediatricians are encouraged to perform well-visits for children using Telehealth[26].

Dedicated telehealth services can reduce the transmission of COVID-19 by keeping patients out of crowded waiting rooms[27,28]. These services can be rendered to raise awareness among the patients related to COVID-19 transmission in high-risk groups of people within the community[13]. Telehealth is an excellent technology-based tool to access patients in a safe and cost-effective manner[4,28–32]. For example, Korea has adopted "drive-through" dedicated COVID-19 testing sites considering the disease prevention and control measures[33].

Amidst the pandemic crisis, patients requiring fertility treatment may feel stressed while facing difficult circumstances due to possible delays in appointments[34]. Counseling of these patients is imperative to address their concerns. Telehealth virtual care providers can utilize the telehealth system to provide preconception counseling and strategic treatment planning. In addition, behavioral health clinics can apply the concept of telemedicine for providing consultations and enhancing access to care while overcoming any impending workforce shortages and avoiding risk to COVID-19 exposure[35].

In pregnancy and lactation, standard treatment protocols and management of COVID-19 should be designed in the light of current COVID-19 related scientific data rather than those driven from the past coronavirus outbreaks[36]. This literature review allows its readers to become aware of the implications of COVID-19 on maternal and fetal health and the role of digital technologies to enhance access to maternal-fetal care in current challenging times of ongoing pandemic. This narrative review is organized to discuss the topic of interest in two sections. The first section summarizes the impact of COVID-19 on pregnant women and lactating mothers and women with infertility. The second section outlines telehealth application and its integration in the healthcare sector for providing obstetrics- and gynecology-related care during the COVID-19 pandemic.

Methodology

This narrative review was performed through a literature search of Cochrane library and digital libraries, including Medline, PubMed, and Google Scholar, using the search terms (keywords) to the articles published between the years 2000 to 2020. References of retrieved scientific publications and websites of various health agencies and professional bodies such as the United States CDC, WHO, and ACOG, were also searched for this narrative review. Strategic search for the following search terms was conducted by using the aforementioned electronic databases of online resources through the Google search engine: 'COVID-19', 'Pandemic', 'Preparedness',

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'Pregnancy', 'Breastfeeding', 'Infertility', 'Telehealth', 'Telemedicine', 'Telecommunication', 'Online Consultation'. Also, the following sets of keywords were used through Boolean search strategy: 'COVID-19' AND 'pregnancy'; 'COVID-19' AND 'breastfeeding'; 'COVID-19' AND 'infertility'; 'Telemedicine' AND 'COVID-19'; 'Telehealth' AND 'COVID-19'; 'Telehealth' AND 'Obstetrics'; 'Telehealth' AND 'Gynecology'. The reviewers performed article selection based on a search of the relevant articles from the literature review restricted between the years 2000 and 2020 after tracing and removing the duplicate and irrelevant articles from the databases mentioned above. A total of 105 relevant articles were selected, reviewed, and included in this narrative literature review.

Discussion

Effects of COVID-19 on Maternal-Fetal Health

COVID-19 and Pregnancy

Certain pregnancy-related immunologic and physiologic changes make pregnant women more susceptible to viral respiratory infections[37]. For example, COVID-19 may cause a high risk of severe illness and lead to adverse sequelae affecting pregnant women[38]. Similarly, the morbidity and mortality associated with other viral infections, including SARS-CoV, MERS-CoV, and influenza in pregnant women, are noticeable compared with the general population[39–42].

Initial information about the susceptibility of pregnant women to COVID-19 in pregnant women was limited, as it mainly was available from published scientific reports and small case series[39,43–45]. However, recent research studies have indicated the potential adverse impact of COVID-19 on pregnant women and their newborns, particularly pregnant women with pre-existing conditions such as diabetes, chronic hypertension, or those who are older or over-weight[46]. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) cautiously recommends considering pregnant women vulnerable during the current pandemic[47]. Data suggest an increased risk of adverse outcomes in pregnant women with COVID-19, such as preterm birth[6,48]. In addition, comorbidities including chronic lung disease, cardiovascular disease, asthma, or diabetes may cause severe symptoms in pregnancy[39]. The American College of Obstetricians and Gynecologists (ACOG) updated its Practice advisory "Novel Coronavirus 2019 (COVID-19)" (*July 1, 2020)* while considering data analysis from United States CDC COVID-19 surveillance[2,27]. United States CDC published the Morbidity and Mortality Weekly Report (MMWR) that suggested pregnant women with COVID-19 (n = 8,207) being more likely to develop certain manifestations of severe COVID-19–associated illness compared to non-pregnant women with COVID-19 (n = 83,205)[49]. Data findings showed an increased risk of hospitalization, ICU admissions, and mechanical ventilation in pregnant women compared to non-pregnant women infected with COVID-19[49]. However, the rate of mortality did

