

REVIEW

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# The role of telemedicine in healthcare: an overview and update

Mason Stoltzfus<sup>1</sup>, Arshdeep Kaur<sup>2</sup>, Avantika Chawla<sup>2</sup>, Vasu Gupta<sup>2</sup>, F. N. U. Anamika<sup>3\*</sup> and Rohit Jain<sup>4</sup>

## Abstract

**Background** First implemented in the 1950s, telemedicine is a rapidly evolving tool for healthcare systems around the world. Technological advancement and increasing access to information technology have made the implementation of telemedicine more feasible. Recent provisions by healthcare governing bodies have increased reimbursement for and the use of telemedicine globally. We have done a literature review to find out the pros and cons of adopting telemedicine.

**Main body** Telemedicine is found to offer many benefits to conventional, in-person healthcare encounters for both patients and providers: decreased travel cost and time, decreased time spent in waiting rooms, decreased risk of transmission of communicable diseases, decreased overall encounter time consumption, increased convenience, and more. Telemedicine also facilitates seamless transitions of care between healthcare teams, connects isolated people groups with healthcare providers, and helps address regional healthcare infrastructure and provider shortages by connecting patients with healthcare teams from any location. Drawbacks specific to telemedicine include the lack of accessibility and advancement of imaging technology required to replace in-person physical examinations, non-universal access to the required devices and networks across the general patient population, and the risk of technical difficulties such as network connection disruptions.

**Conclusion** Telemedicine helps bridging the gap of distance by connecting patients in remote locations with the physicians. This has also become vital in the time pandemic.

## Background

True to its roots in “tele,” the Greek word for distance, the WHO defines telemedicine as “the delivery of healthcare services across distance by all healthcare professionals using information and communication technologies for the exchange of valid information, for the diagnosis, treatment, and prevention of disease and injuries” [1]. Telemedicine was first referenced in 1950 after radiographs were transmitted 24 miles from West Chester to

Philadelphia via a teleradiology system [2]. In 1960, physicians from the National Aeronautics and Space Administration used similar technology to remotely monitor the vital signs of astronauts during space-flight programs [3]. Video communication was first used in medicine by the University of Nebraska College of Medicine to care for psychiatric patients in 1959 [4]. In 1968, technicians at Massachusetts General Hospital created a video link between their hospital and an airport using microwaves [5].

## Main text

Recent significant advancements in the technology of networks and interfaces have advanced the role of telemedicine [6]. Within decades, telemedicine gained popularity and is now accepted as an established part of everyday healthcare practice. In the United Nations,

\*Correspondence:

F. N. U. Anamika  
anamikapilaniya@gmail.com

<sup>1</sup> Penn State College of Medicine, Hershey, USA

<sup>2</sup> Dayanand Medical College and Hospital, Ludhiana, India

<sup>3</sup> University College of Medical Sciences, New Delhi, India

<sup>4</sup> Department of Hospital Medicine, Penn State College of Medicine, Hershey, USA



76% of hospitals connect with patients using forms of telemedicine. Radiology, emergency medicine, pathology, and psychiatry are reported to use the highest proportions of telemedicine for encounters: 39.5%, 38.9%, 30.4%, and 27.8%, respectively [7]. Telemedicine is also established in the healthcare practices of cardiology, dermatology, oncology, and pre- and postoperative surgical care [8, 9]. Even prior to the COVID-19 global pandemic, telemedicine was widely used in medical education and training [10].

Telemedicine's strengths lie in connecting parties over great distances. Consequently, primary care providers in rural regions are twice as likely to use telemedicine compared to primary care providers in urban regions [11]. Patient engagement via telemedicine is influenced by various demographic factors such as age, gender, socioeconomic status, technological literacy, ethnicity, and preferred language. Amongst patient populations that do have access to telemedicine, its convenience and cost-effectiveness have led to it being more widely accepted by patients than healthcare providers [12].

Patient care through telemedicine is achieved nowadays through several modes. Ranging from limited mobile text messages, video conferencing, phones to various websites, apps, gaming programs, robots, and virtual reality approach of delivery [13], it has resulted in better and effective healthcare access [14, 15].

