Telemedicine landscape of India with special reference to national strategy, trends in technology and solutions

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• Introduction
• Strategy of Government of India for ICT application in Health
• Brief Review of Country wide Telemedicine Programs
• Scientific activities
• m-Health in India
• New models of Rural Telemedicine
• Challenges
• Conclusions
Introduction
Indian Demography

- Total Area 3 Million Sq. Mtr
- 29 Provinces & 6 Union Territories
- 6,700 Km Coastal Lines
- Diverse Geography (Inaccessible hilly regions, islands, desert, coast and tribal areas)
- More than 1 billion population (70% Rural)
- Medical Experts: 70% Urban
**Potential of ICT to improve Healthcare**

74.04% literate population

70 million homes have access to TV

650,000 existing PCOs ® internet kiosks

99,247 CSCs operational (www.csc.gov.in)

**Cell phones**: 930.20 million (Sept 2014)

India is likely to have 314 million mobile Internet users by end of 2017 from 159 million users at present

Hardware, software and brain ware all available
12th Plan (2012-2017)

• Access to CME and skill up-gradation programmes, as well as back-up support on telemedicine
• Deployment of Countrywide HIMS
• The use of ICT in health education, public health status analysis and expansion of health related research
• All District hospitals linked by telemedicine channels to leading tertiary care centres
• M-Health, the use of mobile phones to speed up transmission

http://planningcommission.nic.in/aboutus/committee/strgrp12/str_health0203.pdf
Brief Review of Country wide Telemedicine Programs
Major Implementing Agencies

Others

• State Governments

• Medical Institutions (public & corporate)
• Research & Development leading to Indigenous Technology Development – Integrated Telemedicine System (platform + Software)
• Pilot deployment
• Specialty specific platform and network
  – Tele-Oncology System e.g. OncoNET Kerala
  – Tele-radiology
  – Software and system for Tropical Diseases
  – Cancer Screening and follow up using Telemedicine Bus
• Standardization activities in e-health/Telemedicine
• Prepared a framework for IT Infrastructure for Health

http://deity.gov.in/content/medical-electronics-telemedicine-division-projects-0
Indian Space Research Organization
Since - 2001

- ISRO has established total 382 Telemedicine Centers till date
- Super-specialty Hospitals : 73
- District hospitals-Patient end : 280
- Super-specialty + patient end: 13
- Telemedicine Mobile Vans: 16
- Operational Model: fully sponsored

www.isro.org/scripts/telemedicine.aspx
Tele-ophthalmology

- Ministry of Health & Family Welfare under National Programme on Control of Blindness
  
  [Website](http://www.mohfw.nic.in/NRHM/.../NPCB_15Jan_Latest.pps)

- Arvind Tele-Ophthalmology
  
  [Website](http://www.aravind.org/telemedicine/va.htm)

- Sankarnethralaya Tele-Ophthalmology
  
  [Website](http://www.sankaranethralaya.org/teleophthalmology.html)
Tele-radiology

- Tele-radiology is an emerging as successful business model for telemedicine in India
- Best example of business model has been developed at Bangalore by the Teleradiology Solutions [http://www.telradsol.com/](http://www.telradsol.com/)
- Information on other Tele-radiology solution providers are
  - [www.telediagnosys.com](http://www.telediagnosys.com)
  - [http://www.meddiff.com/instacath.html](http://www.meddiff.com/instacath.html) Mediff web based PACS / Teleradiology
Tele-Cardiology


- Telecardiology includes Trans-telephonic Electrocardiographic Monitoring (TTEM); Tele-echocardiography, Tele-stethoscopy.

- TTEM involves applications required to transfer ECG by Direct Electronic Transmission of wave form signal.


- **Narayan Hrudayalaya’s worldwide 308 centers are a part of Trans Telephonic ECG network** [http://www.narayanahospitals.com/services/telemedicine/introduction/](http://www.narayanahospitals.com/services/telemedicine/introduction/)


- **i2i TeleSolutions and Telemedicine Pvt Ltd** [http://i2itelesolutions.com](http://i2itelesolutions.com)
Tele-pathology

• **Static telepathology** link was established between urban Mumbai’s Tata Memorial Hospital and a rural based Nargis Dutt Memorial Cancer Hospital, from 2000 onwards

  [http://www.amj.net.au/index.php?journal=AMJ&page=article&op=viewFile&path%5B%5D=855&path%5B%5D=869](http://www.amj.net.au/index.php?journal=AMJ&page=article&op=viewFile&path%5B%5D=855&path%5B%5D=869)

  [https://tmc.gov.in/misc/aboutus.htm](https://tmc.gov.in/misc/aboutus.htm)

• **Tele-CPC Network**
  Clinico Pathological Conference (CPC) held every Wednesday (08:00-09:00 am) held at Post Graduate Institute of Medical Education & Research, Chandigarh is transmitted simultaneously with 05 Centers across the country.


