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Current Status of Telemedicine Network in India and Future Perspective

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Abstract: India is a vast country with more than 1.15 billion population occupying an area of 3 million sq km. It consists of 29 states and 6 Union Territories governed by a federal system. There is no national health insurance policy for the country. Government supported healthcare delivery follows a three tier system and is the primary responsibility of each state. It has been observed that there is a great deal of disparity in quality and access to healthcare between urban and rural regions. This can be bridged through telemedicine technology if the tool is integrated into existing healthcare delivery system. Both government and private sector have been actively participating in tele-health programmes. India is starting to make strides in the fields of telemedicine and e-Health. The telemedicine market has witnessed spectacular growth during the last two years mainly because of timely convergence in the areas of Information technology, Communication & Healthcare along with launching of central e-health schemes including telemedicine by the Ministry of Health & Family Welfare.

Keywords: Telemedicine, e-Health, Health Network

Introduction:

Most telemedicine activities are in the project mode, supported by the Indian Space Research Organization, Department of Information Technology, Ministry of External Affairs, Ministry of Health & Family Welfare and few others are being implemented through state government

funding. None of the programmes are being adopted into the health system. A few corporate hospitals have developed their own telemedicine networks. Some of the nationwide projects being taken up by the Ministry of Health in the Government of India are Integrated Disease Surveillance Project (IDSP), National Cancer Network (ONCONET), National Rural Telemedicine Network, National Medical College Network and the Digital Medical Library Network. Telemedicine standardization and practice guidelines are being developed by the Department of Information Technology in the Government of India. A National Telemedicine Task Force was set up by the Health Ministry in the year 2005. The terms of reference covered all aspects of e-Health. Various committees and subcommittees have presented their reports. A follow-up action plan is awaited. The External Affairs Ministry has taken up the Pan-African e-Network Project and the SAARC (South Asian Association for Regional Co-operation) Telemedicine Network Projects[20].

The National Knowledge Commission, a high level advisory body to the Prime Minister of India formed with the objective of transforming India into a knowledge society, has also set up a Working Group for the development of an Indian Health Information Network. This working group has proposed to design, develop, and integrate an end-to-end electronic health care informatics network framework in India to improve public health, health research, and the delivery of health care. A National Resource Center for Telemedicine & Biomedical Informatics is being developed at Lucknow with the support of the Department of Information Technology, Ministry of Communication and IT, Government of India. This will piggyback on the infrastructure of the School of Telemedicine & Biomedical Informatics (STBMI)[2] set up by the Uttar Pradesh state government. Besides meeting the need of capacity building in telemedicine and e-Health for the country, this school will be accepting overseas candidates also. Currently, Diploma Courses are being carried out by the STBMI.

India is acquiring a sizeable market segment in health care BPO (business-process outsourcing) and KPO (knowledge-process outsourcing) industries. It is now preferred as a healthcare destination for neighboring and far-off countries. Most of these patients are being catered to by the corporate hospitals. At the same time, both short- and long-term travel by overseas citizens is increasing for business and tourism purposes which increases the potential for the use of telemedicine and e-Health tools to facilitate exchange of electronic health information between hospitals across the globe. The so called medical tourism is getting a boost.

Orissa Trust of Technical Education and Training (OTTET) takes the lead using modern ICT platform and network in Public Private Partnership (PPP) mode in association with Government of Orissa to provide promotive & preventive healthcare & diseases management. Delivery of healthcare services at the door steps of villagers in 51,000 villages of the state is envisaged.[32] Gujarat state government is looking to expand telemedicine network in PPP mode. The state health department of Gujarat is all set to embark on to connect all villages through its telemedicine network. If things go according to plan, all panchayats (HQ of group of villages, first level of government administrative hierarchy) and schools in Gujarat villages would have

visual-satellite connections within the next two to three years. National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore and Mysore based K.R. Hospital has established connectivity for their telemedicine project in collaboration with Larsen & Toubro (L&T) Ltd., Bangalore which has gifted telemedicine solutions and equipment worth INR 600,000 to both the medical centers under Corporate Social Responsibility (CSR) initiative. Similarly, in April 2006 under the CSR program of Gas Authority of India Limited (GAIL), a telemedicine project was started linking SGPGIMS, Lucknow with District Hospital of Raibareli, located at a distance of 80 kms with fiber optic cable network. GAIL has upgraded the infrastructure by providing advanced videoconference equipment and designing and constructing a board room for eCME in the year 2010.

