



## TELEMEDICINE — THE SIMPLE ROUTE TO SPECIALTY HEALTH CARE IN RURAL AREAS AND UNREACHED POCKETS OF THE COUNTRY.

### Hospital Administration

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### ABSTRACT

Telemedicine: Theo WHO defines Telemedicine as, The Delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and for the continuing education of healthcare providers, all in the interest of advancing the health of individuals and their communities. Telehealth is the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education and training, public health and health administration. Teleconsultation is the use of information and communication technology to enable clinical consultation between geographically separated individuals such as health care professionals and their patients or health care professionals engaged in diagnostic, mentoring or other clinical decision making activities related to the delivery of health care services. Teletreatment provided to the patient through telemedicine. The specialist at speciality centre could advise the consulting doctor at the consulting centre about the course of treatment with an over all Telemonitoring process for better outcome.

### KEYWORDS

1. Telemedicine 2. DICOM 3. Satcom 4. Department of Information Technology (DIT) 5. Technical Working Group (TWG) 6. Ministry of Communications and information Technology (MCIT).

In a developing country like India, how many have the privilege of access to good health service. Answer is simple, only those in the Cities have more access to this facility. When you talk of super specialty health care, it is available only in metropolitan cities and not in all cities, the reason for this is that majority of the doctors are in cities whereas majority of the country's population live in rural area. Further, this is compounded by inadequate medical facilities in the rural and inaccessible areas, problem of retaining doctors in rural areas both due to the non-availability of adequate facilities and also due to the feeling of professional isolation among doctors. The magnitude of this problem is enormous. However, the present day technology can provide partial solution for this problem. The user — friendly equipment's make the solution that much simpler. The only requirement is that the concerned people must have a mind to adopt this.

Telemedicine can instantaneously bring to your doorstep the specialty healthcare — no matter where you are. Be it the islands, the hilly terrain, remote places or tribal areas. The technologies have been synergized. The concepts have been successfully demonstrated. It also to great extent will bridge the professionals and decrease the professional isolation of physicians serving in the remote areas; which in long-term can result in retaining of qualified professionals in these areas. Telemedicine system consists of a computer (PC) with customized medical software connected to a few medical diagnostic instruments like ECG or X-Ray Machine or an X-Ray scanner for scanning the X-Ray films. Through this computer which digitizes the medical images and information of the patients like X-Ray images, ECG or blood test report, the details are sent to the specialist Hospital through the communication link which could be a satellite VSAT system or terrestrial links. This information is, in-turn, received at the specialist centre where the specialists examine the reports, diagnose, interact with the patients and suggest appropriate treatment during the videoconferencing session.

#### Telemedicine System:

The telemedicine facility caters to the transmission of patients' medical images, records output from medical devices, besides live two-way audio and videoconferencing. With the help of these, a specialist doctor advises the non-specialist doctor or a paramedic at the patient's end, on line, about the medical care. In the context of distant and total areas, the Telemedicine-based medical care is also highly cost effective.

Telemedicine system consists of customized medical software

integrated with computer hardware along with medical diagnostic instruments connected through the satellite based communications means (like-VSAT) at each location. Generally, the medical record/history of the patient is sent to the specialist doctors, either in advance (offline) or real-time bases (Online); that will in-turn study and provide diagnosis and treatment during videoconference with the patients end.

#### PREAMBLE:

Inspired by recent advances in the provision of health care and medical education through the use of information and communications technology, recognizing the common interest of the health and community welfare of the people of India, Believing that the promotion of telemedicine will contribute to the availability of quality health care to those in need Irrespective of socio economic and geographical disparities, Believing that the telemedicine services envisaged in the country should be available for the benefit of all people located in rural, remote and inaccessible places, and to further enhance its end-to-end capability Recognizing the right to privacy and confidentiality in health matters, Recognizing the advancement in the communication and information technology in India, which is the forerunner for its adaptation in telemedicine, Desiring to contribute to broad international cooperation in the scientific, legal, and ethical aspects of the use of telemedicine, Believing that such cooperation will contribute to the development of mutual understanding and to strengthen the friendly relations between states and people, Encouraging to provide continued support for the advancement of telemedicine/ Tele-Health, its applications and its greater relevance to India, Realizing the importance of Information and Communication Technology (ICT) in Telemedicine programs, a set of guidelines/standards will go a long way in optimally leveraging existing technologies, while ensuring its continuity to the evolving and advancing technical innovations, Realizing the necessity of delivering cost effective solution for telemedicine technology and indigenous enterprise for providing software/hardware for telemedicine, Government of India is convinced that a set of standards and guidelines on telemedicine be defined, that will further the goal of providing all people with a practically attainable standard of health care, which is sustainable in an integrated manner.

