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ROLE OF TELEMEDICINE IN INDIAN HEALTHCARE SYSTEM

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ABSTRACT

Telemedicine is remote diagnosis and treatment of patients by means of telecommunications technology. It holds a great potential to improve the quality, access and affordability of healthcare. This paper analyses the contribution of both public and private sector in making telemedicine an alternate way of providing healthcare services especially in rural India.

Key words: ALTHEA, CISCO Virtual Expertise Digital Solution, ISRO model of telemedicine, Medintegra WEB, Telemedicine.

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1. INTRODUCTION

India faces a great challenge of providing affordable healthcare to all. About 67% of the total population lives in rural areas. Healthcare system in these areas has to cope up with lot of problems like severe shortage of healthcare professionals, lack of medical facilities, basic infrastructure etc. About 60-80 % of the physician positions in different specialties are vacant in rural healthcare services. According to a study conducted in 2009 by the Indian Medical Society, 75% of the qualified consulting doctors in India reside in urban areas, 23% in semi-urban areas and only 2% in rural areas. In such a scenario, telemedicine can play a pivotal role in providing healthcare services to rural population of India.

2. METHODOLOGY

Information on different aspects of telemedicine has been collected through email interviews of the two doctors. One is Dr. Arjun Agarwal, Surgical Oncologist and associated with Varun Arjun Medical College and Rohilkhand Hospital in Shahjahanpur, U.P. and other is Dr. Naheed Rizvi, Senior Consultant at MLG District Women Hospital in Aligarh, U.P. Also material is collected by visiting official websites of Ministry of Health and Family Welfare, ISRO, Apollo Hospitals, World Health Partners, Narayana Health, Sankara Nethralaya etc and analyzed their contribution in the field of telemedicine.

3. LITERATURE REVIEW

In [1] author believed that telemedicine has gained tremendous popularity in developing countries where rural population is deprived access to even basic healthcare. According to the author, telemedicine market has witnessed spectacular growth lately mainly because of convergence of Information Technology Communication and Healthcare.

In [2] authors felt that telemedicine may be as simple as two health professionals discussing a case over the telephone or as complex as using satellite technology and video conferencing equipment to conduct a real time consultation between medical specialists in two different countries. The authors concluded that the implementation of telemedicine in routine health services is being impeded by the lack of scientific evidence for its clinical and cost effectiveness.

In [3] authors opined that using a number of high speed satellite and terrestrial telecommunications links, centralization and coordination of resources and support of government, it has been possible to reach and access the Indian population spread out in heterogeneous geography and thus achieve the goal of health for all. However, all the activities need to be evaluated in a national framework and many issues, such as national e-health policy and legal/ethical issues need to be addressed.

4. TELEMEDICINE IN INDIA

Telemedicine aims at providing technology based primary healthcare services at minimal costs in those parts of India where basic medical facilities are not easily accessible.

There are two types of technology used in telemedicine. The first is Asynchronous type technology in which pre recorded data is exchanged between two or more individuals at different times and locations. This technology is also called ‘store and forward’ Digital camera is used to take digital images which are stored and then forwarded to another location by a computer. This technology is used in tele-radiology, tele pathology and tele dermatology etc. The other is Synchronous type technology in which real time data is exchanged. The patient or the telemedicine coordinator is at one site and the specialist at the referral site. Both the locations are equipped with videoconferencing facility that allows a real time consultation to take place. This technology is preferred in psychiatry, internal medicine, pediatrics, cardiology, obstetrics and gynaecology, neurology etc.

In India, the first telemedicine pilot project was started by ISRO in collaboration with Apollo Hospitals Group in 2001, under which a telemedicine link was established between an Apollo rural hospital at Aragonda village in the Chittor district of Andhra Pradesh and the Apollo hospital at Chennai. ISRO provided the necessary communication links via its INSAT satellites while Apollo group equipped their hospitals with desired medical infrastructure.