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not differ among pregnant infected women versus non-pregnant infected women. Due to the increased risk of severe outcomes in pregnant women with SARS-CoV-2 infection, it is essential to highlight the prevention strategies, particularly in pregnant women, as indicated in this CDC's report[49].

Vertical transmission is possible but uncommon. Reports have raised concerns regarding in utero, intrapartum, and peripartum routes of transmission; however, vertical transmission's extent and clinical significance are not yet noticeably clear[6,50]. A systematic literature review *(published on April 20th, 2020)* suggested increasing reports of possible vertical transmission of COVID-19[51]. In addition, Alexandre et al. presented a case report *(published on July 14th, 2020)* demonstrating transplacental transmission of SARS-CoV-2 in a neonate of an infected mother[52]. This case study also described the neurological manifestations of COVID-19 in the neonate born to an infected mother[52].

Pregnant patients with confirmed COVID-19 or suspected of COVID-19 are advised to inform the obstetric unit before arrival at their hospitals so that appropriate infection control measures are in place[44]. Currently, available data suggest that neonates with underlying conditions and preterm infants are more at risk of developing severe COVID-19[50]. COVID-19 testing is recommended for all neonates born to mothers with confirmed or suspected COVID-19[50]. Mothers with suspected or confirmed COVID-19, and their infants suspected with COVID-19, should be taken to isolation units to separate them from other healthy mothers[50]. Maternal autonomy should be respected while considering the medical decision-making process for deciding infant's isolation from mothers with suspected or confirmed SARS-CoV-2 infection[50]. Many factors that may influence this decision include the clinical condition of the mother and newborn, mother's wish for "rooming-in" to allow mother-infant bonding, COVID-19 test results of a mother and newborn, healthcare facility, and institution's capacity with a suitable environment for the isolated neonate, and other factors[50]. The United States CDC website's guidance mentions the criteria for considering isolation and discontinuing isolation about the care for newborn[50]. Health professionals should keep themselves abreast of updated practice guidelines and any subsequent changes in standard management protocols for obstetric care in patients with COVID-19.

COVID-19 and Lactation

Limited data is available to ascertain the transmission of COVID-19 through breast milk[48]. According to the United States CDC, the chances of COVID-19 transmission from mother to fetus through breast milk are low. Various organizations such as WHO, RANZCOG, Royal College of Obstetricians and Gynecologists (RCOG), and Society of Obstetricians and Gynecologists of Canada (SOGC) encourage infected mothers to remain close contact with their infants while practicing enhanced measures for prevention and infection control[27,53]. However, the United States CDC's recommendations for initiating or discontinuing temporary isolation of

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newborn from a mother with confirmed or suspected COVID-19 are based on certain criteria mentioned in its guidance which is continuously updated on its website[48]. However, such a decision requires the mother's consent after counseling and shared decision-making with the assistance of the clinical team[54].

Impact of COVID-19 on Infertility Treatment

Robust research studies are required to guide health professionals about the short-and long-term impact of COVID-19 on reproductive health and its influence on those intending to seek fertility treatments amid the COVID-19 pandemic[55]. Patients with infertility are more vulnerable to take an emotional toll due to multiple COVID-19 related factors. Mental health rehabilitation services play an important role in patient care with the mental health crisis in response to COVID-19[56].

American Society of Reproductive medicine (ASRM) Coronavirus/COVID-19 Task Force has provided clinical recommendations and guidance for patient management during the COVID-19 pandemic through its periodic updates[55]. In its initial Updates (Update #1 and Update #2), ASRM recommended suspending the new treatment cycle and certain procedures for addressing infertility, elective surgeries, and non-urgent diagnostic procedures. At that time, it strongly considered canceling fresh/frozen embryo transfers; however, it recommended continuing to provide care to most urgent cases, including those who were "in-cycle" or who required urgent stimulation and cryopreservation[55]. Its guidance specifically recommended keeping the physical interactions to a minimum while encouraging telehealth. In later updates (Update #3 to Update #10), the ASRM task force issued recommendations for a gradual resumption of delivering reproductive care safely and judiciously with PPE recommendations and guidance for risk assessment and mitigation for reproductive care and activities[55]. ASRM task force recommends COVID-19 vaccination to women contemplating pregnancy (Update#11 to Update#15). This guidance is revisited and updated periodically as the pandemic evolves. Various health organizations have played a vital role in medical education and reproductive health awareness throughout crisis[56–59].

