Current scenario, future possibilities and applicability of telemedicine in hilly and remote areas in India: A review protocol

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ABSTRACT

In India telemedicine is ideal because of its diverse landmass, difficult terrain and huge population. India, a developing country is witnessing an increase in economic growth but growing health expenditure is still posing a challenge. Telemedicine offers a solution to bridge the gap between resources available and growing needs in the health care set up. It offers an opportunity for effective collaboration of primary and secondary health care setups and to reach population staying in underserved areas. The purpose of this article is to discuss current scenario, future possibilities and applicability of telemedicine in hilly and remote areas in India.

Keywords: Application in hilly and remote area, future possibilities, tele-education, telemedicine

Introduction

Information and communication technologies offer countless opportunities to cater to challenges and issues faced by both developing and developed countries in providing cost-effective as well as good quality health care services. India is a huge country with current population is 1,376,011,193 occupying 1,147,955 sq. miles area. It comprises of 8 union territories and 28 states. It has been noticed that there is a major divide in quality of healthcare services offered to villages and metropolitan cities. Although the use of telemedicine in India is encouraging, COVID-19 pandemic has provided another reason for further expansion of telemedicine services in India.

A review shows that the around 75.1% competent doctors practice in urban areas, 23% in towns (semi urban) whereas only 2% of doctors practice in rural areas. Rural areas are grossly deficient in medical facilities. Thus, there is an urgent need to uplift telemedicine services in India to reduce patient doctor ratio, frequency of patient visits and curtail chain of infection transmission in these COVID times.

Telemedicine delivers health care by virtue of exchange of data, information and use of telecommunication technology. Data and information may be in the form of image, voice and medical record or surgical robot commands. Thus, telemedicine is prudent for effective remote communication of information to facilitate clinical care.

Telemedicine, in the present form, was initiated in 1960. The driving force behind this initiative was space technology and military sector. It was first used in the early 20th century for ECG...
reading. However, recent advancement, increased availability as well as utilization of Information, Communication and Telemedicine (ICT) by the rural population of India has created new health care services opportunities and better delivery of services. Uttarakhand, due to its difficult terrain has not been able to utilize telemedicine to the fullest. The underlying reason is underdeveloped infrastructure and inappropriate bandwidth to run telemedicine health care services in the state. There is also scarcity of trained human resources and capable personal in rural areas. Consequently, there exists a crucial gap between public health services and needy population.[8]

**Material and Methods**

Literature search was done on various features of telemedicine in India such as various projects sponsored by Government of India, activities undertaken by health care, scientific publications and organizational activities by utilizing Google search engines, Web of science and Medline. The information collected was compiled, analysed and synthesized.

**Results**

According to WHO, the recommended ratio of doctor and population is 1:1000 but in India it is 0.62 per 1000.[7,8] As of now, new physicians training is both expensive and time consuming. This shortage is fairly being compensated by the active services of telemedicine in numerous parts of the country.[9] Telemedicine in India could be a boon especially in hilly areas and underserved regions. In these areas, the Government of India along with many private organization has taken up initiative to overcome various health issues through telemedicine.

The information was synthesized on telemedicine across pan India related to future possibilities of telemedicine, challenges in hilly areas and national initiatives. Collective efforts of DIT (Department of Information Technology), ISRO (Indian Space Research Organization), Ministry of Health and Family Welfare in collaboration with the state governments have led to the development of telemedicine services in India.

**Department of information technology (DIT)**

In 2000, a project of telemedicine was initiated in various parts of this country. For instance, in West Bengal it was started for diagnosing and monitoring various diseases. In Kerala and Tamil Nadu it was initiated especially for cancer patients whereas in Maharashtra and Punjab the initiative was taken up for improved access to health care in rural areas. DIT has already established links in premier institutions. These are All India Institute of Medical Sciences Delhi, Sanjay Gandhi postgraduate Institute of Medical sciences (SGPGIMS) and Post Graduate Institute of Medical sciences (PGIMER) Chandigarh which are connected to state level hospitals. It has established more than 70 nodal centres pan India to support various research activities as well as for improved access to health care system. This project was started with collaboration of Webel Electronic Communication System Ltd (Webel ECS), West Bengal state government, Indian Institute of Technology (IIT) Kharagpur and various others health care centres with prime aim to deliver better health care services with various super specialities like oncology, cardiology, dermatology, pediatric, medicine and HIV services in rural areas of India. This project has also played a key role in provide training and medical education to health care workers in these areas of India.[3,10,11]

**Indian space research organization (ISRO)**

ISRO initiated Telemedicine Pilot Project in 2001. It linked Chennai Apollo hospital and rural health care services at Agonda village in Andhra Pradesh.

