REVIEW ARTICLE

Telemedicine: Advancing Smarter by Evolution through Decades

Abida[1], Muhannad Thafi Alshammari[2], Abdulrahman Kreem Alshammari[2], Bader Munif Alshammari[2], Rashed Abdullah Alwatban[2], Seham Eid Alanazi[3], Md. Tauquir Alam[1], Mohd Imran[1,4]

[1]Department of Pharmaceutical Chemistry, College of Pharmacy, Northern Border University, Rafha, Saudi Arabia, [2]College of Pharmacy, Northern Border University, Rafha, Saudi Arabia, [3]Department of Patient Education, Abbive Company, Arar, Saudi Arabia, [4]Center for Health Research, Northern Border University, Arar, Saudi Arabia

Abstract

Telemedicine has undergone significant transformation over the past several decades, evolving from rudimentary communication tools to sophisticated digital health platforms. This manuscript examines the historical progression, technological advancements, and broad applications of telemedicine, highlighting its impact on health-care delivery. A systematic review of literature and case studies was conducted, focusing on the technological, regulatory, and clinical aspects of telemedicine. Key sources include peer-reviewed journals, official health organization reports, and case studies demonstrating practical applications of telemedicine. The evolution of telemedicine is closely linked with advancements in communication technologies, including the Internet, mobile devices, and artificial intelligence. These technologies have enhanced the accessibility, reliability, and functionality of telemedicine platforms. Telemedicine has significantly improved health-care delivery, particularly in remote and underserved areas. It has enabled remote consultations, diagnostics, chronic disease management, and mental health services, thus increasing patient access and continuity of care. Telemedicine represents a transformative shift in health-care delivery, offering enhanced patient care, improved access, and cost efficiencies. Its evolution reflects continuous innovation, increased acceptance, and supportive regulatory environments. Future efforts should focus on overcoming existing challenges and leveraging emerging technologies to further integrate telemedicine into the health-care ecosystem. The potential applications of telemedicine extend beyond traditional health-care settings, promising smarter, more efficient, and more equitable health care for all.

Key words: Challenges, perspectives, telehealth, telemedicine, telemonitoring, teletherapy

INTRODUCTION

By combining cutting-edge innovation with reliable network services, people may enhance health-care delivery and expand access to it. One additional useful tool that may improve people's health in the long run is telemedicine, which can facilitate preventative care more easily. This is especially true for people whose access to high-quality care is hindered by factors such as geography or lack of financial resources. One way that healthcare might be more organized, accessible, and efficient is through the use of telehealth. This field of study is still in its infancy, but it is rapidly growing. Telemonitoring vital signs and providing treatment over the phone improved the quality of life and reduced hospitalization and death rates for people with heart disease. People should acquire a diagnosis and a rehabilitation plan for many good reasons. As a result, patients may have more confidence that they are getting top-notch care. Mental health disorders may be effectively treated using telemedicine. It removes a few obstacles that patients have while trying to access this vital therapy option.[1]

Thanks to telemedicine, he can get the medical care he needs whenever it is most convenient for him, without sacrificing his safety while the doctor attends to him. This might lead someone to believe that they are exempt from taking a leave of absence or making arrangements for child care. There is

Address for correspondence:
Mohd Imran, Department of Pharmaceutical Chemistry, College of Pharmacy, Northern Border University, Rafha 91911, Saudi Arabia.
E-mail: imran.pchem@gmail.com

Received: 19-06-2024
Revised: 11-09-2024
Accepted: 20-09-2024

a risk of contracting an illness if you visit a doctor's office because of the tight confines in which you must sit. Anyone with pre-existing conditions or a compromised immune system should avoid this at all costs. This ensures that you will not become sick while you are in the doctor's office. There may be less overhead for telemedicine service providers. By enabling them to see more patients, clinicians may discover that telemedicine increases their revenue. There is no risk of infection for carers when they visit patients online. Patients are more likely to be satisfied with their doctors if they can avoid hassles such as flying to the office, waiting for treatment, and hospital infections.[2]

Now more than ever, doctors and hospitals can treat a large number of patients remotely because of advancements in telemedicine. In addition, it will remain in existence for quite some time after it has shown its value. The first surge of video conferencing brought telehealth to a lot more clinicians, but the instruments for the next generation of telemedicine would be far better. Natural language processing allows physicians to automate note-taking during patient visits. During times of crisis, experts will provide their opinions remotely. To aggregate the data collected by health-care devices, the provider may upload it to an Internet of Things (IoT) cloud repository. Health-care providers will then transmit this data to their IoT systems for patient management. The latest innovations in telemedicine technology include AI to enhance the efficiency of clinicians. Wearables and other remote patient monitoring tools keep patients informed, and this technology even employs robots to provide specialist therapy to previously unreached places.[3]

For those living in faraway places, telemedicine has a lot of potential. It has the greatest impact in places where medical treatment is very limited or non-existent. All medical professionals and patients must use adequate software and hardware security measures to guarantee the accuracy of medical records. Online video conferencing allows certain medical facilities to provide virtual doctor consultations. Even if a follow-up appointment is not necessary, patients' regular doctors may nonetheless recommend these appointments. Another kind of interactive appointment is a web-based visit with a doctor or nurse practitioner. Several large companies provide health-care services that include access to automated medical offices. Contrarily, nurses answering patients' questions over the phone at a nursing call center might provide them with information on how to treat themselves at home.[4]

Patients can take their blood pressure medication, get prescription refills, and even remember their appointments with the help of this technology. Furthermore, patients may email physicians with symptom descriptions, perform self-tests, and sign up for condition-specific, step-by-step training programs. In every case, patients may more easily manage their chronic illnesses with the use of electronic health technology, which puts care monitoring applications and cell phones in their hands.[5]

IMPORTANCE IN MODERN SCENARIO

Through the use of electronic information and communication technology, a service known as telemedicine provides medical care to patients remotely. Everything that is meant to help patients and their doctors or health-care professionals is included in this. Virtual patient consultations, remote control, telehealth nursing, and psychiatric and physical rehabilitation are just a few of its many applications. It optimizes clinical processes and decreases travel expenditures to hospitals, which in turn allows for better health-care options, faster diagnosis, and greater cost savings for physicians and patients.[6]

The availability of top-notch medical treatment has been expanded thanks to telemedicine. Clinical treatments will now be more tailored to each patient. In addition, using video application software, they can easily meet top medical professionals, and have consultations remotely, and clinicians have improved tools for data storage, networking, report management, and utilizing each other's unique abilities. As a result, medical professionals can devote less time to rural duties and more to patient care, which ultimately enhances the quality of medical practice. In addition to improving the patient experience, telemedicine makes it possible for private health-care professionals to practice. With the transition to electronic records, both patients and doctors will benefit from shorter wait times and easier access to patient information. In addition, physicians may serve a larger number of patients in less time through remote visits.[7]

