Bringing Health Care Closer to People – A Review of Various Telemedicine Models under the National Health Mission in India

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Abstract

Telemedicine is an alliance between technology and medicine. It is a prevalent practice in developed countries; it has been widely used in developing countries to address the issues of access to medical care. India has been experimenting with telemedicine since long to address the issues of access and availability of specialist care and in recent years, with the rapid advancement of information technology, telemedicine has become a popular concept across the country. In this article, we have reviewed the various aspects of different government-funded telemedicine models functional in 12 states across India. We have also attempted to explore the levels of care delivery and services at facilities provided through telemedicine and challenges being faced in the implementation of the models. As a way forward, the health-care community needs to realize the full potential of telemedicine facility and utilize it to their benefit. Telemedicine will work best when it is one component of a well-functioning health system and not as an isolated gap-filling application.

Keywords: Access, government-funded, health care, National Health Mission, public–private partnerships, telemedicine

Introduction

It would be prudent to state that India has made considerable progress in the last decade in providing health-care services to its 1.3 billion population. With the vision to provide universal access to healthcare, India's health system has experimented and adopted many approaches to ensure the availability of health care closer to the community.

Physical access has been cited as a major barrier to both preventive and curative health services for India's large rural population, which accounts for >70% of the country's total population. A large chunk of India's population has to traverse over 100 km to access basic health care. About 86% of these travels for medical attention are made by rural Indians.[1]

Along with the geographical access, unavailability of adequate number of medical and paramedical personnel in remote rural areas is also impeding the country's march toward the universal health coverage. Of all health workers, 59.2% work in urban areas, where 27.8% of the population resides, and 40.8% work in rural areas, where 72.2% of the population resides.[2] The density of qualified health workers was 22.7/10,000 population in urban areas, as compared to 3.0/10,000 population in rural areas.[3] This urban dominance is seen across all health worker

categories. From being a resource-heavy health system, India is moving toward technology-driven efficient health system. In the year 2000, the Government of India realized the potential of information technology in delivering health-care services through telemedicine.[4] Moreover, in recent years, telemedicine has been tested extensively across the subcontinent to bridge the gap of poor access to health-care services in rural areas.[5,6] It has attempted to leverage the urban dominance of qualified health workers and coupled it with information technology to transmit information to and from rural areas without physical presence.

The pioneer telemedicine initiative was formulated by the Government of India with the involvement of the Department of Information Technology, Ministry of Communications and Information Technology (IT), the Indian Space Research Organization, various state governments, and several premier

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technical and medical institutions all over the country.[7] From 2000 until now, many Indian states have implemented different models of telemedicine with varied success. Looking at the success and the potential of telemedicine, the National Health Policy 2017[8] has advocated the scaling of various initiatives in the area of telemedicine.

This article aims to review the various aspects of different government (National Health Mission)-funded telemedicine models functional in 12 states across India. The review explores the levels of care delivery and services at facilities provided through telemedicine and challenges being faced in the implementation of the models. We perused the program implementation plans and review of proposals of various state National Health Mission and state budget documents for financial years 2014–2015, 2015–2016, and 2016–2017. We conducted a desk review of literature available on evaluation studies and systematic reviews of telemedicine with specific focus to Indian experience. Personal interviews with the program officers were conducted to gather specific clinical and technical information about the telemedicine project.

RESULTS

Operating models

Different models of telemedicine are functional in India,[9] which can be categorized into two broad categories: one is the government-operated, government-funded model and the other is private party operated, government funded, that is, public–private partnership (PPP) model. In Tripura, Tamil Nadu, and Maharashtra, telemedicine projects are run and funded by the government, whereas in Rajasthan, Telangana, and Himachal Pradesh, telemedicine is functional in PPP mode. The state of Odisha has both government and the PPP-managed models of telemedicine [Figure 1].

Most of the telemedicine networks in India function in the hub-and-spoke model. The hub is typically a tertiary level health-care center, that is, medical college hospital and the spokes are the peripheral health facilities including district hospitals (DHs), community health centers, primary health centers, and subcenters. In Tripura, 24 peripheral centers or spokes (which include DH, subdistrict hospital [SDH], community health center [CHC], and primary health center [PHC]) across eight districts are connected with three referral centers or hubs, all of which are medical colleges. Similarly, in Maharashtra, the telemedicine network has 62 peripheral centers (23 DHs and 39 CHCs) connected with six specialist nodes including one private hospital and one corporate hospital.

Mode and coordinator

Based on time for data relay, telemedicine models can be classified as real-time model and store-and-transfer model. In real-time model, the patient at the peripheral center connects with the doctor at the hub center in real time. Patient data are relayed in the audio-visual mode when the connecting network speed is high or audio mode when the connecting network speed is low. The doctor perceives the patient's complaints from the data received and issues an e-prescription for the treatment at the same time.

