

AN INSIGHT INTO TELEMEDICINE : A REVIEW

Author 1 : (Corresponding Author)

Dr. Vino Tito V Kurien

Assistant Professor Department of Periodontics Saraswati Dhanwantari Dental College
Parbhani Maharashtra

Email : vinoperio@gmail.com

Author 2 :

Dr. Mahitha M C

Junior Resident Department of Community Medicine Government Medical College
Aurangabad Maharashtra

Email : mahimahimeenu2@gmail.com

Author 3 :

Dr. Suhana Shamsuddeen

Assistant Professor Department of Periodontics Krishnadevaraya Dental College
Bangalore Karnataka

Email : pgsuhana@gmail.com

Abstract:

“Tele” is a Greek word meaning “distance” and “mederi” is a Latin word meaning “to heal.” Telemedicine can be defined as the use of telecommunications technologies to provide medical information and services. It is the use of information and communications technology to deliver health care services to people who are some distance from the health care provider. Telemedicine has a wide range of applications in patient care, education, research, administration and public health. It has come a long way in terms of both healthcare delivery and technology. It is a common practice in developed countries; it has been widely used in developing countries to resolve the issues of medical care access. Even though telemedicine cannot resolve all the problems, it can undoubtedly help reduce the burden of the healthcare system to a large extent. In this article, the literature pertinent to telemedicine and its applications are reviewed and summarized.

Keywords : *Telemedicine, healthcare, remote consultation*

Introduction:

For more than two decades, a group of medical work technologies, known as ‘telemedicine’ have been presented as a complete solution for individuals residing in developing countries and rural and remote areas or urban places with limited healthcare facilities or for those people who cannot afford other types of health care. ¹

The World Health Organization (WHO) defines Telemedicine as, “The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation and for the

continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities.”²

The use of telemedicine as a method of delivering healthcare has been gaining popularity. This may either be due to the advancements in the technology which have made the equipment less costly and easier to use or it may be due to the increased demand to find newer methods of healthcare delivery as the healthcare expenses and patient expectations have increased.³

People residing in rural and remote locations always fail to get timely, high-quality specialty medical care. Telemedicine has a wide range of applications in patient care, education, administration, research and public health.⁴ The aim of this article is to compile a comprehensive review of the literature on telemedicine and its applications.

History of Telemedicine

According to the first published record of telemedicine, ECG was transmitted over the telephone lines in the beginning of the 20th century. In 1960s, telemedicine was initially used by military and space technology sectors and by few individuals who readily used commercial equipments. Inventions like electrical telegraph and telephone had an important role in launching the modern telemedicine. Telephone could reach a larger population in a short period of time. In 1959, the doctors at University of Nebraska used interactive telemedicine to relay neurological tests, which was the first recorded instance of real-time (live) video consultation. Satellite technology used in telemedicine has proved to be crucial in breaking technological barriers and has left an indelible mark in the history.⁵

The introduction and widespread popularity of the internet has hastened the speed of Information and Communication Technologies (ICT) developments, thereby expanding the reach of telemedicine to include web-based applications (example: e-mail, teleconsultations and online conferences) as well as multimedia approaches like digital imagery and video. These developments have resulted in creation of wide range of telemedicine applications that are now being used all over the world.⁶

Goals of Telemedicine

Primary goals of telemedicine:⁷

1. To provide clinical assistance.
2. It aims to break down the geographical barriers, and thereby connecting users who are not physically present in the same place.
3. It involves the application of different information and communication technologies.
4. Its aim is to improve health outcomes.

Types of telemedicine

Telemedicine can be classified into 5 basic types:

Depending upon the timing of the information transmitted:

- (i) Real time or synchronous telemedicine (both the sender and receiver are online at the same time and the information is transferred ‘live’).

- (ii) Store-and-forward or asynchronous telemedicine (sender stores the information databases and sends them to the receiver at a convenient point of time, and the receiver checks the data according to his convenience).
- (iii) Remote Monitoring type of telemedicine, also referred to as self-monitoring or self-testing. Remote monitoring utilizes a number of electronic devices to keep a track of the patient's well being and clinical signs remotely.

Depending on the interaction between the individuals involved:

- (iv) Health professional to health professional (provides easier access to speciality care, referral and consultation services).
- (v) Health professional to patient (provides healthcare to the inaccessible population by giving them direct access to a medical professional).⁵

Applications of Telemedicine

1. EDUCATIONAL

- Tele-education: A flexible and interactive long distance learning programme that allows for easier training and updates of the recent developments for more reliable and effective treatment approaches.
- Tele-Conferencing: Discussion and interaction between doctors during workshop, conferences, seminar or continuing medical education programs in a virtual room setting.
- Tele-Procutoring: Mentoring and evaluating surgical trainees from distance using advanced video-conferencing equipment.⁸

2. HEALTHCARE DELIVERY

- School-Based Health Centers: Helps to treat chronic diseases like bronchial asthma, diabetes and obesity. Telemedicine helps a school nurse to consult a specialist medical opinion from a distance.
- Correctional Facilities: Helps to meet the treatment needs of the inmates without incurring the costs and risks of inmate transportation or the requirement of a specialist doctor.
- Mobile Health Clinics: Provides immediate access to a physician or medical specialist who is present elsewhere.
- Shipping and Transportation: Assists in avoiding evacuations and unscheduled diversions in the event of a medical emergency.
- Industrial Health: Provides medical management and triage advice on-site.⁵

3. HEALTHCARE MANAGEMENT

- Tele-health care: Use of ICTs for preventive healthcare; it is further subdivided into teleconsultation and tele-follow up.