NEEDS AND APPLICATIONS

In light of growing concerns, about health-care costs and the need for better treatment, an increasing number of institutions are considering telemedicine. Better utilization of health-care facilities and more communication between doctors and patients in distant locations are two things they want. There has been an increase in patients following their prescribed treatment programs and a decrease in hospital readmissions as a consequence of the improved connectedness made possible through telemedicine. Doctor-to-doctor communication also benefits from telemedicine's increased interaction. To improve healthcare, doctors may use telemedicine to connect, share knowledge, and form support networks. Medical care may now be delivered remotely, often thorugh video chat, thanks to a practice known as telemedicine. Health care practitioners and patients alike may benefit greatly from this technology. Telemedicine may complement and improve the entire patient experience, although there are still technological challenges and naysayers.[8]

CAPABILITIES AND FEATURES

It is already common knowledge that telemedicine and related services may benefit society. Ultimately, this technique

supports the healthcare and medical care domain by providing prescription compliance, chronic health management, care-for-all under critical, remote services, severe circumstances, etc. Furthermore, patients get well and are kept in the loop regarding their health state using a unique system of tele-wearables.[9]

Some have even gone so far as to label telemedicine a disruptive breakthrough in the medical field. To care for a patient who is far away, telemedicine makes use of many forms of electronic communication, such as image-sharing, remote patient monitoring, and teleconferencing. To provide their patients with high-quality care, doctors may also use automation. They should figure out a better approach to handle files and create stronger IT support services. If a primary care physician has questions or concerns about a patient's condition or treatment, they may use a virtual appointment to consult with specialists. The doctor sends the expert X-rays, medical records, a patient's history, and any other relevant photos for review. The expert may arrange a video consultation with the doctor and respond online. These online consultations have the potential to cut down on needless travel, shorten the time it takes to hear back from experts, and do away with the need for needless in-person referrals. Where a clinician can view the patient, diagnose the illness, and record the experience, telemedicine tactics are more beneficial.[10]

Electronic health records (EHRs) allow for the monitoring and preservation of medical history. At any moment, we may utilize a device that can access the web, such as a desktop computer or a smartphone. In the event of an emergency, key information such as prescriptions, diagnoses, drug references, and the contact information of the doctor may be swiftly retrieved from a personal health record. Customers may benefit from the developed uses of this technology by centralizing their medical records in an organized manner. With the use of mobile health technology, it is becoming easier for recovery programs to set goals for changing patient behavior. Calorie counting, vital sign recording, activity tracking, and medication scheduling and dosing are all possible with this device. The concept of patient self-management through telemedicine has several potential applications beyond diabetes, including the treatment of hypertension and a variety of gastrointestinal problems.[11]

Doctors will greatly benefit from telemedicine options. However, when combined with AI, it might be much more effective. It has the potential to streamline routine tasks for physicians while also increasing their happiness on the job. Appointments go off without a hitch since the app reliably and quickly relays all relevant info. It would allow medical professionals to check for irregularities and conduct more thorough reviews of patients' health. The option to see a doctor's available time slots, view scheduled appointments, and even reschedule appointments is a great perk for patients. The collected data may be seen and interacted with using a user interface in health-care analytics. Store and forward methods suggest a better use of time and money in the long run. Several electronic technologies are essential to telemonitoring because they provide patient data directly to the analytical interface of a health-care provider.[12]

Many areas of the telemedicine and health-care sectors have benefited greatly from this technology. Surgery, medical education, and classroom instruction are all being profoundly affected. It is the patient's responsibility to confirm the appointment after the doctor gives the go-ahead. It may add internal data such as reviews, updates, and important notifications from the hospital to their profiles. Schedules may also be used by doctors to arrange appointments. These days, most telemedicine apps let you schedule and reschedule appointments. Notifying doctors of an appointment allows them to access their patient's medical records and any other information necessary for a proper consultation and diagnosis.[13]

Immersive communication applications in telemedicine devices have been revolutionized by virtual reality (VR) technologies. With the use of VR, surgical teams may now see patient information on a 3D display. Surgeons and doctors may treat patients hundreds of kilometers distant because of video conferencing. Because of this, even under the most critical of circumstances, medical teams located on different continents may work together virtually. One possible feature of the telehealth platform is the ability to combine VR with graphical environments and video conferencing to facilitate patient–doctor communication. Providing patients with local health care is essential, and this strategy is beneficial in rural or remote places as well. By doing so, people in more remote places are more likely to have faith in their local health-care system. More money will be able to go toward local health care for those living in distant areas thanks to this technology. Furthermore, thanks to this equipment, sufferers may stay with their loved ones.[14] Figure 1 describes the basic aspects of telemedicine, telehealth, and E-health.

TREATMENT WORKFLOW PROCESS

It offers a state-of-the-art facility and meticulous attention to detail throughout the whole implementation process. The telehealth supportive care unit is the next step after the patient enters their complete information. Following a meticulous diagnosis and the provision of suitable therapy, this phase is related to the establishment of the doctoral assistant's relationship with the patient.[15]

Through the use of communications, telemedicine and other technologies have enhanced administrative and clinical processes. Emergency treatment in both life-threatening and less serious cases may be provided by this multi-faceted approach. Patients with long-term health conditions are the most common recipients of this treatment. However,

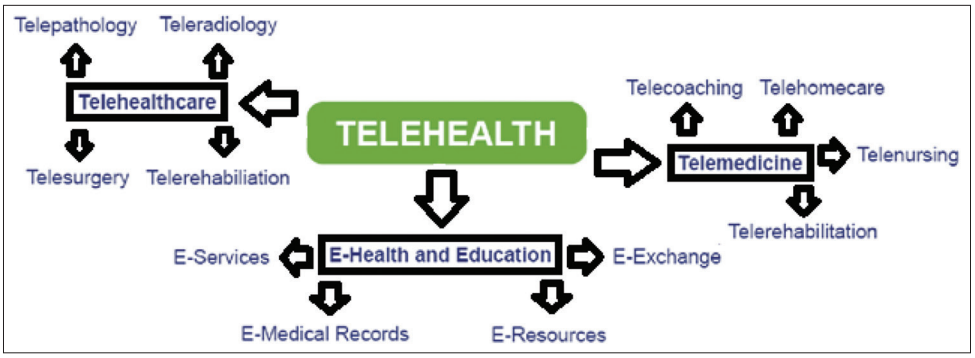

Figure 1: Basic aspects of telemedicine, telehealth, and E-health

a hospital that has the right kind of ambulance team or other staff may make up for telemedicine. In addition, the telemedicine system may be enhanced with other features including electronic prescriptions, treatment dynamics graphs, and the patient's treatment history.[16]