The concept of Village resource centre (VRC) was first introduced by North Eastern Space applications Centre (NESAC), which was established by department of space, ISRO and the North Eastern Council (NEC) in the year of 2000. VRCs provide various other services like creating and maintaining database as well as issuing timely advisories to farmers and villagers which can be helpful in agriculture and weather forecasting. By using satellite GSAT-3 INSTA-3A communication, a plan was formulated in 72 regional telemedicine nodal centres in various districts of Nagaland, Arunachal Pradesh, Assam, Tripura, Sikkim, Meghalaya and Mizoram. The prime aim of this project was to connect tertiary care hospitals to north–east districts level hospitals to provide health care services to these remotes districts of India. This project ensured timely delivery of health care especially in critically ill and emergency situations in distant rural areas. The Ministry of Health has undertaken projects such as Integrated Disease Surveillance Project, National Centre Network, National Rural Telemedicine Network, National Medical College Network and Digital Medical Library Network. The other international projects are Pan-African e-Network Project and SAARC (South Asian Association for Regional Co-operation) Telemedicine.[12-14]

Novel coronavirus, a highly exponentially spreading pandemic has resulted in further scarcity of doctors worldwide. Thus, telemedicine has taken a front seat providing an effective solution to the same.
Corporate sector

The Apollo Hospital Group is playing major role to provide health care facilities using telemedicine in 64 health centres. Amrita Institute of Medical Sciences, Kochi is linked to 60 health centres accross India and 9 international centres. Narayana Hrudayalaya, Bengaluru is linked to 55 centres. Fortis Hospital, New Delhi is linked to 27 centres. Sir Ganga Ram Hospital (SRGH), New Delhi has launched telemedicine services in Rajasthan and Haryana as well.[15-19]

Mobile telemedicine

With the help of ISRO, some eye hospitals (Shankar Nethralaya at Chennai, Meenakshi Eye Mission and Aravinda Eye Hospital at Madurai and four more corporate eye hospitals) have launched mobile tele-ophthalmology services to manage ophthalmic diseases under National Blindness Control Program. The Government of Andhra Pradesh has launched a mobile clinic that would be easily accessible through “104 services” and this mobile clinic daily visits at least two villages of Andhra Pradesh to check health parameters of people.[20-23]

Ministry of health and family welfare (MOH&FW)

Ministry of health and family welfare has already implemented Integrated Disease Surveillance Project networking all district hospitals attached with medical colleges of the state to empower the public health system, mainly focusing on disease surveillance. It has further initiated establishment of National Rural Telemedicine Network in Himachal Pradesh, Maharashtra, Punjab, West Bengal,
Dadra and Nagar Haveli, Assam and Tripura and has launched tele-ophthalmology pilot projects in various states.¹³

**Knowledge sharing**

Various premier institutes, AIIMS Delhi, Christian Medical college (CMC), Vellore, PGIMER, Chandigarh, SGPGIMS, Lucknow are sharing their professional knowledge and varied other educational activities by using teledmedicine network.¹⁰

In India telemedicine has become an integral part of mainstream medical practice. Ex-President Dr Kalam also used the word “teledmedicine” in his Republic day address five times. Clearly, this is a big drive area in India’s race to become a developed nation.¹⁶

To spread awareness program in country about telemedicine Government along with private sector is actively involved. India is emerging as a promising and eminent leader in the field of teledmedicine.¹⁴

A study showed paediatric and geriatric age groups as well as pregnant women are more likely to get benefitted by teledmedicine services. These services will be useful in avoiding unnecessary travel by using teledmedicine under medical care.¹⁷

