

Initiatives in Implementing Telemedicine Technologies –

C-DAC (Mohali), India

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Abstract

Telemedicine is a confluence of Information and Communications technology, Medical engineering and Medical professionals. India is one of the largest producers of doctors and nurses in the world and not far behind in terms of providing science and technology required for successfully setting up the stage for Telemedicine in India. Telemedicine is the hope for a common villager for a better access to healthcare. Now it is the duty of the medical professionals, engineers and technologists, to spread the awareness among the general population and make this promising venture a success. In this paper, we will discuss how Telemedicine Adoption can help to improve the healthcare conditions of rural and remote population in India and how C-DAC is contributing in telemedicine field.

Keywords

Telemedicine, E-Sanjeevani, Telediagnosis Online Telemedicine Research Institute (OTRI)

I. Introduction

Telemedicine (health-care delivery where physicians examine distant patients using Telecommunications technologies) has been heralded as one of several possible solutions to some of the medical dilemmas that face many developing countries. Telemedicine has brought a plethora of benefits to the populace of India, especially

those living in rural and remote areas (constituting about 70% of India's population). One of the many reasons for rapid growth of telemedicine in India is that there are many towns and villages located in remote rural areas of this geographically large country. Few medical facilities exist to serve the large population that resides in the villages. India's rural population is more vulnerable than its urban counterpart based on three particular reasons: late discovery of ailment, transport time to urban healthcare facilities, and inexperienced primary health-care providers in rural areas.

Telemedicine can be defined as a procedure through which medical services are made available remotely, through a combination of telecommunications, multimedia technologies and medical expertise. Telemedicine has become increasingly possible due to a confluence of ongoing technical advances in multimedia, imaging, computers and information systems as well as in telecommunications.

Telemedicine is promising to revolutionize the delivery of healthcare in India. Telemedicine can bridge the existing divide in terms of healthcare between the Urban and Rural areas. According to the available healthcare statistics the statistics, about 75% of the qualified doctors practice in urban areas and 23% in semi-urban areas, so this leaves only 2% of the doctors to cater the health needs of a whopping 70% of the population living in villages. The most unfortunate outcome of this distribution is that 80% of medical facilities are being provided to the urban areas and a meager 20% to rural areas.

II. Telemedicine Background

Telemedicine as the name suggests is the application of communication and information technology for remote consultation and diagnosis of diseases by medical professionals. In many advanced countries particularly USA telemedicine is used to see the views of medical experts during diagnosis, treatment and even surgery. In our country where a large population lives in rural and semi-urban areas, the telemedicine holds a great promise for the masses at large as the hospitals and the Health Centre located in these areas are in general ill- equipped in terms of medical expertise or the diagnostic equipment. Highly skilled medical personals or specialists are normally concentrated only in metropolitan areas or big cities. The telemedicine therefore, would enable the population of remote areas to avail the facilities and expertise of the big hospitals. The timely diagnosis and advise by specialists would in many cases avoid the aggravation of conditions of patients thereby saving the lives, money and the time.

Telemedicine has added a new dimension in modern clinical practice of medicine in

western countries where it is now a matter of routine. Clinical practice with modern technology is an expensive proposition and needs highly experienced experts in interpreting the imaging technology in addition to treatment of various diseases in cardiology, oncology and neurology. The patients at small hospitals including the hospitals in medical colleges are not given the facilities of expert opinion in the clinical practice of using modern technology in diagnosis and treatment. In western countries telemedicine is now utilized as an advanced facility for providing specialty services, for hospitals and medical centers where experts are not readily available, thus eliminating time and distance. The best way and the most economical method to extend these facilities of telemedicine is establishment of referral centers. The referral center will be equipped with all the necessary equipment and will be directly connected via satellite to the user-hospital/institution.

In short, the following advantages from Telemedicine would accrue to the population in general:

- i) Availability of expert services and opinion at affordable cost.
- ii) Possibility of timely intervention by medical specialists thereby preventing the aggravation and conditions of the patients.
- iii) Maintenance of Database with respect to various diseases and locations.
- iv) Training of medical students by expert students by experts at remote place.

In view of this, CDAC initiated the program of development of Telemedicine technology in the country in the year 1999 with an aim to demonstrate and evaluate its feasibility in Indian context. The goal of telemedicine was to improve access to healthcare and medical education and to enhance overall quality of care at affordable cost. The motive was to improve the quality of care by providing the needed services in a timely fashion and expanding the pool of medical specialists available to a given facility, so that a given case could be handled by an expertise necessary.