Since then various government agencies like Department of Information Technology and Ministry of Health and Family Welfare, State governments, Premier medical and technical institutions, Private hospitals and Companies of India have taken several initiatives with the aim of providing quality healthcare facilities to rural and remote parts of the country.

Telemedicine service providers have to deal with many complex issues like availability of technology at reasonable cost, interruption in power supply, lack of trained manpower, availability of funds, data privacy and security concerns.

Telemedicine has many advantages associated with it. Telemedicine eliminates distance barriers and improves access to quality health services for the population living in

underserved areas. It is also helpful in critical care situations where moving a patient is undesirable or not feasible. Around 40% of Indian households report of having borrowed or sold assets to pay for hospitalization expenditure. For rural population paying out of pocket for healthcare is a major burden. Telemedicine can bring some relief to them. Tele-education and tale CME upgrade the knowledge of the rural physicians.

4.1. Indian Space Research Organization (ISRO)

ISRO has deployed a SATCOM based telemedicine network across the country. It has started a telemedicine program in 2001 with the aim to connect remote, rural healthcare providers to major specialty hospitals in cities and towns through the Indian satellites. The states and regions that are covered under this program includes Jammu & Kashmir, Ladakh, Andaman & Nicobar Islands, Lakshdweep Islands, North Eastern States, tribal districts of Kerala, Karnataka, Chattisgarh, Punjab, West Bengal, Odisha, Andhra Pradesh, Maharashtra, Jharkhand and Rajasthan. Presently, the telemedicine network of ISRO covers about 384 hospitals with 60 specialty hospitals connected to 306 remote/rural/district/medical college hospitals and 18 mobile telemedicine units.

4.2. ISRO model of telemedicine

ISRO uses a multi-point to multi-point system. Computers at a specialty hospital connect to a common terminal which links via satellite to rural district hospitals and clinics that have ISRO connectivity in space. To build on ISRO terminal, medical centers have to pay a substantial up-front-cost (around 600,000 INR). But once built, the ISRO network is provided as a free service for hospitals that are linked to rural telemedicine centers.

In 2001, ISRO, Department of Space (DOS) and the North Eastern Council (NEC) collaborated to establish North Eastern Space Applications Centre (NESAC). NESAC started an ISRO-NEC telemedicine project in 2004 utilizing satellite communication through very small aperture terminal (VSAT). They formulated a plan to commission 72 telemedicine regional nodal centers in all districts of north eastern states like Assam, Arunachal Pradesh, Manipur, Mizoram, Meghalaya, Nagaland, Tripura and Sikkim. Around 25 regional telemedicine centers have been commissioned and remaining 47 are in various stages of implementation.

Another telemedicine project known as Army Telemedicine Network for NER is also operational in the north eastern states in collaboration with Indian Army form March 2008. Under this network a total of 6 telemedicine centers have been commissioned in various army hospitals in the north eastern region.

Tripura, one of the north eastern states of India, has set an example of successful implementation of telemedicine program in the country. In Tripura, telemedicine set up has been implemented at 27 hospitals including 3 referral hospitals and 24 nodal hospitals. All these centers are interconnected with internet speeds of 512Kbps/2Mbps for data transfer and data management. This project has been successful in treating approximately 1,16,376 patients by telemedicine from June 2009 to 31sth December 2017.

Some of the other successful telemedicine pilot projects in which ISRO played a key role includes telemedicine network in West Bengal for diagnosis and monitoring of tropical diseases, the oncology network in Kerala and Tamil Nadu, the network of specialty healthcare access in rural areas of Punjab, Maharashtra and Himachal Pradesh.

Following table shows the initiatives taken by Ministry of Health and Family Welfare, Government of India to promote telemedicine for catering healthcare needs of rural population of India.