1. Electronic Medical Records and Hospital Automation

Majority of the hospitals in the country are rooted in manual processes, which are difficult to access. The insurance sector demands a more efficient health information storage and retrieval. Automation alone can help hospitals to meet these challenges. Electronic Health Record (EHR) and Hospital Information Management (HIS) in India is still in the early growth stage. To start with it is a small market dominated by in-house design, development and implementation of customized solutions developed by software developers. In terms of technology adoption, India is far behind its Asia Pacific counterparts such as Australia, Japan, South Korea, Singapore, and Malaysia. Center for Development of Advanced Computing (C-DAC), an autonomous government scientific organization developed and deployed the first indigenously developed total Hospital Information System (HIS) software in collaboration with Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGIMS)[22], Lucknow in the year 1998. C-DAC's HIS solution is now deployed in various hospitals like Guru Teg Bahadur Hospital (Delhi), Mahatma Gandhi Institute of Medical Sciences (Sevagram, Maharastra). C-DAC has also developed Telemedicine enabled Hospital Information System. Currently, electronic medical records and hospital automation have been rapidly getting adopted in most of the corporate and few public sector hospitals. Health system development projects in state governments aided by the World Bank are promoting rural electronic health records. Tata Consultancy Services (TCS) is developing a suitable solution to maintain electronic medical records (EMR) for the Tamil Nadu State Government[6]. Ministry of Health & Family Welfare has launched an initiative to standardize Electronic Medical Records for the country. The Apollo Hospitals Group is initiating a major project with IBM, to build a national health data network called Health Highway[30] to provide a diverse set of software applications for the healthcare segment. Health Highway will be offered as a hosted solution managed and maintained by IBM and Apollo with hospitals using it on demand via a pay-per-use model. A major thrust for adapting a standardized EMR is likely to come following the National Knowledge Commission's Working Group recommendation. It has suggested developing a common national EHR with a minimal data set and making it available in an open domain to encourage widespread use in the country. This would facilitate standards-based development of a knowledge base.

2. Telemedicine initiatives

2.1. Department of Information Technology (DIT), Ministry of Communication and IT (MCIT), Government of India[2]:

The Department of IT has taken a pivotal role in defining and shaping the future of telemedicine applications in India. The DIT has been involved at multiple levels – from initiation of pilot schemes to standardization of telemedicine in the country. It has funded development of telemedicine software systems - the prominent ones being Mercury® and Sanjeevani® software by C-DAC. DIT has also sponsored the telemedicine project connecting three premier medical institutions - viz. SGPGI-Lucknow, AIIMS-New Delhi and PGIMER-Chandigarh. DIT has established more than 100 nodes all over India in collaboration with the state governments. Telemedicine network in West Bengal for diagnosis and monitoring of tropical diseases, Kerala and Tamil Nadu Oncology Network for facilitating cancer care, North-Eastern and Himachal Pradesh hilly states for specialty healthcare access are some of the prominent projects launched by this department.

2.2.Indian Space Research Organization (ISRO)[3]:

Towards societal benefit of indigenously developed space technology, Indian Satellite System (INSAT), ISRO[3] has implemented telemedicine pilot projects around the country under GRAMSAT (rural satellite) program which are very specific to the development of the society. In collaboration with state governments it has established a Telemedicine Network consisting of 382 Hospitals-306 Remote/Rural. District Hospitals/Health Centers connected to 51 super specialty hospitals located in major states. Sixteen mobile Telemedicine units are part of this network. Andaman & Nicobar Islands and Lakshadweep are linked to mainland specialty hospitals through satellite connectivity. In collaboration with state government it has supported establishment of Karnataka state telemedicine network where all the district hospitals in the state are connected with five specialty hospitals in Bangalore and Mysore. Similar operational network has been effectively functioning in the state of Rajasthan where all the 32 district hospitals are connected with six medical college hospitals and S.M.S. hospital in Jaipur. ISRO has also assisted Maharashtra, Madhya Pradesh and Orissa states in establishing satellite communication based telemedicine pilot projects.