The Concept of Telehealth in Obstetrics and Gynecology

Telemedicine allows the exchange of medical information from one place to another using electronic communications and can be utilized as a clinical health tool to improve patient outcomes[60]. Telehealth-based technology works by using the internet, digital image technologies, telecommunications, and health information[61]. Moreover, such techniques can ease the training sessions relating to medical education activities and meetings for administrative purposes remotely[61,62]. The technology makes effective use of real-time “synchronous” secure audio and video services and store-and-forward secure "asynchronous” telemedicine services in the remote monitoring health status of patients[61].

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The term 'Telehealth' can be differentiated from 'Telemedicine'[60]. 'Telehealth' encompasses a broad range of technology-based applications in the clinical contexts, such as teleconsultation and tele-practice, and non-clinical contexts such as Tele-education and Tele-research[60]. In comparison, 'Telemedicine' uses telecommunications-based technology explicitly to provide remote healthcare services to patients[63]. Nevertheless, both terminologies 'Telehealth' and 'Telemedicine' are generally used interchangeably.

Telehealth complements standard practice[60]. It involves providing clinical services through telecommunications, information, and virtual technology remotely[64,65]. An important example is "eHealth," which integrates health-related data through information and communication technologies(ICTs)[66]. Digital technologies can be used to deliver healthcare services and health promotion and education by linking people at the same time present in different locations[60,62]. These modalities can be applied to facilitate patient assessment and surveillance and develop awareness programs for disease prevention and control using telecommunications technologies such as video conferencing[62,67].

Telehealth's Requirements

Fundamental components for telehealth delivery services include secured networking, internet availability, appropriate equipment, electronic health database, encrypted systems to protect data, physical and administrative safeguards. Health professionals must be aware of structured guidance and legal requirements such as telehealth licensing. Digital health systems require certain policies to be in place regarding credentialing and privileging, reimbursement issues, insurance coverage policy, network encryption requirements, billing and coding, and malpractice insurance, as applicable[68–72]

Potential Benefits of Telehealth

Telehealth can serve as an effective and resilient tool in healthcare settings burdened with an overwhelming number of patients, particularly vulnerable and aging population[73]. However, telemedicine's evolving practice necessitates fulfilling certain requirements for implementing such programs[64,67].

Health mitigation strategies can be implemented through telehealth services during the current pandemic by increasing social distancing and reducing infectious exposure risk[63,67,74]. In addition, it can minimize the strain on healthcare systems while preserving the patient-provider relationship in remote areas[67,75–77]. Furthermore, it offers the benefits of prompt access with high patient satisfaction and can address the clinical workforce shortages[78,79].

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Telemedicine applications can be incorporated into the healthcare system of developing countries with limited medical infrastructure and an insufficient number of specialists and consultants, particularly in underserved rural communities[80–82]. Telehealth services can be applied to triage patients into low- and high-risk groups for subsequent care and management, as described in the United States CDC's guidance (shown in tabulated form in **Table 1**)[64].

Table 1: Benefits and Potential Uses of Telehealth[64]

1.	Provide low-risk urgent care for non-COVID-19 conditions, identify those persons who may need additional medical consultation or assessment, and refer as appropriate
2.	Access primary care providers and specialists, including mental and behavioral health, for chronic health conditions and medication management
3.	Provide coaching and support for patients managing chronic health conditions, including weight management and nutrition counseling
4.	Participate in physical therapy, occupational therapy, and other modalities as a hybrid approach to in-person care for optimal health
5.	Monitor clinical signs of certain chronic medical conditions (e.g., blood pressure, blood glucose, other remote assessments)
6.	Engage in case management for patients who have difficulty accessing care (e.g., those who live in very rural settings, older adults, those with limited mobility)
7.	Follow up with patients after hospitalization
8.	Deliver advance care planning and counseling to patients and caregivers to document preferences if a life-threatening event or medical crisis occurs
9.	Provide non-emergent care to residents in long-term care facilities
10.	Provide education and training for H.C.P. through peer-to-peer professional medical consultations (inpatient or outpatient) that are not locally available, particularly in rural areas