2003	Defined National standards on telemedicine
2005	Constituted National steering committee on telemedicine.
(2007-2012) 11th Five Year Plan	In 11th Five Year Plan, there was a budget Head by Planning Commission for e-Health including telemedicine.
2007	Established National Rural Telemedicine Network It includes: Designing, development and implementation of low cost rural telemedicine infrastructure. Establishment of village tele-ambulance system and rural emergency healthcare services/ trauma care module. Development of Rural Health Knowledge Resource through web portal and e-CME module. Providing technology platform for harvest, compilation, storage (data base) at Regional District Hub and Central Data Centre at Ministry of Health and Family Welfare, archive and distribution across network. Released grants to all states/UTs for National Rural Telemedicine Network.
(2012-2017) 12th Five Year Plan	Formulated strategy for ICT applications in healthcare It includes: Access to CME (continuing medical education) and skill up- gradation programs as well as backup support on telemedicine. Deployment of country wide Hospital Management Information System (HMIS). Use of ICT in health education, public health status analysis and expansion of health related research. Introducing m-Health which involves use for mobile phones to speed up transmission. Allocated funds for e-health including telemedicine.
2013	All Regional Cancer Centers along with four peripheral hospitals at district level were networked under OncoNet project. Deployed Tele-ophthalmology projects in most of the states empowering vision centers to link Expert Eye Centers. Proposed a 'National Medical College Network' project to link Government medical collages having National Knowledge Network connectivity. Started pilot projects at three sites under National Optical Fiber Network Initiative.
2015	Launched a telemedicine initiative in collaboration with Apollo Hospitals. As part of the service named 'Sehat', people in rural areas can consult doctors through video link and can also online order generic drugs.
2016	Signed a Memorandum of Understanding (MoU) with ISRO to expand its telemedicine network to remote places. Approved Centrally Sponsored Scheme (CSS) for establishment of National Medical College Network (NMCN), wherein 41 Government Medical Colleges are being networked in the first phase riding over National Knowledge Network- high speed bandwidth connectivity, with the purpose of e-Education and e-Healthcare delivery. Proposed setting up of new Telemedicine nodes in collaboration with ISRO at the following remote locations- One district each in Himachal Pradesh, Odisha, Arunachal Pradesh and Meghalaya. Chardhams, Kailash Mansarovar, Amarnath and Ayappa pilgrimage places. Extended financial and technical support to state governments for strengthening & promoting Telemedicine network under their respective States/ Union Territories Programme Implementation Plan (PIPs) of National Health Mission (NHM) scheme.

Department of Information Technology (DIT), Government of India plays a leading role in the implementation of telemedicine initiatives in India. It creates manual of standards, best practices and procedures to govern the delivery of healthcare. It provides funds for the development of various software systems to support its network of clinics.

Medical Institutions of India have also taken steps to spread telemedicine network. All India Institute of Medical Sciences, New Delhi is linked with hospitals in Jammu and Kashmir, Haryana, Odisha and north eastern states while Postgraduate Institute of Medical Education and Research, Chandigarh, is linked with district hospitals of Punjab and Himachal States. Both institutes are considered as leaders in telemedicine programming and dissemination. The School of Telemedicine and Biomedical Informatics has been established by the Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow with the financial support of the Government of Uttar Pradesh and the Department of Information Technology, Ministry of Communication & IT, Government of India. It is the National Resource Centre for telemedicine.

In the corporate sector, some of the major telemedicine players are Apollo Hospitals Group, World Health Partners, Narayana Health, Sankara Nethralaya etc.

4.3. Apollo Hospitals Group

It established Apollo Telemedicine Networking Foundation (ATNF) in 1999 with the aim of giving remote consultation and second opinion to both patients and doctors for whom access to quality healthcare in difficult due to distance and spiraling costs.

Today, AINF has emerged as India's single largest turnkey provider in the area of telemedicine with over 150 telemedicine centers across the globe.