2.3 Ministry of Health and Family Welfare (MoH&FW), Government of India[4]:

MoH&FW is currently implementing Integrated Disease Surveillance Programme network connecting all district hospitals with medical colleges of the state to facilitate tele-consultation, tele-education/ training of health professionals and monitoring disease trends. It has funded few pilot projects at national level such as; tele-ophthalmology and rural telemedicine projects. OncoNET India project is under implementation which will network 27 Regional Cancer Centers (RCCs) with 108 Peripheral Cancer Centers (PCCs)

hospitals to facilitate national cancer control programme. National Rural Telemedicine Network (NRTN) Project under National Rural Health Mission (NRHM) is under implementation phase. Recently, the ministry has decided to implement National Medical College Network project under the central scheme - e-Health including telemedicine in which all the medical colleges of the country will be linked with high speed high bandwidth optic fiber backbone from "National Knowledge Network". The proposed network will empower learners and teachers to practice distance medical education using various ICT enabled educational technologies. The digital medical library consortium created by the National Medical Library will be able to expand it's reach using this network.

2.4 State Governments:

To strengthen the healthcare facilities in their states, the governments of Orissa and Uttar Pradesh supported networking of their secondary level hospitals and then further linked them to SGPGIMS, Lucknow for specialty consultation[7]. C-DAC is now implementing the third phase of telemedicine network in Orissa by connecting remaining 22 districts hospitals. State-level central telemedicine resource centre is coming up on the premises of SCB Medical College and Hospital, Cuttack for promoting, monitoring, storing and maintaining entire state telemedicine activities and digital medical contents[18]. The Government of Chhattisgarh with the support of ISRO has established state wide network linking state Government Medical Colleges at Raipur and Bilaspur which in turn have been linked with premier hospitals across the country. Rajasthan State Government, also in collaboration with ISRO, has established Telemedicine network between 6 state medical colleges and 32 district hospitals and 6 Mobile Vans. Karnataka State Telemedicine Network Project run by an autonomous trust formed by the State Government has set up 30 nodes in collaboration with ISRO. Intel has initiated a joint telemedicine programme to take the benefits of healthcare to rural Karnataka in association with the state government[26]. Andhra Pradesh state government is planning to launch mobile clinics that would daily visit two villages to check blood pressure, diabetes and other health parameters of people and also carry out telemedicine through "104 services". Gujarat is also starting "104 services" over phone. People can call up and talk to paramedics in call centers who can suggest the primary action to be taken in case of any health emergency. Also, they would be able to suggest generic and over the counter drugs." Punjab government also launched a Telemedicine Project, with state-of-art facilities at Government Medical College and Hospital to link the five polyclinics set up in the state. In Himachal Pradesh 19 health centers at district, block and tehsil headquarters connected with Indira Gandhi Medical College, Shimla and Postgraduate Institute of Medical Education & Research Chandigarh through ISDN link[24]. The Gujarat government will soon launch a Telemedicine Project with the Indian Space Research Organisation (ISRO) as its technology advisor to enhance the quality of healthcare

services in the remote areas of the state. Under this project, government plans to cover 50 Community Health Centers, mainly in interior tribal and coastal areas of the state within a year. Later, this facility will be extended to other remote areas[30]. Maharashtra state has deployed Telemedicine network linking 28 District hospitals with Nanavati super specialty hospital under National Rural Health Mission.

2.5 Telemedicine Initiatives undertaken by Large hospitals: Academic / Public / Corporate

Various tertiary level super specialty hospitals in public and corporate sector have taken initiatives in telemedicine programme with the help of government agencies or on their own. Many of them have now completed a decade of telemedicine journey. Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow, a premier academic medical institution in the public sector, started telemedicine activities in the year 1999 in project mode with the support of various government agencies. SGPGI Telemedicine network has linked 27 national and international nodes and has been carrying out tele-education and tele-healthcare activities. Research and development is one of the focus area at this center. SGPGI has set up a School of Telemedicine and Biomedical Informatics to train man power in the field of telemedicine and e health. Department of Information Technology, Government of India has now recognized it as a National Resource Center in Telemedicine and Biomedical Informatics. All India Institute of Medical Sciences (AIIMS), New Delhi connected with Jammu & Kashmir, Haryana, Orissa, North East states network and PGIMER, Chandigarh connected with Punjab and Himachal state network and Sri Ramachandra Medical College and Research Institute, Chennai connected with Andaman & Nicobar Island Hospital, Amritha Institute of Medical Sciences, Kochi connected with Lakshwadeep island, Tata Memorial Hospital, Mumbai, Christian Medical College, Vellore are involved actively in Telemedicine.