Healthcare delivery services, supplemented by technology advancements, enhance the current standard of practice in Obstetrics and Gynecology. The digital clinical tools for implementing telehealth in practice are becoming popular amongst health professionals[79,83,84]. Medical software applications related to Obstetrics and Gynaecology include fertility tracking and prenatal care Apps[85]. In addition, many user-friendly medical applications can track ovulation, menstrual cycle, and record bladder diary. Wi-Fi smart blood pressure monitoring is another helpful

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application installed through portable electronic devices[86]. Furthermore, the mobile app can deliver follow-up care following an ambulatory surgery such as breast reconstruction[77,87].
Pregnancy and childbirth are the milestones requiring emotional support[88]. Maternal telemedicine may play an important role in providing high-quality patient care while preventing the spread of COVID-19[88–90]. Remote antenatal[91,92] and postnatal care can be delivered through online consultations during the COVID-19 pandemic **(Figure 1).**

Telehealth can improve access to care in patients with infertility living in a remote area through virtual online consultations and ultrasound recording assessments by gynecologists and fertility specialists. Online support communities, including webinars and virtual meetings, are beneficial in this regard. Furthermore, a patient's referral to a trained mental health provider can aid in stress management in patients with infertility requiring counseling. Many healthcare providers may offer telehealth consultation options, particularly if an individual's insurance carrier permits using such services. Virtual care is an effective modality for designing emerging telehealth-based service delivery models and programs with integrated health care[93,94].

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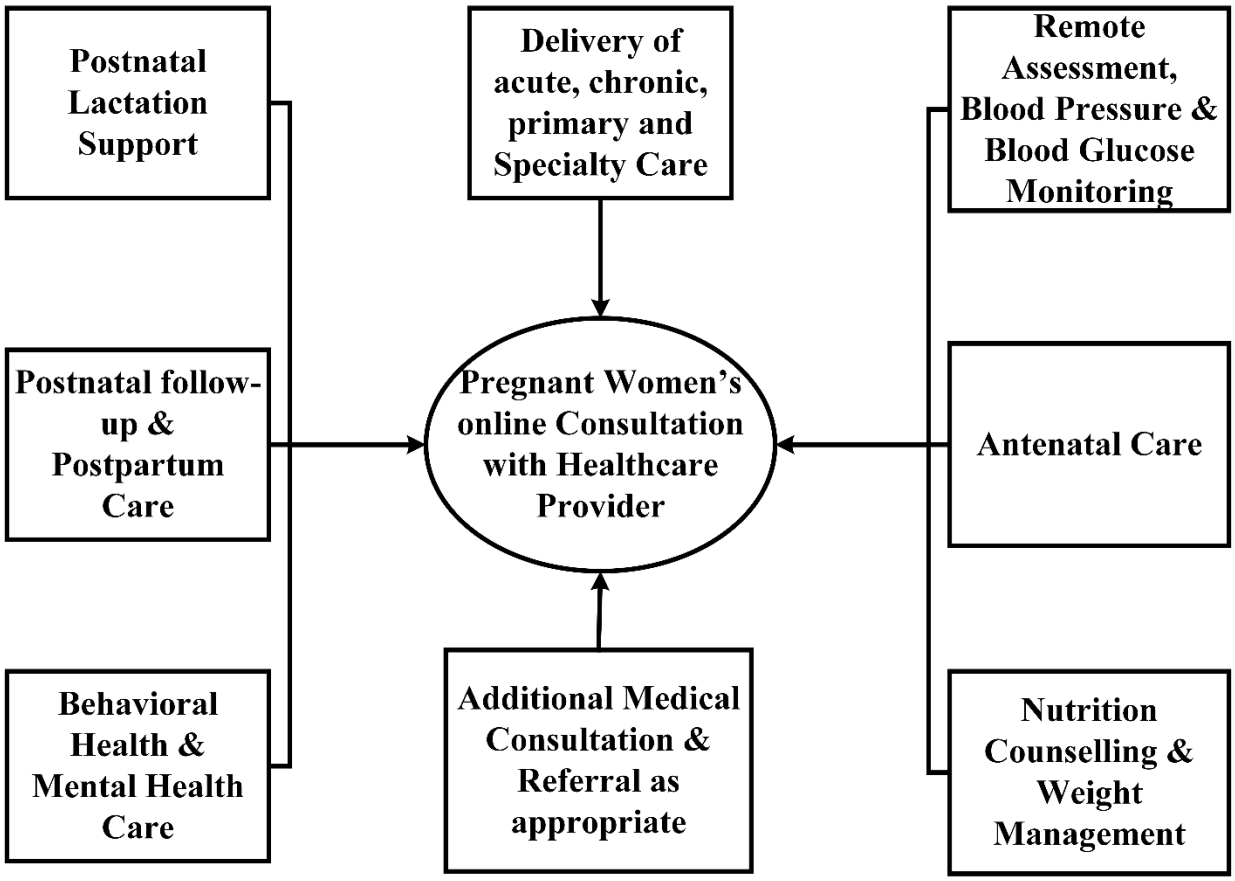