As part of this endeavour, Department of Information Technology (DIT), Ministry of Communications and information Technology (MCIT), has taken initiative on the evolution and adaptation of standards of telemedicine under the aegis of the committee for

standardization of digital information to facilitate implementation of telemedicine system using information technology enabled services.

The committee is supported by a Technical Working Group (TWG), consisting of members drawn from different government and private agencies/institutions that have taken initiatives in the form of pilot projects in telemedicine, with a mandate to evolve and submit a document on suitable standards and guidelines for telemedicine practice in India.

#### AIMS & OBJECTIVES:

1. Design & Development of Low Cost Mobile Satcom Based Tele-Health Improve and enhance the health care services to people in urban and rural area, especially emphasis towards underserved population.
2. Improve healthcare delivery through access to diagnostic/Expert consultation / follow up
3. Improve public health management with special emphasis on epidemiological applications
4. Knowledge and access for public and healthcare professionals particularly in rural and underserved areas.
5. To promote and encourage development, advancement and research in the science of telemedicine and its associated fields.
6. To encourage and promote application of telemedicine technology in clinical care, education and research in the health sector.
7. Fostering networking and collaboration among interest groups in telemedicine technology and professionals from different streams of science, health care providers, policy makers, NGOs and industry.
8. Disseminating knowledge in Telemedicine field by publishing brochures, periodicals and journals.
9. Creating an exclusive web site for the society and regularly updating it with telemedicine news.
10. To promote the growth of Telemedicine and to define specific process for scientific practice of telemedicine

#### EXPECTED BENEFITS:

Timely access to diagnostic, especially healthcare advice for epidemic access to the grass root level through the low cost telemedicine network.

Through various seminars and continuous training programs knowledge of medical and paramedical staff can be updated and their skills and services can be enhanced.]

Remote education, training and skill development at grass root health care workers and professional under NRHM.

#### METHODOLOGY:

Developing and integrating mobile Satcom based Tele-epidemiology system with the hardware, software and wireless communication interface module.

Integration of developed module in to telemedicine system  
Develop a schedule for running mobile system in the area of public health concern right from the grass root level.

#### INFRASTRUCTURE

1. Hardware
  - a. Telemedicine platform
  - b. Clinical devices
  - c. Video conferencing units
  - d. Communication hardware
2. Software
  - a. Operating system
  - b. Licensed telemedicine software (with PIR with the mandatory fields) with appropriate user interface (UI)
  - c. Back end data base with the mandatory tables/ fields (if applicable)
  - d. Connectivity: options for telemedicine services
    1. VSAT
    2. PSTN
    3. ISDN
    4. Leased line
    5. Wireless LAN/WAN
3. Data interchange/exchange standards and minimum data sets

(MDS)

- a. Identifiers
- b. Patient
- c. Telemedicine centre
- d. DICOM: (Digital imaging and communications in medicine) is an industry standard from the National Electrical Manufacturers (NEMA) facilitating the exchange and processing of medical images in digital form. Image acquisition devices (e.g. Computer tomography), image archives, hardcopy devices and diagnostic imaging workstations from different vendors can be connected in to a common information infrastructure and integrated with other information systems (e.g. PACS, HIS/RIS)

#### Applications

1. Tele-Radiology
2. Tele-Cardiology
3. Tele-Pathology
4. Tele-Ophthalmology
5. Tele-Dermatology
6. Tele-Nephrology
7. Remote ICU monitoring
8. Ambulance monitoring
9. Mobile telemedicine unit

#### APILOT OBSERVATIONAL STUDY:

Conducted in different parts of the state has shown the high prevalence of kidney disease in some rural areas of the state. Presumed chronic interstitial nephritis was the major contributing etiological factor for the chronic kidney disease. Villages where the prevalence was high are depending on ground water from deep bore wells for the drinking purpose and they are located in specific locations of the state where the bedrock of the ground is granite/mica. The ground water testing in the different geographic locations showed higher levels of silica and strontium in villages where disease prevalence is high.

Screening procedure: each village was being visited by the study team the information was communicated to the local population through the local village leaders.