The Telemedicine technology thus developed is amenable for use in a number of applications. These include: Teleconsultation, Telediagnosis, Tele education, Telesurgery and Telemonitoring.

III) Can telemedicine really make a difference in India?

India has a large population. Providing quality healthcare to such a large population is not an easy task. The lack of funds is a major parameter in setting up as many medical facilities as are needed. Specialists are stationed at these medical facilities. Patients have to travel to the centers, even to simply get diagnosed. The alternative

being that the specialist makes periodic visits to the patient. Such approaches are implemented in various rural and other parts of India with mobile clinics, mobile specialty hospitals etc. The response time in either case is generally high. Often doctors and specialists need to consult other specialists to ensure that all aspects of a complication or patient disorder have been taken into consideration.

The other important dimension is the financial implication of making visits to a health Center or the patient site for a diagnosis. The associated costs of traveling, staying, equipment movement etc are high. If the patient is to travel to the Referral facility, not only will it cause him discomfort (the situation is much worse in case the patient is under trauma), it will also cost him lot of money. If the specialists has to travel to the site (which is not generally done), then the cost is much more, as his time is very valuable – not only in terms of money, but also because other patients will be deprived of his services while he is traveling.

The concept of telemedicine has gone a long way in reducing the response time, and thus providing better quality of healthcare. One of the biggest benefits telemedicine provides is the death of distance. Deploying it can reduce unnecessary travel, expense and even strain. Once the virtual presence of a specialist is acknowledged, a patient can access medical resources without the constraints of distance. It also solves the problem of retaining specialists in non-urban areas. For instance, since Chennai has three medical universities, there are more neurologists and neurosurgeons in the city than in all the states of the North-East put together. But the increasing availability of telecommunication infrastructure and video conferencing equipment can make a doctor virtual and give his valuable knowledge to anyone, anywhere in the country.

Telemedicine services have been a great aid during times of crises or disasters such as earthquakes, devastating fires, and other natural disasters, to provide backup services. Some recent events suggest that telemedicine can make a great difference in India. On January 26, 2001 due to the devastating earthquake in Gujarat some 40,000 lives were lost, and over one lakh people were badly injured. The need at that point in time was to immediately treat the injured and provide healthcare facilities to prevent further deaths. The earthquake also destroyed many hospitals and other medical facilities. In this gloomy scenario one promising technology made its impact: Telemedicine. The day after the earthquake, the Ahmedabad-based Online Telemedicine Research Institute (OTRI) came to the rescue and established the first communication link from Bhuj, which was close to the epicenter of the quake.

Specialists were able to provide consultations from far-off places, thanks to the established telemedicine links. For example, after the telemedicine center was set up at Bhuj hospital, an X-ray facility was provided to the people whereby a specialist provided online consultation from Ahmedabad. During the subsequent days, quake victims could get medical advice from other doctors based at Ahmedabad and Bangalore. Over 750 sessions were established in a period of 30 days, thus saving many lives.

Apart from Gujarat, there are a couple of other cases that show the potential of the technology. For example, during the last Kumbh Mela, which drew over 25 million pilgrims to the banks of the Ganga for the holy dip, telemedicine was deployed successfully. OTRI, together with a team of tech-savvy doctors, transferred data of over 200 ailing pilgrims, besides sending microscopic images of microorganisms in order to monitor the levels of cholera-causing bacteria in the river. Another example is the Asia Heart Foundation that has been successfully practicing telecardiology between Bangalore and cities in eastern India.

IV) Contribution of C-DAC, Mohali In Telemedicine Field

Centre for Development of Advance Computing (C-DAC), is most professional company focused on the Information technology and Healthcare sector in the field of Telemedicine. C-DAC Mohali, an institute under the Government of India, is the society of Ministry of Information Technology with an ISO 9002 certification, which reflects the quality in conceptualization, design, implementation and monitoring of the projects in the field of Medical Informatics, e-Security and other R&D activities. Centre for Development of Advanced Computing (C-DAC), Mohali formerly known as Centre of Electronics Design and Technology of India (CEDTI) is a premier Institute of Ministry of Communications & Information Technology, Govt. of India involved in R&D, Design, Development and Deployment of advanced Information technology products & solutions. The Centre also specializes in embedded & VLSI technology, Bio-medical, electronics, Telemedicine & Entrepreneurship Development. We, at Centre for Development of Advance Computing, are working in the field of Telemedicine since 1999 and have successfully developed state of the art telemedicine application packages namely, Sanjeevani and eSanjeevani.