In addition, after a consultation, physicians may simply phone patients again to discuss any results or follow-ups. Therefore, text messages are crucial since they allow the doctor to have a direct conversation without the need for a second session. Physicians may also share patient records and prescription information between practices.[17]

The present state of health care makes health-care monitoring an absolute need for preserving health-care quality. Digital health monitoring services and technology have led to the development of smart connection systems. This innovation paves the way for direct patient control, allowing for a far more in-depth understanding of patients through simple video conferencing. Time is saved by both the health-care professional and the patient using the doctor's catalog. The doctor–patient therapy process becomes more precise as a result. It is possible to track the progress of a doctor's appointment using the appointment scheduling feature. Schedule requests and patient profiles are reviewed by physicians before contact with patients. This enables the filtering of patient profiles and displays the patient queue. Any time an emergency arises, the doctor may now quickly reschedule appointments. Information about patients and recorded video consultations used in telemedicine are often saved in the cloud for patient privacy and medical record keeping.[18]

Even a patient's caretaker who requires the data for insurance reasons may easily access their medical records, as can any doctor who specializes in treating a particular patient's condition. Doctors and patients may have a two-way conversation regarding symptoms by teleconference. Video consultations and photographs are gradually displacing in-person assessments. To facilitate remote patient diagnosis and real-time cooperation, telemedicine application software developers use app connection and cloud technology. By tracking health status and conducting inspections as needed, it saves time for doctors and patients alike. The telehealth app makes it easy to gather and consolidate patient records into one place. It expedites the delivery of health-care services, which benefits consumers, prescribing doctors, and pharmacies. There will be fewer mistakes when physicians use an electronic prescription function to write and send out prescriptions. Not only would it improve connection and customer happiness, but it would also help save time.[19]

Both patients and physicians benefit from health-care providers' use of telemedicine technologies, which enhance the quality of treatment. There has been and will be a continued uptick in the demand for mobile telemedicine apps, which is driving the expansion of telemedicine app development. Electronically linked pharmacies also can access physicians' records on prescription insurance forms. Any telemedicine app worth its salt will include a mobile payment option. Any telemedicine software worth its salt will include a system where users can review and compare different physicians. Quality management and ongoing professional growth both benefit greatly from hearing from patients. Furthermore, many new patients will be able to choose the perfect specialized doctor for their requirements with its help.[20]

The use of telemedicine has the potential to make the treatment of many different medical issues much more efficient. Medication from a trained medical provider who takes the time to understand each patient's unique symptoms has a better chance of working. Telemedicine allows for constant two-way communication between doctors and their patients. Using cutting-edge technology and services, it has increased accessibility to health-care facilities. Through the use of telemedicine, any health-care facility or treatment center may have instantaneous access to doctors, consultants, supplementary materials, and data. It may quickly and easily trade services with any health-care facility in the nation using this method. There are not many complicated needs or choices that need to be made while developing a telemedicine application's specs.[21]

A video platform, technical equipment, and likely portable devices may minimize the need for telemedicine technology. A streamlined version of the same technology may enable health-care institutions with broad services to conduct

telemedicine consultations.[22] Decisions over technology are important, but the help needed to manage a telemedicine program is also crucial. To function properly, any program needs a competent computer and access to technical support. The requirements are always being met by doctors, depending on the resources available. Consistent and secure Internet connectivity may be guaranteed by the support staff. It also helps with technical and logistical problems that may occur throughout a clinic day, which is great for keeping patients' treatments uninterrupted.[23]

When it comes to health-care providers, telemedicine offers a lot. To provide better treatment, health-care organizations are using telemedicine in both primary care clinics and hospitals with skilled nursing facilities.[24] Improved patient care and diagnosis are possible with the use of telemedicine software in conjunction with technologies such as EHRs, artificial intelligence (AI) diagnostics, and medical streaming apps. Doctors may monitor their patient's vitals in real time and adjust treatment accordingly. The use of telemedicine allows medical professionals to see more patients without increasing staff size or relocating their practice. The transition to telemedicine has been challenging for some doctors and patients, particularly the elderly.[25]

CHALLENGES IN UPCOMING SCENARIO

When attempting to implement telehealth methods in healthcare and related fields, some common and ordinary obstacles must be addressed. Any breach of privacy, disclosure of sensitive information, fraud or misuse, incorrect answers, etc., might depress anybody or make the situation more difficult from a health perspective, thus everything must be completely free of these problems.[26] Some serious medical conditions, including asthma and diabetes, may be better managed with the use of telemedicine and other forms of remote health monitoring. After a patient is released from the hospital or takes time to heal from an injury, their providers will continue to monitor their progress at home. Doctors worry a lot about their patient's mismanaging. Even though medical technology has become more user-friendly, gadget malfunctions can happen sometimes. Health-care systems that are thinking about using telemedicine consult with professionals in the field. To facilitate the incorporation of telemedicine into their clinics, they provide a variety of practical solutions to practitioners.[27]

Using this telemedicine technology, doctors in different countries may share patient information. Now, primary care physicians and patients may share medical records electronically, even when they are not in the same physical location.[28] One practitioner may be aware of another's previous actions thanks to technology that can transmit data over great distances. Consequently, insufficient medication management is less common and monitoring is done more efficiently. Medical portals allow doctors to access and share medical records with their patients. By sending information about a patient's vital signs and other metrics to doctors, medical gadgets may facilitate the modification of treatment plans. These days, patients may transmit biometric data to their doctors through pulsometers, blood pressure cuffs, and other remote monitoring equipment. It can retrieve patient data from a clinical decision support system or dashboard, aggregate it, and show the patient's state in almost real-time.[29]

Telemedicine has the potential to revolutionize healthcare by facilitating long-distance information transmission between patients. Images from imaging studies results from blood tests, and other data may be sent in real-time to help with precise patient evaluation. Overcrowding in emergency rooms may be reduced by the use of telemedicine, which involves patients first consulting with a remote physician through video chat.[30] Any health-care network worth its salt would attest to the fact that telemedicine implementation is a time and resource hog. To reap the device's advantages, practice administrators, clinicians, physicians, and others must comprehend its operation. Although health-care institutions may incur some initial costs with telemedicine, they should expect a strong return on investment in the long run as a result of increased patient volume and decreased staffing needs. This technology allows doctors to do a lot more, such as check a patient's medical history and conduct clinical exams.[30]