Figure 1: Telemedicine services in pregnancy

Science and technology-based recent advances such as nanotechnology, virtual reality, artificial intelligence, and robotics have enabled telemedicine to come up more than just a connectivity tool[90]. It is an innovative tool that can be integrated within an optimally effective and precise healthcare system, with an effective outreach[64,67,70,91,92]. The rising trend and growing demand for telehealth-based technology have encouraged its providers and policymakers to evolve and advance through the recent medical field[63,65,95]. Appropriate studies must be executed to provide

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a clearer vision of outcome-based telemedicine strategies and tele-triage methods during the current pandemic and post-crisis period.

Potential Limitations to Telehealth

The potential limitations to telehealth include availability of certain prerequisites such as technology requirements; telehealth-eligibility and standardized training programs for the patients, practitioners, and providers, including systematic education and training, telehealth-related academic or vocational educational courses, simulation-based education (S.B.E.) for both formative and summative learning for familiarity with the concept and understanding of telehealth-based modalities; effective communication skills and verbal feedback; licensure and regulatory issues; insurance coverage requirements, economic support, and reimbursement policies; situations requiring an in-person consultation; concerns about patient's comfort and satisfaction; issues related to ethical conduct; limited availability and access to telehealth modalities; pediatric considerations and cultural acceptance of its practice within communities, as applicable[64,69,79,96–98]. Telemedicine is a means of complementing and enhancing access to healthcare; however, it may not replace the current standard of care in certain conditions. One major challenge is the healthcare professional's inability to perform a patient's physical examination as one would do in face-to-face visits[99–101]. Moreover, the telehealth program requires ensuring the proper guardrails for protecting personal health information and addressing patient's privacy concerns by establishing comprehensive privacy and security safeguards for safekeeping of electronic record[81,102]. Before implementing such a program, it is important to ensure the provider's ability to bear the cost required for implementation, maintenance, and continuation of the program and cost linked with security and reimbursement issues for optimal results[95,102]. Barriers to such services include limited access to technology in regions lacking ICTs services, intricate systems, lack of organizational support, resistance, and poor communication on the patient's part, particularly in developing countries[66,69,80,96]. Such projects can be challenging due to the constantly innovative and evolving concepts and technical contingencies related to the evaluation framework and its various components, including health technologies, communication infrastructure, environmental settings, socioeconomic analysis, health domains, and relatable services[103–105].

Telehealth technology can provide a solid foundation for clinicians to deliver the right care to the right patient at the right time[63]. In-depth analysis measuring the cause and effect relationship may help design an optimal telehealth system that could help make an errorless clinical decision during the current pandemic crisis[67]. However, there is a limitation to predict outcomes because of scarce pre-intervention data's availability for comparing pre- and post-measures in telemedicine. Future healthcare systems must have the ability to triage patients to guide them about the potential benefits and identify the possible abuse associated with this system[67]. Further research is needed to test hypotheses about telemedicine-based outcomes within specific clinical applications and comparing them with contextual effects and other telehealth regimens[67].

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Conclusion

Potential telehealth-based health services delivery programs can serve remote patient populations while minimizing the COVID-19 transmission risk. Telehealth-enhanced health care services and technology-based well-designed schemes may help achieve cost-savings to the healthcare system and improve healthcare access in patients with COVID-19 and other low-risk non-COVID-19 conditions. Healthcare providers, regulatory authorities, policymakers, payers, telemedicine advocates, researchers, and society need to collaborate and find a clear path to utilize telehealth as an effective healthcare tool for rural and urban communities during and in the post-pandemic period.

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