In India, Telemedicine market is expected to cross US$5.5 Billion by 2025 which is showing in Figure 1.¹⁹

**Telemedicine in hilly area**

Telemedicine is a most appropriate facility for those living in hilly or remote mountainous areas. With the help of facility of e-health telemedicine, the patient’s diagnosis can be done immediately by the physician’s specialist of Multi-speciality hospital, and medicines ordered as per the ailment as quoted by Shri Trivendra Singh Rawat Chief Minister of Uttarakhand India while inaugurating the project. KareXpert Technologies (Reliance Jio funded organization) signed a 5 Year MoU with Nainital district administration on 06 November 2019.¹⁹

The first teledmedicine centre in Uttarakhand was compositely founded in Tehri (2018) with the efforts of a sponsored NGO (SEWA-THDC) of THDC, and Tehri District Magistrate and initially, a toll free number “555” was launched to provide health care services to the rural public in Uttarakhand. Later, it expanded to 20 dispensaries and each teledmedicine centre is connected to a video control room situated in government hospital of Tehri. All centres are well equipped with a medical kit including ECG machine with Wi-Fi ECG recorder, glucometer, pulse oximeter, X-Ray view box and other important equipment, a complete pathological kit along with important medicines and diagnostic facility with portable hot spot, communication and data transfer with the district hospital. These centres are taken care by skilled pharmacists or nurses, specialist doctor at the control room in Baurari District Hospital and for further expert opinion these are connected with AIIMS, Rishikesh.¹⁸

Nainital, is a hilly area with varied topography in the state of Uttarakhand. Patients residing in these areas have no option but to travel to main cities to avail superspeciality health care services. Thus, making the cost of treatment so expensive for the patients of rural Uttarakhand. Because of challenging conditions of geography of the state, physician is not available in many areas. In this condition, telemedicine facility can be effective for needy population of rural area. Through telemedicine, patient and their relatives who come from remotes area can have easy access to multi-speciality hospitals.¹⁹

**Challenges in hilly or remote areas**

Worldwide, maximum people living in rural and remote areas are struggling to access appropriate and improved health care services. Accessibility of telemedicine helps in remote monitoring, storing and forwarding data and real time interaction between patient and consultants.¹² ¹⁴

- **Telemedicine programs mainly depend on optimum internet network, therefore interrupted and poor connection lead to program failure. For succession it must not be interrupted.**
- **Expensive instruments and lack of service engineers in rural area pose hindrances in the implementation of tele services leading to underutilization of the services.**
- **Due to lack of orientation of use of tele instruments, villagers could not handle tele equipment independently so privacy issues can evolve.**
- **Lack of capacity building of staff and community is being a hurdle for full utilization of telemedicine services.**
- **Expansion of telemedicine centres in rural areas is not easy due to lack of well trained staff in some identified areas where public health facilities still not exist.**¹¹ ¹³

**Future possibilities**

Telemedicine has been effectively used for the betterment of patients while cutting down on healthcare costs. Health policy implementation such as national health protection scheme is one of the World’s largest government funded health care programme. National rural telemedicine network is one of the low costs developmental telemedicine projects. The highlights of telemedicine are lower cost and better accessibility of health care services.¹⁴

- **Currently the ISRO based services could be enhanced by improving mobile services and 4G networking and introducing technical inputs to improve audio-visual quality.**
- **Tele service sessions can be made patient approachable like some days in morning, evening and sometimes on weekends to improve maximum patient and doctor participation.**
- **Telemedicine awareness can be created in order to reduce load of hospital OPD. Patients who come to OPD to meet doctors or staff that can be educated about the usage of telemedicine so that follow ups visits can be done by using tele facility at the village.**
- **Telemedicine implementation can support epidemiological surveillance by assisting in tracking issues of public health and clarifying trends in future.**
• With the help of some technical tool the establishment of telemedicine centres should be encouraged targeting essential services during natural disasters.[39]

It is prudent to keep ethical and legal issues regarding patient privacy, health system priorities and confidentiality of database in mind while implementing telemedicine services.