Based on the interface, telemedicine models functional in real time can be classified as physician–patient, physician–paramedic, physician–physician, etc., In Himachal Pradesh and Rajasthan, the teleconsultations are being conducted live through video conferencing assisted by a qualified nursing personnel.

In the store-and-transfer model, the patient data are stored in the audio or audio-visual form at the peripheral center and relayed over the network slowly. The patient data are received by the doctor at the hub center at a later hour, who then understands and prescribes treatment accordingly. An IT technician uploads the presenting complaints of the patient along with diagnostic tests, if any, on the portal. The doctor at the referral center examines the case records and provides his/her teleconsultation. This prescription is downloaded by the technician at the referral center and communicated to the patient. The patient receives the prescription with a time delay (either in the evening or next day). The teleconsultations at Tripura were mostly in "store and transfer" mode.

Level of care at which the facility of telemedicine is provided

Based on the specialization of service provided, telemedicine can be classified as specialty care telemedicine model wherein specialized outpatient curative care is provided and general care model wherein general outpatient curative care is provided. In the specialty care model, specialist doctors are available at the hub center, who connect with general physicians at the DH/SDH/CHC/PHC. The teleconsultation interface is physician–physician, and the interaction can be live/real time to store and forward. Specialized outpatient curative care may also be provided at the subcenter (SC) level in real time, but the interface is physician–patient/physician–paramedic.[10] Certain image-based specialties such as dermatology,[11] radiology, microbiology, and[12] ophthalmology[13] have been observed to be more conducive to using telemedicine.

In the general care model, general physicians (MBBS doctors) are available at the hub center, who connect with trained nursing personnel (paramedic) at the PHC/SC. Promotive and preventive services are also being provided through telemedicine in certain states. Tamil Nadu combines traditional dial-in audio helplines, emergency medical inquiry to general public, using the same telemedicine infrastructure. In Himachal Pradesh, outreach services for cervical cancer screening and school health education to promote health-seeking behavior are being provided in the hard-to-reach areas of Lahaul and Spiti. Tele-emergency consultations are also being provided in these remote parts of Himachal Pradesh. The telemedicine models in Rajasthan and Odisha focus on the provision of tele-emergency services along with diagnostic services and pharmacy services. These models are also attempting to provide outreach services, including community screening for certain diseases.

The telemedicine setup is also used to provide services such as tele-education, tele support, telemonitoring services, and
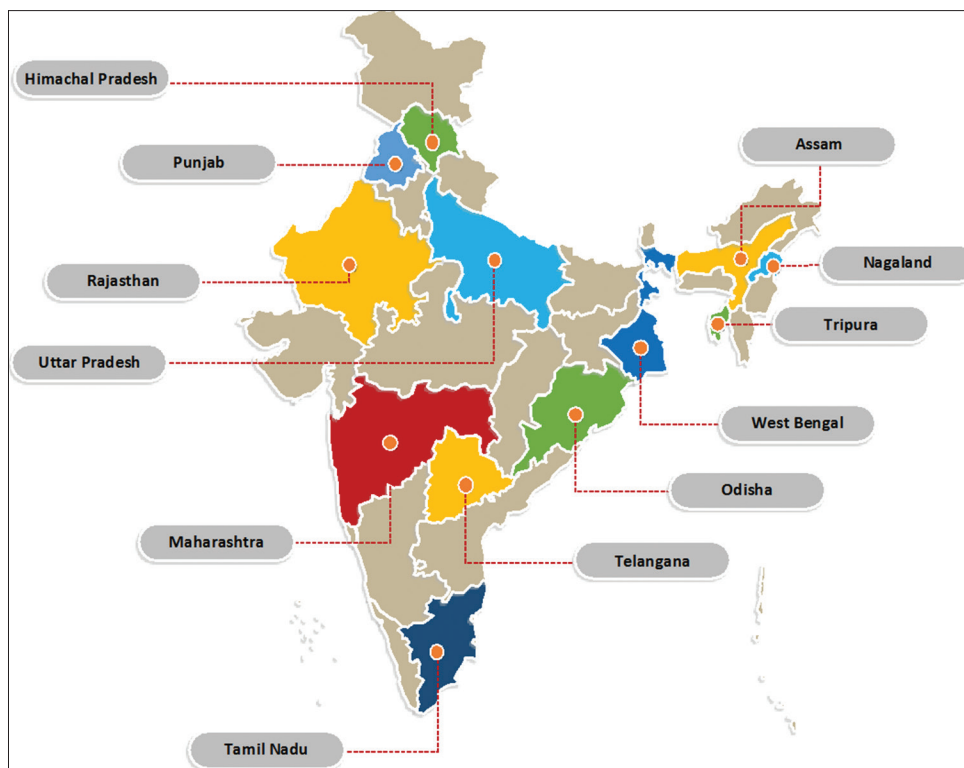
Figure 1: National Health Mission-funded telemedicine projects in India

teletraining. The Maharashtra Telemedicine Network provides multicentric video conferencing for tele-education. In addition, tele support is being provided for medicolegal teleconference and for official meetings through videoconference.