Patients now have the opportunity to get health care from the comfort of their own homes through telemedicine. People who need medical care but cannot afford to wait a long time or travel hundreds of miles would benefit from this process. A doctor at another hospital can quickly assess youngsters in danger by just transmitting the film.[31] Because of this, fewer newborns will have to be transferred to another hospital, which saves both time and money. People who previously had trouble getting to medical facilities may now consult with a professional without ever leaving their house. People with contagious diseases should not expose themselves to others in crowded waiting rooms to reduce the spread of disease. Even outside of normal business hours, people will schedule consultations.[32]

By facilitating even closer relationships between patients and their carers, expanding access to doctors and specialists, and urging both parties to leave potentially dangerous situations, telemedicine ushers in a new era of technology-assisted therapy. Various telemedicine techniques may be used to assist patients who are abusing drugs. Treatment costs less overall, which means money is saved.[33] As technology progresses, the cost reductions will be easier to see. Both doctors and patients benefit greatly from telemedicine when it comes to diagnosis and treatment. It may be a great pillar of support. To provide patients with the right medicines and treatment, health-care providers find this telemedicine technology quite useful. Both the patient and the doctor may save money using

telemedicine instead of traditional medical practices. Proper therapy can only be provided if the health-care practitioner has on-site telemedicine facilities.[34]

Patients may get round-the-clock treatment through telemedicine. This will assist with diagnosis and encourage appropriate self-care. Automated interpretation of patient data and faster physician response to new technology are two benefits of AI-enabled telemedicine services. The usage of telemedicine technology will allow providers to treat a greater number of patients. Both the duration of visits and the number of beds in hospitals may be decreased.[35] Reduced use of emergency rooms may result from easier access to tele-urgent care. Specialists in remote hospitals may work together with patients because of this. These interactions can be placed through live streaming with distant experts who may provide consultations through screen sharing. The practice of transmitting medical data from one place to another using the Internet is known as telemedicine. The goal is to make the individual more physically fit. It could be difficult to get an appointment with either a family doctor or a specialist. Active data collection and transmission to other health-care institutions are being carried out through this distant network. With this new technology, mental health practices may treat more patients without sacrificing the quality of treatment. Better time management and more profits are the outcomes of this. It is expected that parents would refrain from bringing their ailing kid to the doctor's office.[36]

The term "telemonitoring" refers to the practice of collecting and transmitting health records from individuals in different parts of the world. Doctors and primary carers can keep tabs on patients with this kind of surveillance thanks to technological devices. Care for patients at home is also possible using telemonitoring equipment.[37] They get more agency over their sickness treatment and fewer hospital visits as a result. People in remote areas either do not have the financial means to go to hospitals, or they do not have access to the economical health-care options that telemedicine provides. One of their everyday responsibilities is interacting with other health-care professionals, which may be a very time-consuming process. Utilizing telemedicine, radiologists can acquire high-quality images and get feedback regardless of their location. They may now operate more efficiently as they are not required to be physically there when the supplier sends over the photographs. Therapy sessions may be conducted remotely by mental health practices, which are among the most frequent telemedicine specialties.[38]

SIGNIFICANT APPLICATION AREAS

Primary care consultations, psychotherapy, physical therapy, and a host of other treatment choices are now within reach with telemedicine technology. Using mobile devices such as cell phones and computers administers therapy. The majority of telemedicine instances include video conferencing. Conversely, other services choose to serve patients through phone or email. Patients often work with their primary care physician while using telemedicine. Patients who are unable or unwilling to go to a health-care facility might benefit from this technology.[39] It frees up the expense of keeping the office open, allowing practices to offer longer or weekend hours. The increasing number of patients who choose telemedicine as their main care provider option is another benefit of this trend. Involvement in disease management, treatment, and the prevention of consequences is essential for those with serious diseases, and this simple and inexpensive approach may help them do all three. Engineering makes use of a wide range of cutting-edge technological tools. These contribute to the development of a sustainable environment and aid in the resolution of several design and manufacturing-related issues.[40]

This is especially helpful in places where professionals are not easily available, such as in distant or hard-to-reach regions. Reduced time and money spent on distant visits is possible with its help. Much advancement in telemedicine has occurred since the dawn of the Internet era. Patients now have the option of receiving primary and specialized treatment without leaving the comfort of their own homes or workplaces because of the rise of smart technology that can broadcast high-quality video.[41] Telemedicine has supposedly been around since the invention of the telephone, at least in theory. Instead of data, one may transmit pictures over the phone. The use of telemedicine has also become standard practice in many nations' health-care systems. Its remarkable versatility makes it useful for a wide range of purposes, such as facilitating patients' ability to schedule follow-up appointments over video chat, increasing adherence to aftercare visit protocols, and relieving stress for everyone involved.[42]

To facilitate telemedicine, modern mobile health applications integrate a dynamic clinical user interface with the software. Treating patients with minor illnesses, exchanging data inquiry information, or imaging findings are all examples of non-critical events. A specialized app also allows patients to purchase medications and get prescriptions.[43] Work in tandem with online payment vendors. Here, data are sent and analyses are done in real-time. Integrating these telemedicine solutions makes it easy for doctors and patients to work together through a single app for communication and data sharing. Direct patient data collection and transmission to the right doctor is a breeze. The results of a test or an appointment transcript kept in a patient's EHR could serve as this proof. Furthermore, when data has been gathered, it enables clinicians to understand it.[44]

Private patient information is often used in telemedicine. Data capture, storage, and distribution are all aided by its use, which allows for the consideration of crucial factors in this domain. A website that facilitates remote chats with doctors is known as telemedicine. Through the use

of mobile apps, the device may be linked to the hospital's internal infrastructure.[45] To aid in clinical decision-making, specialized modules may provide cautions, research notes, and data visualizations. Patients with serious and long-term illnesses may get the treatment they need with the help of this software and a remote control. A valuable bed is taken up by every patient admitted to the hospital and kept under care throughout the operation. A nurse's station may be equipped with alarms, video conference capabilities, and the ability to gather vital signs through home health telemedicine.[46]