• **Virtual pathology community** of India since 1999  [http://www.pathoindia.com/tele.html](http://www.pathoindia.com/tele.html)

• **Business Model for Pathological Diagnostic Services at Home.**
  Major labs have country wide network and offered web based reporting services.
• Design, development and implementation of
  – Low cost rural telemedicine infrastructure
  – Village Tele-ambulance System and rural emergency healthcare services / Trauma care module
  – Rural Health Knowledge Resource through web portal and e-CME module
  – Technology platform for harvest, compilation, storage (Data Base) at Regional District Hub and Central Data Center at MOH & FW, archive and distribution across network

www.mohfw.nic.in/National%20Rural%20Telemedicine%20Network%20for%20India-...
Telemedicine Programmes at Major Academic Medical Institutions

- Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh
  www.sgpgi-telemedicine.org, www.nrct.in, www.stbmi.ac.in
- All India Institute of Medical Sciences, New Delhi
  http://www.aiims.edu/aiims/telemedicine/telepage.htm
- Post Graduate Institute of Medical Education & Research, Chandigarh
  http://pgimer.nic.in/code/telecentre/html/intro.htm
- Tata Memorial Hospital, Mumbai
  https://tmc.gov.in/
- Sri Ram Chandra Medical Centre, Chennai
  http://www.sriramachandra.edu.in/telemedicine.htm
- Amrita Institute of Medical Sciences, Cochin
  http://www.aimshospital.org/hospital/cdh/cdh.html
- SCB Medical College, Cuttack
  http://scbmc.ac.in/index.php?option=com_content&view=article&id=153&Itemid=182
Telemedicine Programmes at Major Corporate & Not-for-Profit Hospitals

- Apollo Hospital Group, Chennai, Hyderabad, New Delhi
  http://www.apollohospitals.com/initiatives_tele.php
- Narayana Hrudayalaya, Bangalore
  http://www.narayanahospitals.com/services/telemedicine/introduction/
- Aravind Eye Hospital
  http://www.aravind.org/telemedicine/va.htm
- Shankar Netralaya
  http://www.sankaranethralaya.org/teleophthalmology.html
- Max Healthcare
  http://www.cio.in/case-study/max-healthcares-telemedicine-push
- Fortis Escort Heart Hospital
  http://www.fortisescorts.in/services-treatment/telemedicine-ehas
- CMC Vellore
  http://clin.cmcvellore.ac.in/otherwebsite/mission_support/Telemedicine.asp
State Government Initiatives under National Rural Health Mission (NRHM)
Orissa Telemedicine Network

http://scbmch.ac.in/index.php?option=com_content&view=article&id=153&Itemid=182

ITU Regional Workshop for CIS on Use of ICT for Health Protection. Telemedicine Services, Including in Rural and Remote Areas Tashkent, Republic of Uzbekistan, 7-9 October 2015
NRHM Maharashtra

**Telemedicine Project**

Telemedicine is a rapidly developing application that uses networks for the purpose of consulting, and so on. Telemedicine may be as simple as two health and video-conferencing equipment to conduct conferences or as using satellite technology to provide telemedicine services to remote places. Telemedicine project was first started in Maharashtra for four years by the Government of India and Municipal Corporation. It included five hospitals in the state through specialists from health institutions.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Type of node</th>
<th>Phase-I (2007-08)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Controlling node</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Specialist node</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Patient node</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

All the controlling and specialty nodes (6) are situated in Medical Colleges as follows and 27 patient nodes out of 23 are District Hospitals, 4 are Sub District Hospital and New 30 Sub District Hospitals.