The Apollo Telemedicine centers comprise of a Telemedicine Specialty Centre (TSC) and a Telemedicine Consultation Centre (TCC). TSCs are set up at the Apollo Multi Specialty Hospitals in cities like Chennai, Hyderabad, Delhi, Bangalore, Kolkata etc, where experts from different fields are available for consultation. TCCs are set up in the peripheral centers from where the technician and patient can consult the specialist located at the TSC. One of the essential devices used for consultation is a video conferencing tool accompanied by a voice transmission enabler that is connected to the ISDN lines and to the TV both at the TSC and the TCC. From the consultation center, X-rays, CT scan, Color Doppler, ultra sound etc can be transferred over the ISDN line or IP with the help of an interface. In the Telemedicine Specialty Centre, the medical records are received on the system and can alternatively be viewed on the TV using an interface. In the absence of high definition video conferencing camera, a high definition web camera can also be used between TSC and TCC. For better transmission of X-rays and echo-cardiograms, a high resolution/ luminosity sub system is used that enables the ECG readings to be seen at the TSC. An electronic or digital stethoscope is used to hear the heart beats. The equipment is placed on the patient and connected to the telephone line and the doctor at the TSC can hear the heart beat on the system. In case of video conferencing, the voice is transferred using a voice enabling instrument attached to the video conferencing camera. It has features like echo-canceller and noise reduction units for better transmission of heart sounds etc.

Apollo Telemedicine Networking Foundation's web enabled Telemedicine Application 'Medintegra WEB' supports the platform to carry out telemedicine consultation. The software collects the patient's data and converts it into a secure and confidential Electronic Medical Record (EMR). This data is then transferred to the TSC where the authorized specialist studies it and based on the investigation gives his expert opinion which is transmitted back to the TCC. Apollo Telehealth services include Tele Clinics. Tele Radiology, Tele Cardiology, Tele Dermatology, Tele Pathology, Tele Emergency, Remote Condition Management Programs, Mobile Telemedicine Units, Tele Healthcare, Tele Education and Tele ICU (I-SEE-U facility that enables virtual visits to ICU).

In 2013, Apollo Hospitals started an initiative 'Telemedicine 2.0' with the aim of integrating healthcare delivery model with new age technology. Under this initiative, Telehealth services are provided on mobile phones and tablets to make tele health more user friendly.

In 2015, Apollo Hospitals set up one of the highest telemedicine stations in the world, under the government assisted Himachal Pradesh Telehealth Services Project.

4.4. World Health Partners (WHP)

WHP does not have its own network of telemedicine clinics. It coordinates a network of entrepreneurs' independent clinics. The main advantage of such type of franchise service model is that the local franchisees better understand the dynamics, needs and issues specific to their villages.

WHP has over 12,000 'Sky Centers' run be local entrepreneurs located in the remotest areas of Bihar and Uttar Pradesh. At these centers, WHP's 'ALTHEA' system is used. A specially developed application is loaded on a laptop or tablet and is used as a platform to integrate commonly available, medically certified diagnostic devices. The system currently uses devices to measure blood pressure, pulse temperature, blood sugar, blood count, foetal sounds, and cardiac signals with provision for adding otoscope for ear examination and dermascope for skin. The system can work in any digital environment ranging from 2G to 3G, 4G and internet. The village facilitator uses pre-coded checkboxes in English or in the local languages, so writing text is completely eliminated. An algorithm combines the symptoms registered by the village user with the basic vital parameters and patient history to generate a list of differential diagnosis for the doctor. The system allows the automatic generation of a list of most probable investigation and medicines for each diagnosis which will enable the doctor to quickly select his choices and doses. In case the doctor wants to overrule the differential diagnosis suggested by the system, he can access the entire 'International Classification of Diseases' latest version of the World Health Organization. The system also provides task lists for predictable services such as estimation of gestational age, growth monitoring and immunization. Each interaction between a tele healthcare seeker and provider is captured and stored in the internet cloud as an Electronic Medical Record (EMR) under a unique patient identity which makes referrals easier. The ALTHEA system can transmit live videos and audio in real time with the bandwidth strength of 40 Kbps making it suitable even in a 2G environment.