COMMUNICATION PERSPECTIVES

Through the use of audio and video conferencing, telemedicine enables direct communication between patients and clinicians. While on the phone, and even before access to the patient's medical records is granted to the doctor. The practice of providing clinical health care through secure audio and video links is known as telemedicine, and it is a subfield of health information technology.[47] Because of this, those who are ill may also be treated online. With telemedicine, a patient may talk to their doctor whenever and wherever they choose through encrypted audio and video calls; they can even share medical history and photos. When properly planned and executed, telemedicine technologies have the potential to be both convenient and cost-effective. Amid the COVID-19 pandemic, it has exploded in popularity, inspiring innovative uses that will improve health outcomes while cutting costs and guaranteeing that every patient gets the care they need.[48]

Accessing medical records, scheduling appointments, reordering prescriptions, paying for them, and getting in touch with our doctors are all made possible through telemedicine's use of new networking systems, communication and file management applications, and high-tech devices such as computers and mobile phones.[49] Progressive educational institutions collaborate with local medical professionals to provide remote school visits. The provider may assess the gravity of the problem and then advise or reassure the parents. It has also been observed that telemedicine technology effectively keeps residents of assisted living facilities away from hospitals. To determine whether hospitalization is necessary, on-call doctors at distant clinics may employ telemedicine to conduct a remote visit. More and more telehealth services are cropping up to make health-care management and treatment more convenient.[50]

An ideal example of the IoT in healthcare would be telemedicine, which ideally would be accessible, user-friendly, and flexible. All parties involved in patient and doctor care may benefit from computer technology that is esthetically pleasing and easy to use. The solution also has to be easy to integrate with existing health-care infrastructure.[51] The instructions that users will require to use the system efficiently are another aspect to keep in mind. Health-care organizations may harness the potential of the IoT to develop telemedicine apps that are accessible, affordable, and reliable. Over time, these health-care systems capture data while monitoring the user's vitals. Depending on the user's overall health, several of these devices may even predict the onset of illnesses. The goal of implementing a system that is driven by the IoT goes beyond only monitoring patients. Wheelchairs, nebulizers, defibrillators, and other medical equipment may be equipped with IoT sensors, which enable hospitals to monitor them in real time. Keeping tabs on the whereabouts of health-care staff is another potential use of this technology.[52]

Dermatology, mental health, medicine, and cardiology are just a few of the medical fields that are increasingly using telemedicine to better serve people who lack access to traditional medical care. Many believe it might be a cost-effective method of treating chronic conditions that need constant monitoring, such as diabetes, sleep apnea, and asthma.[53] Numerous applications of telemedicine in the recovery sector are tackling these challenges, including psychiatric examinations, cognitive testing, group counseling, Internet access for patients, and remote patient monitoring. Patients suffering from lung illness, for instance, will be able to get well with the use of this technology by participating in video therapy sessions and receiving physical rehabilitation supervision from a nearby satellite location. On a global scale, cardiovascular disease ranks as the leading killer. Drug treatments and social/lifestyle adjustments, however, may help prevent many occurrences.[54]

Telehealth has the potential to lower health-care costs, which would increase the value of health care and allow patients to get treatment more quickly. However, to access inexpensive healthcare, they have to go hundreds of miles across countries. This obstacle has been eliminated thanks to some apps developed for health-related objectives. The advent of telemedicine has greatly simplified the process of scheduling a rapid online consultation with any doctor.[55] Patients have the option to personalize their requirements, choose their preferred location, and ensure compliance with their existing medical information. They may arrange one-on-one consultations with doctors who can gather all the necessary information before the appointment. Furthermore, it grants access to the home screen to various algorithms, allowing them to get pertinent information. Patients would be able to choose from several functional filters, for instance, on a search engine that uses sophisticated filter algorithms.[56]

Using telemedicine software, patients are connected with physicians who may consult with them over video chat. The program uses the number of registered physicians to determine the available doctors.[57] Conditions such as diabetes, high cholesterol, and addiction may all benefit from telehealth applications as well. In addition, users may easily pick up their meds by having their prescriptions sent to pharmacies they have already chosen using the applications.

Medical professionals may provide guidance, diagnoses, treatment programs, and prescriptions through telemedicine. Online consultations allow physicians to gain additional training. The utilization of telehealth apps is revolutionizing patient care and the efficiency of healthcare in the current day. To put it another way, it backs health-care systems that are based on technology.[58]

COVID-19 SCENARIO AND TELEMEDICINE

There has been a past description of the possibility of using telehealth—the use of digital technology to provide medical treatment, public health, and health education during calamities and disasters; however, its primary focus has always been on serving underserved or distant places.[59] Quickly replacing conventional in-person visits with virtual ones, telehealth has grown globally as a means to reduce the spread of SARS-CoV-2, the COVID-19 virus, while keeping people's access to health care intact. The quick implementation of telehealth services should not compromise the security and convenience of patients or the quality of treatment, even if some doctors are excited about this new trend.[60]

The use of electronic technology in the diagnosis, treatment, and monitoring of patients (including the recording of adequate medical histories and conducting suitable physical examinations) is known as telemedicine.[61] Using real-time, synchronous video conferencing, patient interactions strive to provide treatment that is just as safe and effective as conventional in-person visits. Patients are increasingly wearing wearable devices that can transmit and interpret their health data; telemedicine enables additional electronic exchange of health information by facilitating the collection, transmission, and interpretation of this data; and it allows for the rapid exchange of digital information through patient portals, tablets, and cell phones, which can allow for updates and reminders.[62]

As a "disruptive process," telehealth requires substantial adjustments to pre-existing frameworks, and while it provides answers for fundamental access to health care during the present epidemic, it is still not universally incorporated into traditional health-care systems. Even with all these developments, it is the clinician's responsibility to make sure patients get the treatment they need and to know the limits of telemedicine sessions.[63]

Gentle percussion of the spine allowed identifying "heartburn" (which had happened without any back pain) as the only symptom of spinal osteomyelitis, a diagnostic maneuver that could not have been accomplished using a computer screen. Since it is physically there, the screen could be an obstacle for some patients who are trying to establish rapport with their doctor. Because anomalies may manifest either visibly or subtly, this is a very crucial obstacle for doctors to surmount when treating patients with complicated health issues.[64]

Everything from dermatoscopes and retinal imaging systems to video otoscopes and electronic stethoscopes are examples of such instruments, as well as intraoral scopes, and can be influenced by factors such as storage space, budget, and the need for "net neutrality" (under stable and secure Internet connectivity). However, adoption may be hindered by the fact that these devices are not uniformly or widely used, and because particular clinics are required to support certain usage.[65] In addition to these tools, we believe that medical decision-making should take into account both the art and science. To ease into it, we propose that basic, common conditions such as hypertension and rashes might be safely examined with a virtual visit. If a patient presents with symptoms such as fever or back discomfort, it may be required to exclude a urinary tract infection as a possible diagnosis. If the patient lives in an area without access to a dipstick or culture, the clinic must follow its process to arrange for testing.[66]

