Review Article

Telemedicine : Current Status & Future Prospects

Ajay Manikrao Khade[1]

Recently Telemedicine has gained importance. The distribution of healthcare facility at distant places is Telemedicine. It has played important role during COVID-19. Healthcare facilities are well developed in urban areas whereas it is compromised in rural areas. Telemedicine can be the solution. There has been lot of development in this field. There has been use of smartphones and satellite communication in Telemedicine. In USA, NASA was instrumental in the implementation of Telemedicine whereas in India ISRO initiated Telemedicine. There is also involvement of private companies. There is support from Government and coordination by ISRO to provide different types of healthcare services. ISRO has developed Village Resource Centre to provide Tele-education, e-governance services, water management etc. Ministry of health and family welfare provides online consultations, e-learning, tele-education by involving Government Medical Colleges. Even Telemedicine mobile vans are deployed during religious congregations. Telemedicine is of two types mainly pre-recoded in which information is stored and the real-time in which there is interactive communication. There are different challenges in the implementation of Telemedicine like infrastructure high cost, implementation, awareness about digital technology, acceptance of digital technology and regarding diagnosis. But still there are certain advantages like convenience, being economical its usefulness in remote areas.

[*J Indian Med Assoc* 2024; **122(6):** 55-8]

Key words **: Telemedicine, e-learning, Tele-education, Types of Telemedicine.**

During the recent COVID-19 pandemic, the awareness about Telemedicine has gained importance. As strict lockdown was imposed throughout the country, the patients found difficulty in availing consultations for less severe ailments. The practitioners had resorted to teleconsultations. Thus, Telemedicine is in news. Telemedicine is the distribution of healthcare facility at far places. It is done by use of internet for the diagnosis, prevention and treatment. The healthcare professionals are continuously educated and updated so as to make significant improvement in the healthcare particularly of those individuals who are living in far distant places[1]. The Greek meaning of the prefix Tele means 'at a distance'. Hence, Telemedicine refers to the delivery of healthcare and healthcare information at a faraway distance.

India is one of the big countries in world having an enormous population. The Doctor Population ratio in India is alarming and it was 0.77: 1000 in 2017 whereas according to World Health Organization (WHO) it should be 1:1000[2]. The urban rural doctor ratio is 3.8:1 ie, four times more doctors are available in urban regions as compared to doctors available in villages where maximum population resides[3]. Healthcare infrastructure is well developed in urban areas whereas the healthcare facilities in rural areas, tribal region is minimal. Moreover, there is lack of trained manpower and limited hospitals. This barrier can be removed by the effective usage of Telemedicine.

Editor's Comment :

- Telemedicine is an extremely beneficial healthcare service with a potential of alleviating the shortage of physicians in remote areas and providing access to specialty services in a cost-effective manner. If policymakers could ensure adequate availability of technological resources and security of patient's personal information, then Telemedicine can be utilized to its highest potential in Indian context

History of Telemedicine :

The earliest mention of using medicine at a distance was in Middle age. This was regarding the use of bonfires for alarming the public about Bubonic Plague in Europe. Telegraphy was used to transfer inventory of casualties in American civil war to receive supply of medicines and to send X-ray images. In Europe and USA, telegraphy was replaced by telephone. Telephone was one of the important means for delivering healthcare services. By 1910, telephone was also used for innovative purposes other than communication of voice. The telephone network transmitted the heart sounds from stethoscope. It was also used for ECG and EEG transmission. In Radio News magazine of

[1]MD, Professor and Head, Department of Pharmacology, Datta Meghe Medical College, Nagpur, Maharashtra 440016 and Corresponding Author

Received on : 28/10/2022
Accepted on : 10/01/2023

April 1924 issue, cover displayed a picture of a diseased person along with Television and microphone interacting with a physician. By 19th century end, successful communication by means of Radio began. This was achieved by using Morse code and subsequently by voice. Radio was used to get help for seamen. In 1920, Seamen's Church Institute of New York was established to give treatment using Radio. It formed Radio Medical Services in 1938. In Rome, International Radio medical Centre was formed and it helped 42,000 patients and it is the largest single organization in world that used Telemedicine for seafarers. Recently, Radio Medical Service is also provided for passengers travelling by air. Telemedicine has developed in USA due to the efforts by NASA[4]. Introduction of Television by 1950 further led to the development of Telemedicine with Doctor's making use of video communication and closed-circuit TV in clinical situations. The distance between Nebraska Psychiatric Institute in Omaha and State Mental Hospital in Norfolk is 180 km and a two-way close circuit television was established to connect them[5]. A television linking set up between doctors and patients was started in Massachusetts General hospital and Logan International Airport Medical station in 1967[6].