Types and application of Figure 2 is showing various type of Telemedicine[37] where as Figure 3 is showing its applicability.[38]

Applications:

1. Health Education
   1.1 Tele-Education: A long distance program on health promotion and disease prevention including diet plan, exercise, cessation of smoking and immunization as well with more precise and actual training methods.[39]
   1.2 Tele-Proctoring: Monitoring and evaluation of learners while doing any surgical procedures from remoteness with the help of video conferencing equipment.[10]
   1.3 Tele-Conferencing: A very interactive conversation between health care professionals during workshops, conferences, seminars or CME programs in a simulated room environment.[10]

2. Counselling
   A specific advice can be given to patients and participants, for instance, do’s and don’ts in prevention of COVID-19, use of hearing aid, food restrictions, etc., and also advice some new investigations that may or may not to be carried out before next tele visit.[38]

3. Health management:
   Tele-health care provide chance to tele-follow up and tele consultation, to ensure 24 hours monitoring of patients from home. It can also be used to explore its others specialities like tele-psychiatry, tele-ophthalmology, tele-cardiology and tele-surgery with diagnostic services like tele-endoscopy and tele-radiology.[9,39]

   It can also be used to manage patients with chronic conditions like diabetes, asthma, tuberculosis, obesity and also provide triage and medical management advice on – site.[40]

   With recent guidelines of telemedicine in partnership with NITI Aayog India, medicine to be prescribed by health professionals are divided in several categories; O, A, B; whereas O list consist of paracetamol, oral rehydration solution (ORS) packets and antacids etc., A list consist of anti-fungal for tinea cruris, cipro floxacin eye drops for conjunctivitis etc., and lastly the B list consist of “add on” medications which are used to improve an existing condition. For instanceenalapril etc.[41]

4. Disaster and pandemic management:
   A pandemic like COVID-19 poses a hurricane challenge to provide health care facilities especially in rural and hilly areas but telemedicine offers an effective solution for the difficult times. It is best suited for this scenario in which a health care personnel can evaluate the patient and manage as well. A telemedicine visit can be safe without exposing medical personnel to virus/infections in this time of such outbreak if conducted. Using telemedicine patients can be screened in remote and hilly areas and thus unnecessary exposure can be prevented.

In India, till now there were no specific guidelines related to practice of telemedicine, phone, video, internet-based platforms. But now government of India has released guidelines related to telemedicine on 25 March 2020. A portable and mobile system of telemedicine with good connectivity with suitable software for disaster trouble areas may be a better way when other modes of connection are disrupted.[41,42]

Discussion

There are multiple challenges faced by telemedicine in delivering health care in underserved areas not only in India but throughout the world. There is an urgent need to standardize methods and techniques of telemedicine while delivering health care. They should be able to provide cost effective services. Standardization is also important in the management of critically ill patients as there can be underlying medico-legal implications. It is very important and need to be capitalize some successful projects like OncoNET in south India and ISRO projects in others state of India. Collaboration of World bank, UNICEF and many more international agencies could be a key player in success of telemedicine.[41-43]

Telemedicine has carved a distinct identity within the world and it has done so in several super speciality of medicine, cardiology, palliative care, diabetes and neurology, ophthalmology, dermatology and many more where it has been very successful. Recently NITI Aayog has issued telemedicine practice guidelines by virtue of which telemedicine can achieve different identity while easing delivering health care services pan India.[41]

Telemedicine services are mainly rendered by primary physicians. Thus, it is very important to train them to utilize these services to the maximum and reach out to larger section of society.

Conclusion

Telemedicine has appeared as a key player in healthcare system especially in underserved areas. Despite having utmost potential it still has not been able to attain the “boom” which it meant to create. The use of telemedicine and technology can have a great impact on rural population, especially in hilly and remote areas of India. It can offer both cost-effective as well as good quality care.

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Conflicts of interest

There are no conflicts of interest.