In corporate sector, the major players are Amrita Institute Medical of Sciences (AIMS), Kochi (69 nodes), Apollo Hospital Group (150 nodes), Asia Heart Foundation, Bangalore, Mumbai (02 nodes), Fortis Hospital (20 nodes), Narayana Hrudayalaya (26 nodes), Dr. Balabhai Nanavati Hospital, Mumbai (32 Nodes) and Escorts Heart Institute and Research Center (08 nodes). Recently Sir Ganga Ram Hospital, New Delhi has launched its telemedicine centers in Haryana and Rajasthan states. With the support of ISRO, Shankar Nethralaya at Chennai, Meenakshi Eye Mission at Madurai and four other corporate eye hospitals have launched Mobile Tele-ophthalmology service for early diagnosis and treatment of ophthalmic diseases under National Blindness Control Programme. Sir Ganga Ram Hospital, New Delhi and AIMS, Kochi have launched mobile Tele-hospital for rural access of specialty healthcare services. Hyderabad-based Global Hospitals announced the opening of their information and telemedicine centre in Ahmadabad. The telemedicine centre in the city is the fourth after Kolkata, Puducherry

and Bhubaneswar. The telemedicine centre will help them to reach out to the specialists in Hyderabad and Chennai[29].

3. eLearning in the Health Sector

3.1 Online Open Access Bibliography: Two government agencies, the National Informatics Center (NIC) and the Indian Council of Medical Research (ICMR) have established the Indian Medical Literature Analysis and Retrieval System (MEDLARS) Center to cater to the information needs of the medical community of India. This ICMR-NIC Center for Biomedical Information has developed various web-based modules such as a union catalog of the journal holdings of medical libraries of India (http://uncat.nic.in), a bibliographic database of Indian biomedical journals (http://indmed.nic.in) and full texts of Indian biomedical journals (http://medind.nic.in).

3.2 Collaborative Knowledge Sharing through Telemedicine Network: In the interest of professional knowledge sharing, premier academic medical institutions including AIIMS, PGIMER, SGPGIMS, Christian Medical College, at Vellore, and AIMS are actively involved in sharing their academic activities over the telemedicine network.

4. Education & Training in e Health towards Capacity building:

4.1 The Apollo Telemedicine Network Foundation, in collaboration with Anna University in Chennai, was the first to start a 15-day certification course in Tele-health Technology, which is a blend of technical, medical and managerial skills. The first course commenced in October 2003. As part of its efforts to popularize telemedicine, an interactive section on telemedicine has been made available in the division of emerging technologies at the renowned National Science Center in New Delhi. Thousands of public individuals now have an opportunity to see telemedicine and learn about it.

4.2 SGPGIMS, in collaboration with the Uttar Pradesh State government and Department of Information Technology (DIT), Government of India, has taken the initiative to set up a **School of Telemedicine and Biomedical Informatics** in it's campus. Curriculum based diploma courses was started in 2009. First batch of the diploma course has finished and second batch is enrolled in this session year. It will house different laboratories in the field of e-Health such as telemedicine, hospital information systems, biomedical informatics, medical multimedia and image management, medical knowledge management, artificial intelligence, virtual reality, and robotics. The objectives of the school are to create various resource facilities, run structured training programs, conduct research and development, and provide consultancy to government and private health care organizations in collaboration with technological and medical universities in the country and abroad. Five trainees from the Maldives (sponsored by the WHO), 30 Indian trainees sponsored by the government of Madhya Pradesh, and 13 Indian trainees sponsored by the government of Uttar Pradesh learned telemedicine technology and its

application in October 2007 and February 2008. Two trainees from the DPR Korea (sponsored by the WHO), 38 Indian trainees sponsored by different organization in 2009 and 69 in 2010. The school is being identified as a **"National Telemedicine Resource Center" by DIT.**

4.3 Tele-training Center at National Institute of Health & Family Welfare, New Delhi

The Ministry of Health & Family Welfare in the Government of India is setting up a tele-training center at the National Institute of Health & Family Welfare in New Delhi to create a facility that will offer tele-training of public health professionals across the country through various e-learning modules. This will enable professionals to switch to more efficient electronic modes from the currently practiced on-site training modules. This initiative would boost capacity building in public health as has been envisaged under the National Rural Health Mission[4].

The National Board of Examinations (an autonomous body under the aegis of Ministry of Health, Govt. of India) offers a satellite-based postgraduate e-lecture program in all medical specialties. It is now mandatory for every institution recognized by the board to make available the necessary infrastructure for receiving these programs.[33]

4.4 e-Continuing Medical Education (e-CME)

MoH&FW is planning to network all the government medical colleges with high bandwidth fiber to facilitate an e-CME program.