- Tele-home health care: With the aid of a Computer Telephone Intergrated (CTI) device, track patients from a central station for 24 hours vital monitoring.
- Specialties like tele-ophthalmology, tele-psychiatry, tele-cardiology, and tele-surgery.
- Diagnostic services like tele-radiology and tele-endoscopy⁸

4. SCREENING OF DISEASES

Examples:

- Diabetic screening project by MDRF: The Chunampet Rural Diabetes Prevention Project.
- Ophthalmology screening by Aravind Hospitals at Andipatti village.^{9,10}

5. DISASTER MANAGEMENT: A mobile and portable telemedicine system with satellite connectivity and customized telemedicine software is ideal for a disaster stricken area where all other modes of communications are disrupted.⁵

Examples:

- NASA tele-medicine services provided during 1985 Mexico City earthquake and 1988 Soviet Armenia earthquake.¹¹
- Amrita hospital tele-medicine services provided during 2004 Tsunami disaster.

Telemedicine In India

In India, the use of telemedicine services is slowly gaining popularity. The Department of Information Technology (DIT), Ministry of External Affairs, ISRO (Indian Space Research Organization), Ministry of Health and Family Welfare and the state governments have played a crucial role in the growth of telemedicine services in India.

ISRO was the first to introduce telemedicine in India in 2001, with Telemedicine Pilot Project, connecting Chennai's Apollo Hospital with Apollo's Rural Hospital at Aragonda village in the Chittoor district of Andhra Pradesh.¹²

In India, telemedicine services are actively supported by:

- Department of Information Technology
- Indian Space Research Organization
- NEC Telemedicine program for North-Eastern states
- Apollo Hospitals
- Asia Heart Foundation
- State governments
- Private organizations.¹³

The private sector has shown great interest in the field of Telemedicine. Some of the major Indian private sector groups in telemedicine operate with the help of central and state governments as well as organizations like ISRO, which provide them with appropriate and latest technology.

The telemedicine network of ISRO has progressed in last few years. It connects 45 rural and remote hospitals as well as 15 superspeciality hospitals. The islands of Andaman and Nicobar and Lakshadweep, the hilly regions of Jammu and Kashmir, Medical College hospitals in Orissa and few of the rural/district hospitals in other states are some of the remote nodes.¹⁴

In India, various models of telemedicine are operational, which can be divided into two broad categories: one is the government-operated, government-funded model and the other one is the private party operated, government funded (Public-private partnership model). The hub-and-spoke model is used by majority of telemedicine networks in India. The hub is usually a tertiary health-care center like medical college hospital and the spoke is the peripheral health-care center such as district hospitals, community health center, primary health center and subcenters.¹⁵

Challenges in the line of telemedicine

Medical doctor's perspective: Doctors are not completely convinced and are unfamiliar with e-medicine.

Patient's anxiety and unfamiliarity: Patients are doubtful of the outcome of e-Medicine.

Expensive: The technology and communication used for telemedicine are highly priced and thus become financially unfeasible.

Lack of basic amenities: In India, almost 40% of the population are deprived of the basic amenities like transportation, electricity, telecommunication, safe drinking water and primary health services.

Literacy rate and diverse languages: In India, only about 65.38% of the population is literate and only 2% is fluent in English.

Technical sensitivity: Various software and hardware used in telemedicine requires to be updated. Advanced biological sensors and faster bandwidth support are required for proper diagnosis and data pacing.¹⁶

Telemedicine during the era of COVID-19 pandemic

Telemedicine has proved to be an added boon in the aftermath of the current pandemic, and provides added advantages to both health care professionals and the patients.

Telemedicine can be used to treat chronic diseases like bronchial asthma, hypertension, and diabetes mellitus especially during these times when social distancing is followed. COVID-19 is more common in people with these chronic diseases and drug adherence and disease management are effective ways to reduce its severity.

Telemedicine is a safe and an effective substitute to in-person care. Telemedicine may also be used to provide support to the patients and their family members thus preventing them from being infected.

During COVID-19 pandemic, the use of telemedicine will help ease the pressure on the tertiary hospitals by providing with the diagnosis and treatment to the patients in their own geographical area and thereby reducing the risk of patient's exposure from the hospital visits.

Telemedicine may also aid in training the caregivers to provide adequate care to the sick, disabled children and elderly.¹⁷

Benefits of telemedicine

- Better access to information
- Availability of previously inaccessible resources
- Better access to health care services and increased care delivery
- Facilitates professional education
- Quality control of screening programmes
- Reduced health-care costs.¹⁸

Drawbacks of Telemedicine

Even though telemedicine has a lot of possible advantages, there are certain drawbacks too. The following are the main disadvantages that can be envisaged:

- a breakdown in the relationship between health care professional and patient
- a breakdown in the relationship between health care professionals
- problems with the quality of health information
- organizational and bureaucratic challenges.¹⁸

Conclusion

Telemedicine has the potential to augment conventional methods of health care so that one day high-quality health care will be available to everyone, everywhere. Although telemedicine cannot solve all the problems, it can be very helpful in resolving a wide range of problems. Telemedicine has the potential to reduce healthcare costs for both hospitals and patients. Telemedicine can improve access, quality, quantity, and continuity of medical care for patients as well as reduce healthcare costs. Telemedicine should not replace face-to-face consultations of providers and patients. Rather, it should supplement these important relationships. Telemedicine is best utilized when patients would otherwise not have access to needed primary and specialty care in many remote and rural areas.

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