Current Scenario :

Nowadays there has been lot of development in Telemedicine. There is a change in electronic mode of communication from analogue to digital. Telemedicine based on videoconferencing is the newer initiative. Recently with the use of Smartphones and Satellite communication, mobile Telemedicine has started. ATS-6 Satellite Biomedical Demonstration provided healthcare services in villages of Alaska using Satellite mediated video communication[7]. Telemedicine saw its application in disaster management in 1985 when NASA used it in Mexico City earthquake of 1985 and also in earthquake tragedy at Soviet Armenia in 1988 where >50,000 casualties happened. Due to massive earthquake all modes of communication were disrupted, hence satellite communication was used[8]. USA is making the use of Telemedicine more as compared with European union, Japan and Korea. In Japan 12.5% hospitals use Teleradiology and 6.1% use Telepathology. Another problem in Japan is that the insurance companies reject claims related to Telemedicine. In Korea, Telemedicine is used for chronic disease management, for disabled patients and for patient living in remote areas[9].

Telemedicine in India :

ISRO started the first project of Telemedicine in 2001 in India by connecting Apollo Hospital in Chennai with Apollo Rural Hospital at Aragonda village in Chittoor district of AP[10] ISRO, Department of IT and Ministry of Health and Family Welfare, have coordinated in this project. Various projects have been initiated by Ministry of health like ONCONET (National Cancer Network) and IDSP (Integrated Disease Surveillance Project)[11].

The Telemedicine services established in India are Mammography services at Sri Gangaram Hospital, Delhi, Oncology at Regional Cancer Center, Trivandrum, Surgical services at SGPIMS[12].

Some of the leading private companies involved in Telemedicine are Apollo Telemedicine enterprises, Narayana Hrudayalaya, Escorts Heart institute, Asia Heart foundation, Aravind eye care and Amrita Institute of medical sciences[13]. These companies get support from State and Central Government and they coordinate with ISRO[14].

ISRO has made tremendous progress by providing health services to islands at Lakshadweep, Andaman and Nicobar and hilly regions of Jammu & Kashmir.

ISRO developed Village Resource Center (VRC) to provide services like online support, education, interaction with farmers, fishing, climate, e-governance, water management. There are 500 VRC in the country[15].

ICMR initiated a project which is internet based mobile Telemedicine conglomerate called AROGYASHREE that connects rural clinics with specialists and multiple hospitals[16].

Benefits of traditional methods of healing are promoted by National AYUSH Telemedicine Network to people with the effective use of Telemedicine.

Current Status of Telemedicine in India :

Government of India through Ministry of Health and Family welfare, provides Telemedicine as follows:

Online consultation – Telemedicine

This is meant for providing cost effective healthcare services to a large number of individuals. It links Information and Communication Technology (ICT) with the existing healthcare infrastructure facility. By making use of ICT, guidance is provided to impart basic and specialized healthcare facilities to the people living in distant and inaccessible regions. This involves coordinated efforts of: —

(1) National Medical College Network (NMCN)
(2) National Telemedicine Network (NTN)
(3) Space technology for Telemedicine

In NMCN, 50 Government Medical Colleges are linked by National Knowledge Network (NKN) for e-learning, Tele-education and online medical

consultation. Online consultation is provided by specialists/superspecialists. Patients from remote locations can have access to doctors from their home by Smartphones through PHC/CHC. Medical colleges conduct lectures or seminars and these can shared/ streamed.

NTN provides services to faraway places by upgrading the existing Government healthcare facilities ie, CHC, PHC, DH, MC. Telemedicine centers/nodes are created by connecting these healthcare facilities in every state. These services seek financial assistance through National Health Mission (NHM).

Department of Space under the aegis of ISRO initiated Telemedicine in 2001. They supplied Telemedicine system hardware, communication equipment, software and satellite bandwidth for 384 hospitals.

As per the Prime minister's vision of using space technology for providing healthcare facility at distant faraway regions, Ministry of Health and Family Welfare and Department of Space have set up satellite communication-based Telemedicine node at various difficult terrain like Chardham, Amarnath, Kedarnath to provide specialty consultations to devotees.

A Telemedicine Mobile van was deployed at Ujjain Kumbh mela in 2016.It was well-equipped with medical facilities for screening of non-communicable diseases and health awareness. Specialist consultation was also provided by a team of doctors from SGPGI Lucknow and AIIMS Bhopal through Telemedicine by using VSAT connectivity[17].

Types of Telemedicine :

Depending on the interaction between the expert and the client, Telemedicine is divided into following types:

(1) Pre-recorded/Store-and-forward

In this type the data is collected and stored. It is later given for analysis by expert. The most common method used is email.

(2) Realtime/Synchronous

In this type, there is literally no lag between the data collected, transmitted and displayed. It is possible to have interaction between the individuals on the site. It is done by video-conferencing[18].

Telemedicine is also divided into :

(1) Registered Medical Practitioner (RMP) to RMP — In this Telemedicine is used to communicate between two RMPs.

(2) Patient to RMP — Patient make use of Telemedicine to connect with RMP

(3) Caregiver to RMP — The patient or a family member representing the patient authorizes a person. In this method caregiver is connected with RMP.