Funding for pilot programs of telemedicine was initially provided by government entities, including NASA, Centers for Medicare and Medicaid Services, and the Indian Health Service [16]. However, due to rapid advances in technology and increased demand, telehealth reimbursement policies quickly became insufficient. The strict geographic coverage programs and payment restrictions of both private and public health insurers limited telehealth adoption by healthcare providers [17]. To address the slow establishment of telemedicine in the USA, Medicare, Medicaid, commercial health insurance companies, and certain government-funded programs began expanding their policies to make it easier for healthcare providers to implement telemedicine. In 2018, Medicaid broadened access to telemedicine by approving it for reimbursement for substance use disorder services in California, prohibiting the requirement of a physician's physical presence with a patient for reimbursement in Kentucky, and enabling reimbursement for telepodiatry in Colorado [18].

In Japan, providers use telemedicine to complement in-person encounters and follow up on in-person encounters in South Korea. Across the European Union, telemedicine is used to monitor patients with chronic conditions. In the USA, telemedicine is now widely

adopted by healthcare providers and is even used to determine prescriptions and treatments [19].

### Pros of telemedicine

Telemedicine has already been incorporated into healthcare by various health systems and groups [20, 21]. Electronic medical records further facilitate secure, smooth transfers of patients' protected health information [22]. Telemedicine also allows coordination between primary care physicians and specialists, improving health outcomes by ensuring a smooth transfer of care that reduces the wait for feedback, unnecessary patient travel time, and unnecessary in-person examinations for referrals [23, 24]. The remote administration of healthcare is especially effective for follow-up care of patients that were already examined in-person, patients with conditions that follow clear clinical illness scripts and do not require laboratory diagnostics or physical examinations, and patients who may have communicable diseases that would put providers and other patients at risk if seen in-person [25].

Telemedicine makes it possible for team members to contribute from any place on Earth with the necessary equipment and network. In this way, teams can bridge the gaps between urban and rural medicine and build teams that represent the populations they are serving [26]. When social distancing is necessitated for health and safety, such as during a global pandemic, the use of telemedicine significantly increases [27]. In addition to reducing the risk of infection spread through physical contact, telemedicine allows healthcare providers to continue to work and serve their community [28].

When engaging in telemedicine instead of in-person appointments, patients often experience decreased wait times, decreased to no travel time, decreased cost due to less use of transportation, and decreased cost due to less use of healthcare facilities [29, 30]. Telemedicine also enables healthcare providers to reach patients in isolated communities, including those with developmental or physical disabilities, the elderly, incarcerated patients, and those living on the cultural or geographical margins [31].

The benefits of telemedicine extend to a range of specialties and can also easily be consulted with other healthcare teams via remote technology to deliver quick, cohesive care to their patients [32–35]. School nurses can now use telemedicine to network remotely with healthcare providers to aid in the acute, complex care of students without leaving the school. This both reduces the disruption of students' studies and gives nurses more freedom to care for multiple students. This ultimately reduces educational, time, and fiscal costs to students and their families [36]. Dermatologists can evaluate patients suffering from eczema, pressure injuries, psoriasis, and

other conditions depending on the equipment available to both the patient and provider. In this way, remote correspondence can increase patient privacy and reduce stress related to public interactions [37]. Healthcare providers have been motivated to address patient access and their financial sustainability by changing how they give care as a result of the coronavirus disease 2019 (COVID-19) pandemic and the ensuing orders for social distancing [38]. Only 11.8% of family doctors and pediatricians in the USA employed telemedicine in their practices in 2016 (Kane C. K.). Only 9% of primary care doctors were employed by practices that did not use telemedicine after the COVID-19 pandemic had been going on for 2 months [39]. Due to the COVID-19 pandemic, telemedicine became the sole way to provide crucial developmental follow-up care to this group on a temporary basis.

As a component of the “Digital India” program, the Indian government launched its telemedicine platform, eSanjeevani, on August 9, 2020. With the advent of the COVID-19 pandemic, healthcare providers have leveraged video conferencing technology to diagnose and treat patients residing in remote locations, utilizing the eSanjeevani service. At present, the platform offers two distinct telemedicine services: eSanjeevani, which facilitates communication between doctors, and eSanjeevani OPD, which enables patients to connect with doctors remotely [40].

An in-person medical examination is a necessary cornerstone of healthcare, and telemedicine can improve its delivery. Telemedicine can be used to triage patients and allows patients with less life-threatening conditions to wait in the comfort of their homes rather than in a crowded emergency department waiting room [41]. Advances in telemedicine also allow patients to track their vital signs, medication adherence, and more from the comfort of their homes. This data can be quickly uploaded to electronic health records and sent to providers [42–44].