5. e-Governance in the Health Sector under the Statewide e-Governance Network

DIT has launched the National e-Governance Action Plan (NeGP) to support the growth of e-governance within the country. The National Informatics Center (NIC) is the DIT arm that provides a range of services to all the government departments at the center, the states and the districts. A separate "e-Governance Standards Division" has been created by NIC to steer the process of evolving the standards.

Common Service Center (100,000 nodes), DIT Project

DIT has formulated a proposal to establish 100,000 common service centers (CSCs) in rural areas, which will serve not only as the front end for most government services, but also as a means to connect the citizens of rural India to the web. CSCs would extend the reach of electronic services, both government and private, to the village level. Various government departments have been advised to design and evolve their mission-mode projects, laying adequate emphasis on services and service levels with respect to their interface with citizens and businesses. Telemedicine has been identified as one of the

service modules. It is envisaged that initially, 20,000 CSCs would have tele-health outlet service managed by a village-level entrepreneur.

6. Village Resource Center (VRC)

The VRC concept has been evolved by ISRO to provide a variety of services such as tele-education, telemedicine, online-decision support, interactive farmers' advisory services, tele-fishery, e-governance services, weather services and water management. By providing tele-education services, the VRCs act as learning centers focused on the virtual community. At the same time, VRCs will provide connectivity to specialty hospitals, thus bringing the services of expert doctors closer to villages. Nearly 500 such VRCs have been established in the country.

7. Policy Initiatives

7.1 Ministry of Communication & IT

a. Standardization of Telemedicine Platform and Services

To standardize services of different telemedicine centers, a document called "**Recommended Guidelines & Standards for Practice of Telemedicine in India**" has been prepared by DIT. It is aimed at enhancing inter-operability among the various telemedicine systems being set up in the country. These standards will assist the DIT and state governments and health care providers in the planning and implementation of operational telemedicine networks. To establish a telemedicine center, standards should be set for telemedicine systems, software, connectivity, data exchange, security and privacy. Guidelines should also be established regarding telemedicine interaction.

b. Defining the IT Infrastructure of Health

DIT also took initiative, in a project mode, for defining **"The framework for Information Technology Infrastructure for Health (ITIH)"** to efficiently address the information needs of different stakeholders in the health care sector.

7.2 Initiatives of Ministry of Health & Family Welfare (MoH & FW)

National Task Force on Telemedicine:

1. To work on inter-operability, standards for data transmission, software, hardware, training etc.
2. To define a national telemedicine grid and consider its standards and operational aspects.
3. To identify all players and projects currently involved in telemedicine in India and evaluate their performance, capacity and replicability.
4. To prepare pilot projects for connection of super specialty hospitals/ medical colleges with district hospitals and/or Community Health Centers /Primary Health Centers especially keeping in mind to provide access to remote areas.
5. To prepare national cancer telemedicine network

6. To examine possibilities of utilization of standalone centers of department of communication in rural areas
7. To define standards and structures of electronic medical records and patient data base which could be accessed on a national telemedicine grid?
8. To enable telemedicine centers in teaching institutions to impart training to all government medical/ dental/nursing colleges in three years time
9. To prepare curriculum and projects for CMEs through telemedicine.
10. To draft a national policy on "telemedicine and tele-medical education" and to prepare a central scheme for the 11th Five Year Plan.

7.3 Medical Informatics Education for Graduate Medical Students

The Medical Council of India is considering the introduction of medical informatics in the course curriculum of graduate medical students.

8. National e-Health Projects under Planning and Implementation

8.1 Ministry of Health & Family Welfare Projects

a. National Onco NET Project:

Under the National Cancer Control Program, 27 Regional Cancer Centers will be linked with 100 peripheral centers for primary prevention, early detection, treatment and rehabilitation of cancer patients.

b. National Medical College Network:

The National Task Force on Telemedicine, set up by the Union Ministry of Health and Family Welfare, plans to establish a national grid on telemedicine for networking medical colleges. A few tertiary-care academic medical institutes from different regions of the country will be identified as medical knowledge resource centers (in a regional hub), each of them connected to medical colleges (nodes) in that region. One of these regional hubs will be identified as the central hub, which will have overall responsibility for co-ordinating the national network in addition to providing infrastructure for a central content development center.

c. National Digital Medical Library Consortium:

The National Medical Library's Electronic Resources in Medicine (ERMED) Consortium is an initiative taken by the Director General of Heath Services (DGHS) to develop nationwide electronic information resources in the field of medicine. A total 39 centrally-funded government institutions (including 10 under DGHS, 28 laboratories under the Indian Council of Medical Research, and the AIIMS libraries) have been selected at the initial stage as core members. The MoH&FW aims to provide funds required for the purchase of electronic journals under this consortium project.