We have, as a pilot project, established Telemedicine Technology at six major locations in India. These locations were subsequently connected to nearby districts and

primary health centers to make a Telemedicine hub. Our first endeavor was establishing telemedicine sites at All India Institute of Medical Sciences New Delhi, Post Graduate Institute of Medical Education and Research Chandigarh, Post Graduate Institute Lucknow. We expanded it in the second phase to connect three more medical colleges namely, Indira Gandhi Medical College Shimla [4], Medical College Rohtak and Medical College Cuttack. The Telemedicine software package was developed in-house under the expert guidance of the doctors in these hospitals.

Our second effort was establishing telemedicine sites at different locations in the state of Himachal Pradesh, which is a remote and hilly state of India. C-DAC is further working on implementation of telemedicine technology in rural areas of Punjab and in Chandigarh.

Program Objectives

A pilot project on 'Development of Telemedicine Technology and its Implementation' was approved for implementation by Department of Information Technology, Ministry of Communications and Information Technology, Govt. of India and it has been implemented over the 'Telemedicine Network' connecting PGIMER Chandigarh, SGPGI Lucknow and AIIMS New Delhi on ISDN lines.

The objectives of this pilot project are outlined below:

- 1) To run and implement successfully the Telemedicine Technology over the Telemedicine Network connecting the three locations at PGI Chandigarh, AIIMS New Delhi, SGPGI Lucknow.
- 2) To establish a dedicated satellite communication facility using very small aperture terminal and thereby networking medical centers in northern part of peninsular India.
- 3) To establish a telecommunication technology network which can provide a comprehensive range of high-quality health services to rural and remote areas in India.
- 4) To purchase cost effective hardware needed for transmitting data and images of adequate diagnostic quality.
- 5) To enable well-established image & data archiving, printing for graphics, images and video data.
- 6) To train the Doctors and patients to use the Telemedicine Technologies effectively and optimally with a view to develop their faith and confidence in these technologies.

- 7) Documenting the technology and extending it to specialty centers world wide and within India.

V) Telemedicine in Himachal Pradesh

The project envisages the customized development of Telemedicine Application “Sanjeevani” and its subsequent deployment in the rural areas. “Sanjeevani” is an integrated telemedicine solution based on ‘Store & Forward’ concept of telemedicine. As many as 24 locations have been identified for deployment of the project. These range from Community/ Primary Centre to Civil / Regional hospitals and IGMC, Shimla. The telemedicine application will comprise the basic tele-radiology, tele-pathology and tele-cardiology modules. This Telemedicine Application will deliver the specialized healthcare to the patients of under-served rural areas of Himachal Pradesh at very low cost. At present, the position of healthcare in these rural areas is not good. The number of primary health care centers in the State is less and most of the vital medical facilities close to the population are not possible. In rural areas of Himachal there is a high prevalence of untreated curable disease, which remains untreated due to lack of resources.

The application will enable the provision of specialized medical care, services and treatment to the patients in the far flung, remote and inaccessible areas from the specialty hospitals where it is not possible for them to reach there in time.

The objectives of the project were as follows:

- 1) To develop a customized Telemedicine Applications in the rural and remote areas of Himachal Pradesh for providing the specialized medical care and support to the patients at their convenience and at an affordable cost. This will involve connecting the community health centers/primary health centers and block level/district level hospitals in the rural areas to IGMC, Shimla for expert advice. As many as 14 such centers / hospitals are being connected in Phase I and rest in Phase II. The connectivity will be further extended to PGIMER-Chandigarh over the existing telemedicine linkage.
- 2) To establish seamless connectivity over diverse communication environment in the state.
- 3) To develop software interfaces with low cost medical diagnostic equipment so as to offer a very low cost telemedicine solution for rural areas.