In a similar vein, telemedicine visits may be a safe and effective way to monitor patients on particular treatment protocols for things such as treatment-related side effects, compliance, progress, or deviations from predicted courses. To ensure that patients who are determined to need an in-person examination get the prompt medical treatment they need, health-care professionals should be ready to end digital visits or set up fast follow-up appointments as needed.[67]

Furthermore, we firmly believe that direct physician-patient engagement should occur during at least the first appointment since in-person interactions may build a relationship of trust and collaboration between the patient and provider.[68] The conventional doctor-patient connection is rooted in the bond-forming aspect of human awareness of personal space as well as the therapeutic benefits of touch and direct face-to-face contact. To illustrate the point, we were able to diagnose polymyositis in a patient who manifested symptoms of interstitial pneumonia whose cause had previously remained unknown; the patient's spouse and in-person interaction were instrumental in gathering the necessary details, which prevented the patient from undergoing a needless lung biopsy.[69] This advancement might be due to an increase in severity, a change in distribution, or a new beginning of symptoms. Conditions that are often considered to be low-risk might worsen or be a "harmless" sign of something far worse. Therefore, we should exercise care when it comes to the unfettered use of AI technology, particularly in the task of triaging patients seeking appointments.[70]

A threat to conventional bedside or in-person care delivery is the increasing use of telemedicine, which is driven by a feeling of crisis and urgency. Health-care facilities have a responsibility to inform patients that every precaution is being taken to avoid the spread of infection without

compromising the quality of treatment. In the end, the pros and cons of telemedicine visits need to be considered about the advantages of face-to-face consultations. It urged health-care practitioners to provide recommendations or best practices for handling new patients in the age of telemedicine, as the COVID-19 pandemic will have long-lasting effects.[71]

Limitations

When opposed to more traditional forms of therapy, telemedicine offers several potential downsides. While it does provide limited support for the current health-care system, it cannot be considered a replacement for it. If a patient uses an unsecured route or connects to telemedicine over a public network, there is a significant risk that hackers may access their medical records. Because a doctor cannot provide life-saving treatment or laboratory testing remotely, this technology might postpone the medicine when a person needs emergency care. Different states have different regulations, thus doctors cannot treat patients from other states just because they are licensed in the same state.[72] In addition, doctors should check that the telemedicine service they are using is secure, rigorous, and abides by all applicable privacy regulations. To acquire a full picture of a patient's health status during a telemedicine session, doctors will need to ask more questions and concentrate on patients' self-reports. If a patient fails to report a serious symptom that should have been detected during in-person therapy, medication safety might be compromised. Not having it readily available and affordable is one of the biggest problems. Setting up and managing it might be expensive for the provider. Telemedicine is a great service, but it might be out of reach financially for certain smaller medical centers. Reliable care cannot be provided due to poor communication either.[73]

FUTURE OF TELEMEDICINE

After a simple and fast registration procedure, patients will soon be able to schedule appointments with their preferred doctors. Patient records, including verification papers, medical reports, and previous prescriptions, will be electronically uploaded rather than typed. A doctor may make an emergency care plan with the help of the patient interface, which is a legitimate feature. It helps the doctor decide by providing an overview of the patient's medical and life history. Rapid mobilization of local health-care resources allows for the provision of both urgent and routine medical treatment.[74] Because of this, doctors will be able to spend more time in person on complex, high-demand patients and less time on simple, distant situations. Video consultations will help emergency rooms prioritize patients in the future, allowing them to release those with less serious conditions sooner rather than later. This leads to better patient care and less emergency diversion. Some health-care companies are getting ahead of the curve Using telemedicine application software. It facilitated communication between cardiologists and patients seeking treatment at the outlying clinic. In addition to supplementing the current system, they will cut down on the amount of time needed for follow-up visits. Many companies are capitalizing on the opportunity presented by the next big cause for virtual healthcare: remote patient management.[75]

CONCLUSION

This comprehensive review traces the development of telemedicine, highlighting key milestones and the factors that have driven its progress. The integration of telemedicine with various technological advancements has been pivotal. Early implementations leveraged basic telecommunications infrastructure, but the advent of the Internet, mobile technology, and digital health platforms has dramatically expanded telemedicine's capabilities. Advanced technologies such as AI, machine learning, and big data analytics are now being integrated into telemedicine platforms, providing personalized and predictive health-care solutions. It has also improved chronic disease management, mental health services, and emergency care through real-time communication and remote monitoring. The acceptance of telemedicine by both patients and health-care providers has been a critical factor in its success. Initial skepticism regarding the efficacy and reliability of remote consultations has gradually diminished as telemedicine has demonstrated its effectiveness. Patient satisfaction has increased due to the convenience, reduced travel time, and cost savings associated with telemedicine. Integrating telemedicine platforms with existing EHR systems to facilitate seamless data exchange and comprehensive patient care is essential. Harmonizing regulations across different jurisdictions enables cross-border telemedicine services while maintaining high standards of care and patient safety is crucial. Telemedicine represents a paradigm shift in health-care delivery, offering unprecedented opportunities to enhance patient care, improve access, and reduce health-care costs. The evolution of telemedicine over the decades has been marked by continuous innovation, increasing acceptance, and growing regulatory support.

ACKNOWLEDGMENT

The authors extend their appreciation to the Deanship of Scientific Research at Northern Border University, Arar, KSA for funding this research work through the project number "NBU-FFR-2024-2042-01."

ETHICAL DISCLOSURE

None required.