(4) Healthworker to RMP — health worker can be a qualified nurse, mid-level health provider, allied health professional, ANM. The health worker can take the history, conduct the examination of patient and report the findings to RMP[1].

Challenges in implementation of Telemedicine :

(1) Infrastructure :

High cost is involved to develop infrastructure required for information and communication technology in order to initiate telemedicine for patients from rural and remote areas[19]. This requires monetary support from the Government for software, hardware and qualified manpower.

(2) Implementation :

Implementation of Telemedicine involves the role of several factors such as technological, legal, regulatory, security and human resources.

(3) Awareness about digital technology :

This problem specifically arises if Telemedicine has to be implemented for remote areas and for people from rural background and also for the elderly age group patients. These people are not techno-savvy. They are not comfortable in handling the gadgets like smartphone.

(4) Acceptance of digital technology :

People from rural background do not readily accept this new technology. There are certain issues related to privacy and security. Moreover, wearable devices that measures blood pressure, heart rate are used for monitoring and transmission of data to the receiving nodes. This can be used for early detection and warning. Hence, the targeted population must be willing to accept the newer technology, otherwise Telemedicine will be futile.

(5) Regarding diagnosis :

In Telemedicine, correct diagnosis of the disease condition can be questionable as the physician and patients are at distant locations. Clinical diagnosis requires direct interaction between physician and the patient. It also imparts a psychological impact on the patient. The physician can diagnose based on the clinical signs and physical examination[20].

Conclusions

The current COVID-19 pandemic has highlighted the significance of Telemedicine. Telemedicine plays important role in providing healthcare facilities while maintaining physical distance to prevent the spread of infection. It is not known what sort of infections lies in future. Its other advantage is convenience, economical and particularly its usefulness to patients living in

remote locations, difficult terrain. More research work and development should be done to explore the use of Telemedicine in our country.

Conflict of Interest : None

References

1 Telemedicine Practice Guidelines-MoHFW. Available from: https://www.mohfw.gov.in accessed on 17/7/2022.

2 India achieves WHO recommended doctor population ratio: A call for paradigm shift in public health discourse! Raman K, Ranabir P. *J Family Med Prim Care* 2018; **7:** 841-44.

3 National Medical Commission Bill 2019. Available from: https://pib.gov.in accessed on 17/7/2022.

4 Kichloo A, Albosta M, Dettloff K, Wani F, El-Amir Z, Singh J, *et al* — Telemedicine, the current COVID-19 pandemic and the future: a narrative review and perspectives moving forward in the USA. Fam Med Community Health.2020; 8: e000530.

5 Mclaren P, Watson JP, Summerfield AB, Lipsedge M — Interactive television in psychiatry. *Psychiatric Bulletin* 1992; **16:** 288-91.

6 Murphy RLH, Bird KT — Telediagnosis: a new community health resource. Observations on the feasibility of telediagnosis based on 1000 patient transactions. *Am J Public Health* 1974; **64:** 113-9.

7 Foote DR — Satellite communication for rural health care in Alaska. *J of Communication* 1977; **27:** 173-82.

8 Chellaiyan VG, Nirupama AY, Taneja N — Telemedicine in India: where do we stand? *J Family Med Prim Care* 2019; **8:** 1872-6.

9 Oh J-Y, Park Y-T, Jo EC, Kim S-M — Current status and progress of telemedicine in Korea and other countries. *Healthc Inform Res* 2015; **21:** 239-43.

10 Tele-medicine – ISRO. Available from: https://www.isro.gov.in

11 Mishra S, Kapoor L, Singh I — Telemedicine in India: Current scenario and the future. *Telemed J E Health* 2009; **15:** 568-75.

12 Sudhamony S, Nandakumar K, Binu P, Niwas SI — Telemedicine and tele-health services for cancer care delivery in India. *IET communications* 2008; **2:** 231-36.

13 Mehta KG, Chavda P — Telemedicine: A boon and promise to rural India. *J Rev Prog* 2013; **1:** 1-3.

14 Dasgupta A, Deb S — Telemedicine: A new horizon in public health in India. *Indian J Community Med* 2008; **33:** 3-8.

15 Village Resource Centre– ISRO. Available from: https://www.isro.gov.in

16 Arogyasree: an enhanced grid-based approach to mobile telemedicine. Available from: https://dl.acm.org

17 e-Health & telemedicine. Available from: https://main.mohfw.gov.in accessed on 17/7/2022.

18 Craig J, Patterson V — Introduction to the practice of telemedicine. *J Telemed Telecare* 2005; **11:** 3-9.

19 Bujnowska-Fedal MM, Grata Borkowska U — Use of telemedicine-based care for the aging and elderly: promises and pitfalls. *Smart Homecare Technology and Telehealth* 2015; **8:** 91-105.

20 Khemapech I, Sansrimahachai W, Toahchoodee M — Telemedicine-Meaning, Challenges and Opportunities. *Siriraj Med J* 2019; **71:** 246-52.