- 4) To introduce new software/hardware features in the existing telemedicine technology for developments not covered already.
- 5) To give boost to the production of low cost medical diagnostic equipments for telemedicine technologies in India.
- 6) To spread medical education among the medical professionals for their continuous up gradation at a very low cost even to far off places in rural areas.
- 7) To develop it as a pilot project for subsequent implementation all over India.

Telemedicine setup implementation at various health institutions in Himachal Pradesh will be based on the network that can be classified into the following categories:

Phase I: Installation of the identified equipment and to link two medical colleges in the state

Phase II: Linking with all the identified hospitals

Phase II: Integration with Hospital Information System (HIS)

Implementation of Telemedicine application software Sanjeevani in Himachal Pradesh is providing benefits to the population in following ways:

- 1) A best possible health care facility is available to all of them.
- 2) They need not to move the patient to specialty hospital at far away places unnecessarily.
- 3) Since this population earns their livelihood through daily wages. So they will be saving time and hence their income will increase.
- 4) Since the cost involved in the treatment using telemedicine technology shall definitely be many fold less than the cost now being spend by this population.
- 5) People of this hill state are definitely getting a very good health care facility and that again at very low cost without traveling much distance.

VI) Telemedicine in Punjab

Access to quality health care is important to the viability of rural communities. Although access has always been a challenge, declining and aging populations, increased poverty, and residents with no medical insurance present a dilemma regarding how to maintain the range of services and personnel required to meet the demands for health care. The aim of the project is to deploy the customized Telemedicine Application at a wider network covering the rural areas of Punjab. The application will enable the provision of specialized medical care, services and treatment

to the patients in the far flung, remote and inaccessible areas from the specialty hospitals where it is not possible for them to reach there in time.

The browser based Telemedicine application named “E-Sanjeevani” is an outcome of the advancement over the existing desktop application Sanjeevani. This Telemedicine Application will deliver the specialized healthcare to the patients of under-served rural areas of Punjab at very low cost. This package has been lab tested on LAN (10/100 Mbps) and is running on a public website <http://www.esanjeevani.in/>

The main outcome of the project is to deploy “e-Sanjeevani” in all the districts of Punjab but the intermediate output is to deploy and test it at as many as 20 locations which have been identified with Punjab Health Systems Corporation Punjab.

Deployment of “e-sanjeevani” will help the poor and needy sitting at remote and urban places where specialized treatment is not available. With this the poor can easily have the advice of the specialists and suffer less. Hereby the deployment of this project by C-DAC, Mohali will effectively help the entire community of Punjab.

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Project Deployment Plan of Telemedicine Technology By C-DAC Mohali, India

06.02.1998	Project Proposal on development of telemedicine submitted to dept. of electronics and government of India by CEDTI (Now CDAC), Mohali
03.03.1999	Administrative Approval for the execution of the project, Development of telemedicine Technology and its implementation
03.04.1999	First Program Advisory Committee (Steering Committee) formed.
29.06.2000	Training at Telemedicine center in Ahmedabad to study the Konee Meditech Pvt. Ltd. System for Telemedicine.
22.02.2001	Finalization of purchasing Committee. Procurement of Telemedicine equipments.
21.05.2001	Layout of the Telemedicine room was finalized by CEDTI, Mohali (Now CDAC)
07.12.2001	Formation of a committee for standardization of digital information to facilitate implementation of telemedicine system.
21.12.2001	Development of β version of software "Sanjeevani" for integration of telemedicine module.
09.02.2002	Testing of telemedicine and telecommunication.
04.04.2002	Final testing of equipment and telecommunication systems on-site, preparation for equipment installation and training of personnel.
03.06.2002	Successful Installation of Telemedicine software and hardware equipment at PGI, Chandigarh. Start of telemedicine sessions.
16.07.2002	Successful Installation of Telemedicine software at SGPGI, Lucknow, start of telemedicine sessions
28.07.2002	Successful Installation of Telemedicine software at AIIMS, New Delhi, start of telemedicine sessions
12.08.2002	Sanjeevani user manual and reference guide prepared and released.
04.02.2003	Teleconsultation trials conducted between PGI-Chandigarh and SGPGI-Lucknow.
19.02.2003	Training given to Doctor's on telemedicine. Views and user's comments demanded by doctors for improvement in working software.
22.02.2003	Maintaining of telemedicine sessions in all 3 sites.
04.03.2003	Analysis of the results, writing reports, development of recommendations and policy documents
17.03.2003	Presentations and press conferences.