All 6 specialty nodes
(1) K.E.M. Hospital Mumbai,
(2) Sir JJ Hospital Mumbai.

http://www.nrhm.maharashtra.gov.in/telemed.htm
# Kerala Telemedicine Network

<table>
<thead>
<tr>
<th>S.No</th>
<th>Projects</th>
<th>Number of Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Onconet - Cancer Care For Rural Masses</td>
<td>06</td>
</tr>
<tr>
<td>2</td>
<td>Telemedicine Kerala for Taluk hospitals</td>
<td>08</td>
</tr>
<tr>
<td>3</td>
<td>Telehealth and Medical Education Kerala</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>Rural Telemedicine Project for primary care in Tirur taluk</td>
<td>11</td>
</tr>
</tbody>
</table>

[http://ehealthkerala.com/MedicalInformatics/nrhm.jsp](http://ehealthkerala.com/MedicalInformatics/nrhm.jsp)
Floating hospital, constructed by the state government under the National Rural Health Mission (NRHM)

• First telemedicine network in Tripura between GB Pant Hospital and IGM Hospital, Agartala and five other Nodal Centers
• 2\textsuperscript{nd} & 3\textsuperscript{rd} Telemedicine projects on the development and application of Telemedicine for Tripura Government Hospitals sponsored by the DIT, MCIT, GoI. Implementing Agency WEBEL ECS Ltd. & IIT Kharagpur.
• Network for alternate medicine - AUYUSH [http://tripuranrhm.gov.in/Auyush.htm](http://tripuranrhm.gov.in/Auyush.htm)
Uttar Pradesh

• State Medical College Network
  Three Medical Colleges- Allahabad, Kanpur and Meerut connected with SGPGIMS, Lucknow – Super Specialty Hospital

• Rural Telemedicine Centers at Raibareli District Hospital & Bachrawan Community Health Center
Boat Clinic in ASSAM under NRHM

http://healthmarketinnovations.org/sites/healthmarketinnovations.org/files/Boat%20Hospital%20PPP.pdf

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Bihar

- State of Bihar Initiated an unique telemedicine project for delivering service in alternative medicine – Ayurveda, Yoga, Unani, Sidha & Homeopathy (AYUSH)


http://ehealth.eletsonline.com/2013/11/telemedicine-project-for-bihar-soon/
mHealth in India
Mobile Portable System
Integrated Medical Equipments

PC Interface:
USB & Bluetooth

- Spirometer
- Common Interface
- Digital Glucometer
- Blood Pressure
- Wrist Clinic
- Weighing Machine
- SPO$_2$
- ECG

Atom based Low Cost Laptop with Integrated Telemedicine Software

Connectivity via High Speed Broadband (HSB)
• All Software Servers are Installed at Data Center of School of Telemedicine & Biomedical Informatics

Screen Shot of Cure-Soft
Low cost portable Telemedicine Unit

Digital Operation Theatre (High Cost)  Low cost portable Telemedicine Unit
Mobile Telemedicine Kiosk Applications

- Mobile kiosk @ Patient’s bedside
- Doctor’s Duty Room
- Department’s Seminar Room
- Tele-Clinic in Out Patient Department
Live streaming of surgical video

Live streaming of surgical video at doctor’s workplace
Section I, II, III & Auning
School of Telemedicine & Biomedical Informatics, SGPGIMS
Green Telehealth Infrastructure
Chain of eHealth Centers in Rural and Semi Rural India

M-Health 4U
Mobile Health Worker + Electric Vehicle = Last Mile Healthcare Delivery
Village eHealth Center using Solar: Concept

Mobile Health Vehicle

Charging of Battery Operated Vehicles

One Charge takes you 60 KM
• A leading example of ICT enhanced, curriculum driven medical education particularly for undergraduate programmes is Medisys Edutech (Formerly MEDRC Edutech)

• Medisys has produced over 4500 lectures, engaging several hundreds of leading faculty and edited and enhanced this repository with illustrations, animations, powerpoints etc.

• It is also bundling cases/ PBLs, ICT based CME Courses and Courses to support test preparation (FMGE, USMLE and such others)
• There are many limitations to overcome in medical education & CME in medical education such as faculty availability, time and distance, consistency of standards and right learning besides cost and universal reach.

• ICT offers interesting answers and Medisys is pioneering supplier of products and turnkey services.

www.smarteach.com
Digital Approach to Medical Education:
Provides On-The-Go learning facility for Students

SmarTeach® on Tab (UGMed)

m-Learning (Tab) Mode:

The e-Lessons are ported onto a SmarTeach tablet making the learning accessible offline on a 24x7 basis with the following benefits:

• **No need for Internet:** Student has all lessons “offline” in his mobile SmarTeach device. This increases accessibility and does not depend on Internet Bandwidth.

• **English Language:** Acts as a Revision Support for students who come from vernacular background (such as in Marathi, Telugu, Hindi, etc).