The study subjects of age 18 years or more were covered from the rural villages of the Prakasham district, those who are using ground water for drinking purpose and having kidney disease on screening.

Population with established kidney disease secondary to known aetiology such as diabetic nephropathy, congenital kidney diseases and patients with serum creatinine > 3mg% are excluded.

The technical expertise and training for this project was supported by the Electronics Corporation of India (ECIL) and Indian Space Research Organisation (ISRO).

#### MOBILE UNIT PLATFORM SPECIFICATIONS:

1. Mobile Van with fabrication.
2. Hardware
3. Video conferencing units
4. Communication hardware
5. Software
  - a. DICOM viewer
  - b. DICOM Gateway
  - c. Video conferencing software
6. Medical equipment
  - a. Digital ECG standard 12 leads
  - b. Digital X-Ray
  - c. Refrigerator to store the chemicals and samples
  - d. Auto blood analyser
  - e. Ultrasonography machine
7. Power source

#### RESULTS:

Total population screened for the study purpose were 1535 in different villages. The patients with serum creatinine > 1.5mg/dl were 270. The subjects were selected based on study criteria and location of the village. Test and control villages were separated by distance. Test group (n=40): received chlorinated surface water through 20 litres can per subject daily for 3 months. Control group (n=40) continued to use same ground water.

**GRANITE AND MICA BELT REGION:**

	Total population screened	Patients with S.Cr> 1.5mg%	Prevalence of disease
Prakasham District	2804	488	17.4
Nellore District	499	104	20.8

**Non Granite/Mica region:**

	Total population screened	Patients with S.Cr> 1.5mg%	Prevalence of disease
Rangareddy District	436	20	4.5

**DISCUSSION**

1. There is high prevalence of Kidney disease as estimated by camp based study in rural villages of Prakasham, Nellore districts where groundwater is being used for drinking purpose.
2. The kidney disease is found on the screening tests, suggesting the silent disease burden in the community, there by emphasizing the role of screening for kidney disease,
3. The ground water is being indiscriminately used in many rural villages and quality control of the ground water also should be looked with reference to the local health problems.
4. The ground water quality should be looked holistically. Apart from fluoride which is a known cause of non-communicable disease, other elements also should be looked in the quality control as the levels of silica and strontium were found to be in higher concentration in Villages where the kidney disease prevalence is high.
5. Risk factor intervention with simple cost effective easily adaptable and acceptable by the community like utilization of surface water and rationing the water for drinking purpose are needed to halt the epidemic of non-communicable disease.
6. The strategy of utilizing the surface water resources for drinking purpose with available resources and infrastructure can yield long term benefits.

**SUMMARY**

Telemedicine in the present study has shown the utility of technology to conduct a major preventive programme at community level. The burden of non-communicable diseases is increasing worldwide more so in the developing countries like India. The creating awareness, screening and early detection of the diseases will play a major role in the preventing these at community. This also helps to decrease the burden on the government and family for management of the chronic diseases.

**The present study has increased the awareness of the rural population**

The study by using the telemedicine and mobile vehicle has reached the villages with the help of the educational material in local language and with the help of health care volunteers; awareness of the management of diseases, preventive modalities was created among the villagers. The impact of awareness was obvious during the study period itself. Majority of the people who got the awareness came to the telemedicine centre and got them screened for the diseases. The health education was also given to the at risk population which will enable them to adapt a healthier lifestyle for prevention of the diseases. The people have also interacted with the specialist located in a remote end to get the clarifications of the advices. This has increased their confidence in the awareness programmed because the specialist is monitoring and advising them

**The screening of non-communicable diseases was done:**

The non-communicable diseases may not have the clinical manifestations in the early phase of the illness which make them to present at the end stage of the disease, which makes them difficult to manage them.

The screening of the non-communicable diseases was performed at the rural villages. On site performance of the evaluation for the diseases and immediate result - advice has resulted in huge community participation in the programmatic view of the telemedicine connectivity the test results were sent to the expert centre and needed advice was obtained from the specialist at the remote end. This is the first time that telemedicine is used to run the major non-communicable screening programme.

About 10-20% of population was Identified for the major non-communicable disease those are not aware of the disease, if they were not screened might have presented in end stage disease. Early screening gives an opportunity for the management in terms of prevention of progression of the disease with minimum mortality and morbidity. The early disease management is also in the reach of many.