REFERENCES

1. Ekeland AG, Bowes A, Flottorp S. Effectiveness of telemedicine: A systematic review of reviews. Int J Med Inform 2010;79:736-71.
2. Roine R, Ohinmaa A, Hailey D. Assessing telemedicine: A systematic review of the literature. CMAJ 2001;165:765-71.
3. Wilson LS, Maeder AJ. Recent directions in telemedicine: Review of trends in research and practice. Healthc Inform Res 2015;21:213.
4. Scott Kruse C, Karem P, Shifflett K, Vegi L, Ravi K, Brooks M. Evaluating barriers to adopting telemedicine worldwide: A systematic review. J Telemed Telecare 2018;24:4-12.
5. Hailey D, Roine R, Ohinmaa A. Systematic review of evidence for the benefits of telemedicine. J Telemed Telecare 2002;8 Suppl 1:1-30.
6. Baker J, Stanley A. Telemedicine technology: A review of services, equipment, and other aspects. Curr Allergy Asthma Rep 2018;18:60.
7. Loane M, Wootton R. A review of guidelines and standards for telemedicine. J Telemed Telecare 2002;8:63-71.
8. Wootton R. Telemedicine. BMJ 2001;323:557-60.
9. Ekeland AG, Bowes A, Flottorp S. Methodologies for assessing telemedicine: A systematic review of reviews. Int J Med Inform 2012;81:1-11.
10. Nittari G, Khuman R, Baldoni S, Pallotta G, Battineni G, Sirignano A, *et al*. Telemedicine practice: Review of the current ethical and legal challenges. Telemed e-Health 2020;26:1427-37.
11. Hersh WR, Helfand M, Wallace J, Kraemer D, Patterson P, Shapiro S, *et al*. Clinical outcomes resulting from telemedicine interventions: A systematic review. BMC Med Inform Decis Mak 2001;1:5.
12. Bashshur R, Shannon G, Sapci H. Telemedicine evaluation. Telemed J e-Health 2005;11:296-316.
13. Hersh W, Helfand M, Wallace J, Kraemer D, Patterson P, Shapiro S, *et al*. A systematic review of the efficacy of telemedicine for making diagnostic and management decisions. J Telemed Telecare 2002;8:197-209.
14. Waller M, Stotler C. Telemedicine: A primer. Curr Allergy Asthma Rep 2018;18:54.
15. Lupton D, Maslen S. Telemedicine and the senses: A review. Sociol Health Illness 2017;39:1557-71.
16. Craig J, Petterson V. Introduction to the practice of telemedicine. J Telemed Telecare 2005;11:3-9.
17. Chen S, Cheng A, Mehta K. A review of telemedicine business models. Telemed E Health 2013;19:287-97.
18. Bashshur RL, Reardon TG, Shannon GW. Telemedicine: A new health care delivery system. Annu Rev Public Health 2000;21:613-37.
19. Garg V, Brewer J. Telemedicine security: A systematic review. J Diabetes Sci Technol 2011;5:768-77.
20. Hjelm NM. Benefits and drawbacks of telemedicine. J Telemed Telecare 2005;11:60-70.
21. Whitten PS, Mair FS, Haycox A, May CR, Williams TL, Hellmich S. Systematic review of cost effectiveness studies of telemedicine interventions. BMJ 2002;324:1434-7.
22. Mair F, Whitten P. Systematic review of studies of patient satisfaction with telemedicine. BMJ 2000;320:1517-20.
23. Stanberry B. Telemedicine: Barriers and opportunities in the 21st century. J Intern Med 2000;247:615-28.
24. Whitten P, Holtz B, Laplante C. Telemedicine. Appl Clin Inform 2010;1:132-41.
25. Combi C, Pozzani G, Pozzi G. Telemedicine for developing countries. Appl Clin Inform 2016;7:1025-50.
26. Di Cerbo A, Morales-Medina JC, Palmieri B, Iannitti T. Narrative review of telemedicine consultation in medical practice. Patient Prefer Adherence 2015;9:65-75.
27. García-Lizana F, Muñoz-Mayorga I. Telemedicine for depression: A systematic review. Perspect Psychiatr Care 2010;46:119-26.
28. Amadi-Obi A, Gilligan P, Owens N, O'Donnell C. Telemedicine in pre-hospital care: A review of telemedicine applications in the pre-hospital environment. Int J Emerg Med 2014;7:29.
29. Aoki N, Dunn K, Johnson-Throop KA, Turley JP. Outcomes and methods in telemedicine evaluation. Telemed J E Health 2003;9:393-401.
30. Dávalos ME, French MT, Burdick AE, Simmons SC. Economic evaluation of telemedicine: Review of the literature and research guidelines for benefit-cost analysis. Telemed E Health 2009;15:933-48.
31. Saliba V, Legido-Quigley H, Hallik R, Aaviksoo A, Car J, McKee M. Telemedicine across borders: A systematic review of factors that hinder or support implementation. Int J Med Inform 2012;81:793-809.
32. Broens TH, Huis in't Veld RM, Vollenbroek-Hutten MM, Hermens HJ, van Halteren AT, Nieuwenhuis LJ. Determinants of successful telemedicine implementations: A literature study. J Telemed Telecare 2007;13:303-9.
33. Burke BL Jr., Hall RW, Section on Telehealth Care. Telemedicine: Pediatric applications. Pediatrics 2015;136:e293-308.
34. Haleem A, Javaid M, Singh RP, Suman R. Telemedicine for healthcare: Capabilities, features, barriers, and applications. Sens Int 2021;2:100117.
35. Wootton R. Telemedicine support for the developing world. J Telemed Telecare 2008;14:109-14.
36. Nguyen M, Waller M, Pandya A, Portnoy J. A review of patient and provider satisfaction with telemedicine. Curr Allergy Asthma Rep 2020;20:72.
37. Kvedar J, Coye MJ, Everett W. Connected health: A review of technologies and strategies to improve patient care with telemedicine and telehealth. Health Affairs (Millwood) 2014;33:194-9.
38. Barbosa W, Zhou K, Waddell E, Myers T, Dorsey ER. Improving access to care: Telemedicine across medical domains. Annu Rev Public Health 2021;42:463-81.
39. Wilcox ME, Adhikari NK. The effect of telemedicine