4.5. Narayana Health

In 2016, a Memorandum of Understanding (MoU) was signed between Narayana Health and CISCO. According to it, both the parties dedicated themselves to deliver affordable healthcare services remotely using CISCO's Virtual Expertise Digital Solution. This solution enables real time telemetry of medical device data, audio, high definition two way video, ECG and other vitals and radiology, analytics of medical reports and a web based portal which supports mobile end points. A detailed examination of a patient can be possible now with the option of recording the entire interaction. This solution allows the doctors to conduct highly critical diagnostics such as Diacom viewing and detection of Thrombolysis in cardiac care. The CISCO Virtual Expertise Digital Solution is encrypted to protect the patient's related information. It ensures that there will be no leakage of information during its storage and transmission while using the solution.

Under the agreement, Narayana Health and CISCO decided to work together in setting up advanced telemedicine solutions across 3 centers in Indian – Sirsi and Bellary in Karnataka,

and Rajarhat in Bengal via the main centre at Narayana Health City located in Bommasandra, Bangalore, Karnataka.

4.6. Sankara Nethralaya

Ophthalmology lends itself easily to telemedicine as it is largely image based diagnosis. Sankara Nethralaya offers tele ophthalmology services to rural areas. The services include comprehensive eye examination, training school teachers for vision screening programs, organizing diabetic retinopathy screening camps and performing eye surgeries free of cost at the base hospital.

Dr. Arjun Agarwal believes that connecting and helping doctors in rural areas through telemedicine is possible but without examination of patient personally, it is hard to prescribe any medicine. He stresses that treatment through telemedicine can raise legal issues as well.

Dr. Agarwal suggests that those private hospitals and companies that provide healthcare services through telemedicine should get financial support from the government. It can be in the form of payment to private hospital for each consultation.

Dr. Naheed Rizvi feels that government should give monetary incentives to private practitioners and encourage them to adopt treatment through telemedicine for the patients living in remote areas. She has also informed that at MLG, District Women Hospital, there is a proposal to establish a setup for telemedicine and it will function in due course.

5. RESULT

Public Private Partnership is required to make telemedicine a success in India.

6. DISCUSSION

For telemedicine project to be successful, it is important that before entering a rural market, a thorough analysis of the local medical system prevalent there, should be done. Companies providing telemedicine healthcare services should collaborate with other such providers so that they together mount some pressure on the government for extending its support and provides financial assistance to the private players.

Many private companies don't see Indian rural areas as potential markets for providing telemedicine services. Since profit is limited in serving rural areas, companies that provide healthcare services need alternate profit streams.

In villages, inferior quality medicines are supplied by the chemists of the local drug stores. Also limited and only common types of drugs are available in such stores. The healthcare providing companies can make profit by opening their own drug shops where a wide range of quality medicines should be made available.

In many rural areas, the quality of water available for drinking is very poor. So in such areas, the demand of clean drinking water can be met by the healthcare providing companies. To earn profits, they can open a chain that provides portable drinking water cans at reasonable price to households in those areas.

In rural areas, training centers should be established to give training to local people regarding the use of different equipments that form part of telemedicine set up. Such training centers are beneficial for both the healthcare providing companies as well as for rural population. On the one hand companies can make profits by establishing such centers and on the other hand, these centers open employment opportunities for the trainees.

When the first telemedicine pilot project was started in India, satellite was used to establish links between peripheral healthcare centers and referral hospitals. At that time cellular network for mobile communication as well as optical fiber network for internet communication was not fully developed and distributed across the country. But times have changed now, with the expansion of cellular and optical fiber networks throughout the nation, the accessibility to internet and mobile services have increased many folds even in rural areas. Internet and mobiles can enhance the effectiveness and range of telemedicine services by allowing faster transmission of large data files at relatively lower costs. Earlier video conferencing which is the crux of telemedicine in India was possible only through the satellites but now video conferencing can be easily done through internet or even through mobiles. In such a scenario, technology shift is very important. The old telemedicine infrastructure needs to be replaced by new one which should be compatible with the recent mobile and internet technologies.

7. CONCLUSIONS

It is true that telemedicine is not a substitute for traditional healthcare system, but it is surely helpful in bridging disparity in quality and access to healthcare between urban and rural areas of India. Telemedicine is successful in providing basic healthcare services at affordable price to the underserved population of India.

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