DISCUSSION

After reviewing these models, one gets a brief idea of the various models tested through telemedicine in India. However, there is limited literature available on the impact and feasibility of telemedicine projects. We have made an attempt to arrive at factors which positively impact the success of a telemedicine project. The success of a telemedicine project depends largely upon three major factors – sustainability, conducive environment, and efficient implementation.[14,15]

Financial sustainability

Most of the telemedicine projects in India are government funded, so there is no dependence on private providers or patients to share the cost. However, when the government budgets are cut, telemedicine projects are the first to be shelved. Another important factor affecting the financial sustainability of a telemedicine project is the high initial capital cost involved in establishing a telemedicine network.

Conducive environment

It is essential to create a conducive environment for the proper implementation of the project. It includes policy framework and guidelines for implementation, network connectivity, acceptance by the community, and referral connections. It has been noted that there is an absence of an updated policy framework for telemedicine in the country due to which, we observe various models of telemedicine from live audio–video

consultation to only audio (telephony based) consultations. There is a need to standardize the protocols for telemedicine projects in order to maintain uniformity in service provision. Furthermore, legal issues related to telemedicine are being faced across states. In some states, the first consultation cannot be through telemedicine. Prescription rights and vicarious liability need to be revisited. In the context of India, accountability, the Consumer Protection Act, and ownership by physicians and patients remain unclear, warranting discussions.

As for network connectivity, India has witnessed the telecom revolution and IT revolution in the past two decades. However, the effects are yet to percolate down to the rural areas. Live audio–video-based telemedicine services require high-speed Internet connectivity, but in places where proper Internet connectivity is difficult to establish, it has been observed that both government and private partners in PPP mode resort to audio-based consultations or store-and-transfer model. As our review suggests that patients prefer live audio–video consultation to audio-based or store-and-transfer model, it would be recommended to align telecom policies to promote the provision of high-speed Internet connectivity in rural areas.[16]

For a telemedicine project, it is very important to factor in the community acceptance for technology. In order to ensure that the community sees telemedicine as a service provider, it needs to be integrated into the existing health-care system and the community needs to be sensitized.[17]

Implementation efficiency

As for implementation is concerned, states have a limited capacity to implement the telemedicine projects themselves

and in the absence of any evaluation for PPP projects, it would be difficult to comment upon the implementation efficiency.

Telemedicine needs to be seen and implemented as a component of the health system, rather than as a separate service provision vertical. In remote rural areas, it can improve access to health-care services. It can be used as a first point of contact for primary care services and also establish referral linkages to secondary and tertiary care facilities. Moreover, in urban areas, it can be used as a substitute for follow-up visits to the physicians and for home-based monitoring of critical patients. Telemedicine can also be seen as an opportunity to promote electronic health records system. These strategies will not just bring efficiency in the telemedicine system but also in the overall health system.

Along with the patients, the existing medical and paramedical staff too need to be sensitized. Regular Continuing Medical Education (CMEs) and second-opinion consultations with seniors and experts may prove to be of much value in building relationships and motivating the remote physicians for utilizing the telemedicine facility. Furthermore, success will depend on mainly upgrading the paramedics, technicians, pharmacists, and auxiliary nurse midwife nurses and their ability to use telemedicine.

Provision of parallel services such as tele-education, tele support, telemonitoring services, and teletraining besides teleconsultation is acknowledged to improve the utility and sharing of costs of telemedicine, worldwide.[18-20] The higher volumes of consultations, incentives for teleconsultations, physicians at both ends knowing each other professionally, trust, shared liability, viability, compliance to referral protocols, and standard treatment guidelines have been studied to be some key determinants of successful telemedicine projects.

Conclusion

The role of telemedicine will be crucial in the delivery of health-care services close to the community as well as improving the system's efficiency. The case for telemedicine has been a persuasive argument for resource-poor environments, however, high-income countries have been more successful in adapting to this technology.[15] However, India needs to integrate the facility with the existing health structure. A national consensus building among various stakeholders to formulate guidelines based on what is being practiced in other countries will be required. Telemedicine will work best when it is one component of a well-functioning health system and not as an isolated gap-filling application. With the upcoming technology push at the health and wellness centers providing comprehensive PHC, under the Ayushman Bharat scheme, India has one more such opportunity.

Limitation

Large-scale user satisfaction studies were unavailable, and most reports were from providers demonstrating success in telemedicine provision.[21] The focus of research has been on the technology transfer and engineering aspects of telemedicine, whereas the failure of adoption and success of this technology which is more human and service related was much less studied. There is inadequate research about the effectiveness of telemedicine in reducing costs and improving outcomes, in the acute care setting in India and overseas.

Conflicts of interest
There are no conflicts of interest.

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