References

1. Prospects WP, Indian T, States U, Prehistory H. Demographics of India. 2020;1-3.
2. Mishra SK, Singh IP, Chand ED. Current status of telemedicine network in India and future perspective. Proc Asia-Pacific Adv Netw 2011;3:2-15.
3. Agarwal N, Jain P, Pathak R, Gupta R. Telemedicine in India: A tool for transforming health care in the era of COVID-19 pandemic. J Educ Health Promot 2020;9:190.
4. Bajpai M. Telemedicine: A Review. Webmed Central PUBLIC HEALTH 2012;3:WMC002847.
5. Currell R, Urquhart C, Wainwright P, Lewis R. Telemedicine versus face to face patient care: effects on professional practice and health care outcomes. Nurs Times. 2001;97:35. PMID: 11957394.
6. Suresh S, Nath L. Challenges in managing telemedicine centers in remote tribal Hilly areas of Uttarakhand. Indian J Community Heal 2013;25:372-80.
7. World Health Organization. Global Health Observatory (GHO) Data. Density Of Nursing And Midwifery Personnel (Total Number Per 1000 Population, Latest Available Year). 2015:1000. Available From: Http://Www.Who.Int/Who/Health_Workforce/Nursing_Midwifery_Density/En/.
8. Nagarajan R. 6 States Have More Doctors Than WHO’s 1:1000 Guideline. Tnn [Internet]- 2018;1-29. Available From: Http://timesofindia.indiatimes.com/India/6-States-Have-More-Doctors-Than-Whos-11000-Guideline-ArticleShow/65640694.Cms.
9. Chowdhury S, Chakraborty PP. Universal health coverage—There is more to it than meets the eye. J Fam Med Prim Care 2017;6:169-70.
10. Available from: http://Telemedindia.ORG. [Last accessed 2020 May 14].
11. Available from: https://www.webel.in/webel-electronic-communication-systems-ltd. [Last accessed 2020 May 1].
12. Dasgupta A, Deb S. Telemedicine: A new horizon in public health in India. Indian J Community Med 2008;33:3-8.
13. Available from: https://nesac.gov.in [Last accessed 2020 May 14].
14. Available from: Http://Www.Cips.Org.In/Documents/Publicated_Documents/E_Books/2015/Health_Telemedicine/Telemedicine-In-Tripura.Pdf. [Last accessed 2020 May 14].
15. Available at: from: https://www.isfreh.org/files/media/Dr_.Ganapathy_telemedicine_Apollo_contribution_an_overview.pdf. [Last accessed 2020 May 14].
16. Available from: http://www.amritahospitals.org/Amrita-Telemedicine. [Last accessed 2020 May 14].
17. Available from: https://www.fortishealthcare.com/20th-Annual-Report-2015-16_opt.pdf. [Last accessed 2020 May 14].
18. Available from: https://www.narayanahealth.org/sites/default/files/news-media/Press%20Release%20%28Edited%29%20CISCO-NH.pdf. [Last accessed 2020 May 14].
19. Available from: http://https://www.hindustantimes.com/delhi-hospital-keen-on-telemedicine-project/story-I4d0KjPzJftpnXUzW5PMdM.html. [Last accessed 2020 May 14].
20. Available from: https://www.sankaranethralaya.org/teleophthalmology.html. [Last accessed 2020 May 14].
21. Available from: https://timesofindia.indiatimes.com/city/madurai/city-hospitals-to-take-teleconsultation/articleshow/74921093.cms. [Last accessed 2020 May 14].
22. Available from: https://www.thehindu.com/news/cities/Madurai/Telemedicine-takes-healthcare-to-a-new-level/article14414168.ece. [Last accessed 2020 May 14].
23. Available from: https://www.r4d.org/wp-content/uploads/Andhra-Pradesh-Health-Sector- Reform_A-Narrative-Case-Study.pdf. [Last accessed 2020 May 11].
24. Division T. — Evolution of Telemedicine In India: Summary. 2006.
25. Mahapatra AK, Mishra SK. Bridging the knowledge and skill gap in healthcare: SGPGIMS, Lucknow, India Initiatives. J eHealth Technol Applic 2007;5:67-9.