This virtual bridge also sets the stage for future involvement of artificial intelligence (AI) algorithms. AI will likely expand the role of telemedicine through its pattern recognition and monitoring capabilities, alerting providers when notable trends in their patients’ home-collected data arise [22]. In addition to advancing the delivery of healthcare, telemedicine also plays a role in ancillary divisions of the healthcare sector, like medical education, employee training, provider recruitment, administrative meetings, research, and more [22, 45].

### **Cons of telemedicine**

While telemedicine offers many benefits to the healthcare field, it cannot deliver the same level of care as many in-person healthcare encounters and does not facilitate

thorough physical examinations and may lead to missed diagnoses. Remote visits will also likely not provide the same social and emotional connections between patients and providers that in-person visits offer [46]. Consequently, in their code of ethics updated in 2020, the American Medical Association emphasized that telemedicine should not compromise patient welfare or interfere with the delivery of quality healthcare or follow-up [47].

The adoption of telemedicine depends on physician’s acceptance of new systems and remote modes of healthcare delivery. Providers and ancillary staff will have to receive training prior to engaging in telemedicine. New equipment may need to be purchased, installed, and maintained. Telemedicine programs require full-time staff to manage and troubleshoot equipment and systems. All these processes may be expensive and time-consuming. Remote medicine also relies on patients having the devices and network access necessary to successfully participate in a telehealth encounter. As with any information technology sector, telemedicine is also likely to face intermittent delays due to technological difficulties such as poor network connections, equipment failures, and more [22, 48].

Despite the 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act permitting the transfer of protected health information via electronic systems, there is significant risk of privacy breaches. Protected health information (PHI) transferred during telemedicine encounters would be at risk of interception and theft, and proper security could prove costly [49]. Reimbursement for telemedicine will also prove to be a costly process, as regulations vary from state to state in the USA. Currently, Medicare is likely to cover teleconsultations for patients located in areas with healthcare infrastructure and provider shortages. However, the interplay between state’s laws, individual’s own insurance plans, and clinicians’ fee schedules may require more staff hours to navigate [50]. A provider’s ability to conduct a successful telemedicine encounter as compared to conventional medicine may be hindered by several challenges, such as frequent technological connectivity issues experienced by both the provider and family, which can result in multiple reconnections and hence delay in the follow-up in certain cases [51].

Although India has made significant strides in the realm of telecommunication over the past two decades, the full potential of telemedicine is contingent upon the availability of robust infrastructure. Unfortunately, a substantial number of individuals residing in rural areas are still deprived of the advantages of the digital revolution, hindering the widespread adoption and success of telemedicine [52]. The significant economic, social, gender, and geographic inequalities in India present obstacles

to the widespread adoption of telemedicine throughout the country. The COVID-19 pandemic led to a substantial increase in Internet usage, resulting in a surge in data consumption within households, placing additional pressure on limited resources such as insufficient optical fiber infrastructure, which is fundamental to providing Internet services. Unfortunately, Internet speed in India is sluggish, with the country ranking 131st in mobile Internet speed and 65th in fixed broadband speed, compounding the issue [53].

## Conclusion

Telemedicine is rapidly emerging as a useful tool for healthcare teams around the world. It offers the ability to communicate with isolated patient populations across significant geographical distances, helps address regional healthcare infrastructure and provider shortages, and saves all parties, including the patient, time, and money. In emergency situations, telemedicine can connect patients with teams of providers and specialists and expedite care. Telemedicine shows promise as a triage method that could reduce wait times and patient volumes in emergency departments. It also could help connect school nurses with healthcare providers, and both expedite the delivery of care to students and reduce time away from school. While there are many benefits to telemedicine, it is not without drawbacks. Telemedicine currently lacks the technology to effectively replace the physical examination that is core to healthcare encounters. Therefore, remote healthcare will likely continue as a supplement to in-person encounters until further technological advancements are made.

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## Authors' contributions

All authors have contributed substantially to writing this manuscript and meet the criteria for authorship. MS, AK, and AC helped in collection and analysis of data and writing the first draft. VG and FNU-A helped in design and concept of the manuscript and worked on proofreading and editing the manuscript. RJ helped in design, concept, and final approval of the manuscript.

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The authors declare that they have no competing interests.

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