in critically ill patients: Systematic review and meta-analysis. Crit Care 2012;16:R127.
40. Klaassen B, van Beijnum BJ, Hermens HJ. Usability in telemedicine systems-A literature survey. Int J Med Inform 2016;93:57-69.
41. Ftouni R, AlJardali B, Hamdanieh M, Ftouni L, Salem N. Challenges of telemedicine during the COVID-19 pandemic: A systematic review. BMC Med Inform Decis Mak 2022;22:207.
42. Colbert GB, Venegas-Vera AV, Lerma EV. Utility of telemedicine in the COVID-19 era. Rev Cardiovasc Med 2020;21:583-7.
43. Nittari G, Savva D, Tomassoni D, Tayebati SK, Amenta F. Telemedicine in the COVID-19 era: A narrative review based on current evidence. Int J Environ Res Public Health 2022;19:5101.
44. Baigi SF, Baigi SM, Habibi MR. Challenges and opportunities of using telemedicine during COVID-19 epidemic: A systematic review. Front Health Inform 2022;11:109.
45. Shanbehzadeh M, Kazemi-Arpanahi H, Kalkhajeh SG, Basati G. Systematic review on telemedicine platforms in lockdown periods: Lessons learned from the COVID- 19 pandemic. J Educ Health Promot 2021;10:211.
46. Mehraeen E, SeyedAlinaghi S, Heydari M, Karimi A, Mahdavi A, Mashoufi M, *et al*. Telemedicine technologies and applications in the era of COVID- 19 pandemic: A systematic review. Health Inform J 2023;29:14604582231167431.
47. Nanda M, Sharma R. A review of patient satisfaction and experience with telemedicine: A virtual solution during and beyond COVID-19 pandemic. Telemed E Health 2021;27:1325-31.
48. Kruse CS, Williams K, Bohls J, Shamsi W. Telemedicine and health policy: A systematic review. Health Policy Technol 2021;10:209-29.
49. Chellaiyan VG, Nirupama AY, Taneja N. Telemedicine in India: Where do we stand? J Family Med Prim Care 2019;8:1872-6.
50. Şahin E, Yavuz Veizi BG, Naharci MI. Telemedicine interventions for older adults: A systematic review. J Telemed Telecare 2024;30:305-19.
51. Tan AJ, Rusli KD, McKenna L, Tan LL, Liaw SY. Telemedicine experiences and perspectives of healthcare providers in long-term care: A scoping review. J Telemed Telecare 2024;30:230-49.
52. Ijeh S, Okolo CA, Arowoogun JO, Adeniyi AO. Theoretical insights into telemedicine and healthcare ICT: Lessons from implementation in Africa and the United States. World J Biol Pharm Health Sci 2024;18:115-22.
53. Tierney AA, Mosqueda M, Cesena G, Frehn JL, Payan DD, Rodriguez HP. Telemedicine implementation for safety net populations: A systematic review. Telemed E Health 2024;30:622-41.
54. Tabaeeian RA, Hajrahimi B, Khoshfetrat A. A systematic review of telemedicine systems use barriers: Primary health care providers' perspective. J Sci Technol Policy Manag 2024;15:610-35.
55. Venkataraman A, Fatma N, Edirippulige S, Ramamohan V. Facilitators and barriers for telemedicine systems in India from multiple stakeholder perspectives and settings: A systematic review. Telemed J E Health 2024;30:1341-56.
56. Alnasser Y, Proaño A, Loock C, Chuo J, Gilman RH. Telemedicine and pediatric care in rural and remote areas of middle-and-low-income countries: Narrative review. J Epidemiol Glob Health 2024. https://doi.org/10.1007/s44197-024-00214-8.
57. Cummins MR, Soni H, Ivanova J, Ong T, Barrera J, Wilczewski H, *et al*. Narrative review of telemedicine applications in decentralized research. J Clin Transl Sci 2024;8:e30.
58. Savoldelli A, Landi D, Rizzi C. Exploring quantitative methodologies for assessing the environmental, social, and economic impacts of telemedicine: A literature review. Sustainability 2024;16:2438.
59. Colburn DA. The impact of telehealth expansion on health care utilization, access, and outcomes during the pandemic: A systematic review. Telemed E Health 2024;30:1401-10.
60. Garcia JP, Avila FR, Torres-Guzman RA, Maita KC, Lunde JJ, Coffey JD, *et al*. A narrative review of telemedicine and its adoption across specialties. Mhealth 2024;10:19.
61. Du Y, Gu Y. The development of evaluation scale of the patient satisfaction with telemedicine: A systematic review. BMC Med Inform Decis Mak 2024;24:31.
62. Leighton C, Cooper A, Porter A, Edwards A, Joseph-Williams N. Effectiveness and safety of asynchronous telemedicine consultations in general practice: A systematic review. BJGP Open 2024;8:BJGPO.2023.0177.
63. Vinadé Chagas ME, Cristina Jacovas V, de Campos Moreira T, Rodrigues Moleda Constant HM, Fernanda Rohden S, Stiehl Alves S, *et al*. Are we adequately measuring patient satisfaction with telemedicine? A systematic review with a meta-analysis. Telemed E Health 2024;30:1522-38.
64. Burger SJ, Sage S, Bondini CM, Ly NB, Iseli RK. Telemedicine models of care: A retrospective review of telehealth in a Melbourne outpatient chronic wound service in 2021. Int Wound J 2024;21:e14648.
65. Valencia-Arias A, Gallegos A, Aliaga Bravo VD, Victoria Mori FL, Uribe-Bedoya H, Palacios-Moya L. Understanding telemedicine adoption: Evidence, gaps, and future perspectives for sustainable healthcare. Cogent Soc Sci 2024;10:2306712.
66. Anawade PA, Sharma D, Gahane S. A comprehensive review on exploring the impact of telemedicine on healthcare accessibility. Cureus 2024;16:55-61.
67. Al-Faraj AO, Ukonu N, Mohtar O, Jha V, Chen DT, Lau KV. Telemedicine in neurology: Challenges and opportunities. Discov Health Syst 2024;3:33.

68. Bruchanski L, Frid S, Tejerina L, Sommer J, Nelson J, Otero P, *et al*. Effectiveness, costs and satisfaction of telemedicine: Review of the current state. Stud Health Technol Inform 2024;310:399-403.
69. Seuren LM, Ilomäki S, Dalmaijer E, Shaw SE, Stommel WJ. Communication in telehealth: A state-of-the-art literature review of conversation-analytic research. Res Lang Soc Interact 2024;57:73-90.
70. Hollowell A, Swartz J, Myers E, Erkanli A, Hu C, Shin A, *et al*. Telemedicine services in higher education: A review of college and university websites. J Am Coll Health 2024;72:548-53.
71. Damaševičius R, Abayomi-Alli OO. The future of telemedicine: Emerging technologies, challenges, and opportunities. In: Metaverse Applications for Intelligent Healthcare. United States: IGI Global; 2024. p. 306-38.
72. Yusuf M, Ahmed W, Jameel A, Khan MW. IT based telemedicine: Global and Indian prospects with future outlook. Int J Adv Stud Humanit Soc Sci 2024;13:128-50.
73. Lopez AM. Telehealth in cancer care: Inequities, barriers, and opportunities. Cancer J 2024;30:2-7.
74. Imam SN, Rubin A. History and overview of telehealth. In: Leading an Academic Medical Practice. Cham: Springer International Publishing; 2024. p. 169-77.
75. Zhang X, Ma L, Sun D, Yi M, Wang Z. Artificial intelligence in telemedicine: A global perspective visualization analysis. Telemed J E Health 2024;30:e1909-22.

Source of Support: Nil. **Conflicts of Interest:** None declared.

Author Queries???
AQ5: Kindly provide history details