26. Telemedicine in India. 2006;10:1086-91.
27. Hersh WR, Wallace JA, Patterson PK, Shapiro SE, Kraemer DF, Eilers GM, et al. Telemedicine for the medicare population: Pediatric, obstetric, and clinician-indirect home interventions. Evid Rep Technol Assess (Summ) 2001;24 Suppl:1-32.
28. Available from: https://www.gmindsight.com/industry-analysis/telemedicine-market. [Last accessed on 2020 May 16].
29. Technologies K, Limited P. Karexpert join hands with the government of Uttarakhand to provide advanced telemedicine services. 2020. Ava lable from: https://www.theweek.in/wire-updates/business/2020/02/25/pwr10-karexpert%20technologies%20private%20limited.html. [Last accessed 2020 Sep 10].
30. HI B, Dehradun B, Magistrate D, Minister C, Singh T. TDHCl spearheads telemedicine health scheme in Tehri. 2020/Jan 2019:2019-20.
31. Allow D. Uttarakhand: Telemedicine and radiology service will be expanded. 2020;4-7. Available from: https://www.google.com/search?rlz=1C1CHBF enIN912IN913&ssrf=AleEkKo17w_w0ZGzma7hjcoOZReki s4GyGRA%3A1604899452938&q=+Uttarakhand%3A+Telemedicine+and+radiology+service+will+be+expanded%2C+doon+live+January+15%2C+2020&oi=highres&srcid= piss4xmAEAoAEBqgEHZ3dzLkpesgRCMABAQ&scsid=psy-ab&ved=0ahUKEwju340U3tPSrAhXCrXMBHYb3DWC4dU DCAC&uact=5. [Last accessed on 2020 Sep 10].
32. Lee ACW, Harada N. Telehealth as a means of health care delivery for physical therapist practice. Phys Ther 2012;92:463-8.
33. Higgins C, Dunn E, Conrath D. Telemedicine: An historical perspective. 2020;2-3. Available from: https://www.sciencedirect.com/science/article/abs/pii/03085916184900442. [Last accessed on 2020 Sep 10].
34. Bashshur R, Lovett J. Assessment of telemedicine: Results of the initial experience. Aviat Sp Environ Med 1977;48:65-70.
35. Questions FA. Telehealth use in rural healthcare how does telehealth improve healthcare access in rural communities, and what types of services have proven to be. 2019:1-11. Ava lable from: https://www.ruralhealthinfo.org/topics/telehealth. [Last accessed on 2020 Sep 10].
36. Mahar BJH, Rosencrance JG, Rasmussen PA. The future of telemedicine (And what’s in the way) issues of interstate licensure and reimbursement abound telemedicine at Cleveland clinic. 2016.
37. Kay M, Santos J, Takane M. Telemedicine: Opportunities and developments in member states. Observatory 2010;2:96. Available from: https://www.who.int/goe/publications/goe_telemedicine_2010.pdf [Last accessed on 2020 Sep 10].
38. Holla B, Viswanath B, Neelaveni S, Harish T, Kumar CN, Math SB. Karnataka state telemedicine project: Utilization pattern, current, and future challenges. Indian J Psychol Med 2013;35:278-83.
39. Curran VR. Tele-education. J Telemed Telecare 2006;12:57-63.
40. Available from: https://portal.ct.gov/DPH/Family-Health/School-Based-Health-Centers/School-Based-Health-Centers. [Last accessed 2020 May 11].
41. Available from: Https://Www.Mohfw.Gov.In/Pdf/Telemedicine.Pdf. [Last accessed 2020 May 17].
42. Mathur P, Srivastava S, Lalchandani A, Mehta JL. Evolving role of telemedicine in health care delivery in India. Prim Heal Care Open Access 2017;7:1-6.
43. Sudhamony S, Nandakumar K, Binu PJ, Issac Niwas I. Telemedicine and tele-health services for cancer-care delivery in India. IET Commun 2008;2:231-6.
44. Available from: Https://Www.Researchgate.Net/Publication/4363182_Nationwide_Tele-Oncology_Network_In_India_-_A_Framework_For_Implementation. [Last accessed 2020 May 17].
45. Available from: Http://onconet.in/?page_id=8377. [Last accessed 2020 May 11].