**CONCLUSION:**

Telemedicine is a major tool for conducting the community oriented specialised programs it offers an effective utilization of manpower and infrastructure for the better health care to all.

Creating awareness, conducting the screening, disease counselling and follow up can be effectively performed by using the Telemedicine Interface.

Telemedicine Network Topology has progressively graduated from a simple point-to-point system to multipoint-to-multipoint system covering telemedicine, Continuing Medical Education and Mobile system which is scalable and reliable. The benefits of the advancements in ICT (Info & Communication Technology) & reduction in the cost of hardware and software should reflect in the Telemedicine system becoming simpler and affordable.

There are different challenges and issues in the implementation of Telemedicine Systems and network and they can be categorized under technical, managerial, ethical, legal and financial aspects and they need to be addressed systematically for establishing a successful Telemedicine network. This requires an integrated effort by all agencies - the government, health care providers, administrators, doctors, technologists and financial institutions.

It is important to follow the required standards as delineated in various chapters of TWG Report for practice of Telemedicine; however it is essential to know the local conditions of a particular Hospital especially the hospitals in the rural areas when applying certain standards. For example in many hospitals the x-Ray/Cr/MR may not have DICOM in the older versions of the machine. In this case methods of provision for DICOMising the image are possible. That is image & single image so that nobody can change the image of patient data.

With adaptation of HL-7 it is to be noted that aspects of Admission Discharge Transfer (ADT) 8. Clinical Data architecture (CDA) in the form of basic minimum essential fields needs to be used. Indian Space Research Organization, Ministry of Communication & Information Technology, Healthcare providers, Media Lab Asia, and several other organizations are actively involved in setting up the standards of Telemedicine systems in India and promoting the same, which is internationally accepted and aimed at interoperability between the Telemedicine systems. The challenge of Telemedicine lies in the proper motivation & training of the End users. Successfully overcoming this challenge through a determined collaborative effort will be vital. Only then can the promise of Telemedicine be converted to a reality that improves healthcare delivery and outcomes for our underserved populations.

For proper functioning of a Telemedicine system and also keeping in mind the future expansion, the devices and equipment's should be selected in such a way that there are no problems of audio-video interface.

While various connectivity options, Terrestrial/wireless or Satellite based are available in general, the Selection and implementation in Telemedicine data delivering are site/project specific. The considerations - need accessibility, affordability etc. play a vital role in the selection. The bottom line is whatever the option may be it should follow standards to meet the user requirements.

Currently medical images can be stored in an archival server in DICOM format from any modality whether it is DICOM or Non DICOM. Once this is done the images can be stored in compressed or non-compressed format in the webserver. This is available for communication to the entire hospital, outside the hospital, residence, or other countries. Simultaneously Telemedicine link help in easy interaction of clinical data with the imaging data from experts from remote corner. This can help in solving difficult clinical problems instantaneously. However, we have to adhere to the DICOM-ACR-NEMA-3 standard failing which the disadvantage can overtake

the advantage of this wonderful technology. Hence we have to address the following issues also.

1. Protection against loss.
2. Protection against alteration.
3. Privacy and confidentiality requirements.
4. Patient identification number requires stronger protection.

The data from our study reveals that Telemedicine applications in paediatric cardiology allow definitive diagnosis of any heart disease in children, both acquired and congenital. By offering immediate management advice, it can be saving and avoids potentially life-threatening travel while the patient is acutely sick, importantly, in those with a non-cardiac problem, by ruling out cardiac pathology, it facilitates initiation of treatment for the appropriate system without undue delay.

In the coming years technological advances in medicine would definitely play a very constructive role in delivering eye care to remote areas that cannot afford to have tertiary care treatment facilities. Emerging technologies in virtual reality and micro machines will transform the eye care scenario (patient consultations and ophthalmic education) in the country, resulting in providing world class eye care to everybody.

With these in mind, it is concluded that delineation of major morbidity patterns in the intended areas of application and the existing infrastructural facilities for delivery of health care is essential. Once the macro picture of the situation is analysed the micro-planning for implementation may be evolved.

Subsequent interactions with concerned specialists would help in developing a workable plan of action for successful accomplishment of this realistic endeavour of bringing the Telemedicine for primary health care.

A Telemedicine setup can be painless, simple and economical, if the right SOP's are followed and if the right equipment is selected and right protocols are adopted, this would go a long way in bridging the Rural Urban healthcare divide.