8.2 Ministry of External Affairs Project:

a. SAARC telemedicine network[20]

The South Asian Association of Regional Co-operation (SAARC), created as an expression of the region's collective decision to evolve a regional cooperative framework, received a major impetus during the 14th SAARC Summit held in New Delhi in April 2007. The pilot project connecting one or two hospitals in each of the SAARC countries with three to four super-specialty hospitals in India. The super specialty hospitals in India include the SGPGIMS, Lucknow and PGIMER, Chandigarh. which are connected with JDWNR Hospital, Thimphu, Bhutan, Indira Gandhi Child Hospital, Kabul, Afghanistan, Patan Hospital, Kathmandu, Nepal. This is being developed as an exemplary model for implementing projects at the regional level. It has immense potential to expand the scope of regional cooperation to other ICT enabled areas such as education, business process outsourcing and mass communication.

b. Pan-African e network project:

The Ministry of External Affairs for the Government of India is implementing this project through Telecommunications Consultants India Ltd. (TCIL) to establish a VSAT-based telemedicine and tele-education infrastructure for African countries in 53 nations of the African Union. This will be accomplished via a satellite and fiber-optic network that would provide effective tele-education, telemedicine, Internet, videoconferencing and VoIP services and also support e-governance, e-commerce, infotainment, resource mapping and meteorological services. Ten super-specialty hospitals in India have been identified to provide tele-health services to 53 remote African hospitals. In August 2010, the second phase of the Pan-African e-Network project had been launched[31].

9. e-Health Industry

Technologically, India is now self-sufficient in meeting the needs of hardware, software, connectivity and services. The prominent industries providing hardware and software supports are C-DAC; The Apollo Telemedicine Network Foundation in Hyderabad; The Online Telemedicine Research Institute in Ahmedabad; Televital India in Bangalore; Vepro India in Chennai; Prognosys Medical Systems Pvt. Ltd. in Bangalore; Medisoft Telemedicine Pvt. Ltd in Ahmedabad; Idiagnosis Technologies in Ahmedabad; and Karishma Software Ltd. in New Delhi. Many sturdy, standard HIMS solutions have been developed by the major IT companies such as C-DAC, Wipro GE Healthcare, Tata Consultancy Services (TCS), Amrita HIS Solution, Sobha Renaissance, and Siemens Information Systems Ltd (SISL).

10. Research and Development

10.1. DIT Initiative:

DIT, along with its societies such as CDAC and Media Lab Asia and in collaboration with many premier medical and technical institutions such as SGPGIMS, AIIMS, PGIMER and IITs, is involved in research, design, development and deployment of advanced telemedicine products and solutions. They also specialize in embedded and VLSI technology and biomedical, electronics, telemedicine and entrepreneurship development. C-DAC's Sushrut, a hospital information system (HIS) has been designed, developed and deployed at SGPGIMS[1]. It has also developed the institution-based application oriented telemedicine software systems Mercury® and Sanjeevani® and validated them at three premier medical institutions: SGPGIMS, Lucknow; AIIMS, New Delhi and PGIMER, Chandigarh.[22]

10.2 SGPGIMS Initiative:

In collaboration with its technical partner, SGPGIMS developed and validated several application modules in telemedicine in addition to developing the prototypes Tele-ambulance for emergency health care, Mobile Tele-hospital for rural health care, and the portable suitcase telemedicine module for disaster situations.

11. Research publications:

India has contributed several research publications in peer reviewed scientific journals and book chapters in related field. A compendium of these publications can be found at www.telemedindia.org.

12. Conclusion:

Over a decade India has gone ahead with experimenting the utility of Information and Communication technologies in healthcare and educational practice. Indigenous technology and tools have developed, Policy issues addressed and national level programmes are in different phases of implementation. Since health is a state subject it will take some time to get the technology adopted to health system. However, the national schemes are now being implemented by the user ministry i.e. Health and family welfare which will cover many areas in healthcare and e-continuing medical education. India has been able to prove it’s technology and managerial strength by implementing SAARC and Pan-African e-Network Project. The vision of the Prime Minister of India to make India a knowledge society by providing high speed optic fiber based broad band connectivity to far flung areas has now being fulfilled. Many of the national tele-health schemes are now based on terrestrial broadband rather than satellite connectivity. Indian experience of ICT application in health can be taken as a case study for other developing countries to formulate national plan for e-health.

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