• **Comprehensive & Modular Coverage:** 1st professional students get Anatomy (466 units), Physiology (340 units) and Biochemistry (206 units). Subsequent subjects get added on as they progress through MBBS professional 2 and 3.

• **Student controls pace of learning:** Student can learn at his own pace – weaker students may view and review several times until they absorb the concept. Very useful for students coming from cultural backgrounds where English is not their first language or medium of instruction.

• **Student can learn 24x7 anywhere** – The lessons are accessible in the campus, at the bedside in the teaching hospital, in the hostel, at home and even in the bus on way to college and back home.

• **Integrated Learning:** Student can now return back and study a pre-clinical or para-clinical topic during later clinical years when what he learnt in 1st year makes more sense.

• **Instant Recall:** Ability to create Bookmark and jot down Quick Notes to which a student may jump back just before exams or when reviewing a case.
National Mission Mode Projects
Upcoming National Telemedicine Projects

• National Medical College Network over National Knowledge Network Fiber Backbone
  http://www.nrct.in/nmcn/

• Rural Telemedicine Network over National Optic Fiber Network
  http://iii.gov.in/index.php?option=com_content&view=article&id=397&Itemid=265

• National Cancer Network
  http://onconet.nic.in/

• National Tele-ophthalmology Network
National Medical College Network (NMCN)

National Resource Center

06 Regional Resource Center

All govt. Medical Colleges
UP Medical College Network
Block Diagram for Medical College Level: WAN & LAN Connectivity

Digital Lecture Theater

Tele-Consultation Facility

eLearning & Digital Library

Use of ICT for Health Protection. Telemedicine Services, Including in Rural and Remote Areas Tashkent, Republic of Uzbekistan, 7-9 October 2015
• National Knowledge Network (NKN)

• National Optic Fiber Network (NOFN)

• State Wide Area Network (SWAN)
ITU Regional Workshop for CIS on Use of ICT for Health Protection. Telemedicine Services, Including in Rural and Remote Areas Tashkent, Republic of Uzbekistan, 7-9 October 2015

http://www.nic.in/nkn
Broadband Connectivity to 250,000 Panchayats through National Optical Fibre Network (NOFN)

The Office of Adviser to the PM on PII has been working with various stakeholders on a plan for connecting 250,000 Panchayats in the country to optic fibre based Broadband. Effort is also underway to ensure that this hardware connectivity is supplemented by requisite software that takes into account local requirements, and provision of the right ecosystem at the Panchayats to best leverage the benefits of Broadband connectivity. The vision is to transform governance, service delivery and unleash local innovation capacity through rural broadband.

Government has approved the cabinet note on the Scheme for creation of the National Optical Fiber Network (NOFN) for providing Broadband connectivity to Panchayats on 25th October 2011. The implementation framework, budget, technology architecture and other issues related to NOFN are being worked out by the High Level Committee (HLC) constituted by the Department of Telecom (DoT) under the Chairmanship of Adviser to the PM and Chairman UIDAI (constituted on 26th April 2011). To move the project forward, an SPV has been incorporated named “Bharat Broadband Network Limited” (BBNL) which will be the executing agency for the project and will use the capabilities of three prominent telecom PSUs to implement the project. To grant right of way, a draft tripartite MoU (among GoI, the SPV and the State Government) has been sent to the State Governments and Union Territories for their concurrence. Pilots are also being tried in Ajmer, Vishakhapatnam and Goa to test the broadband infrastructure and adoption after being approved by MCI. Universal Service Obligation Fund (DOT), BBNL, BSNL, RailTel, Power Grid and Telecom Players, USPs and content providers, along with State Governments, will work on the Pilot Trials.

Simultaneously, the Office of Adviser is working on applications for rural broadband in collaboration with Ministries of Rural Development, Panchayati Raj, HRD, Health and the Prime Minister’s National Council on Skill Development so that even as hardware connectivity is under progress, applications also get addressed. The office has begun work on applications through a pilot in Ajmer district in Rajasthan and proposes to enlarge this to one district in each State.

As part of building Public Information Infrastructure, effort is underway to closely coordinate with the GIS plan, UIDAI, National Informatics Centre etc. to build relevant platforms, applications and portals (including developing India’s version of Data.gov under the aegis of the Department of Information Technology).

http://iii.gov.in/index.php?option=com_content&view=article&id=397&Itemid=265
GPON Ring Branch Topology

Applications:
- High construction neighborhoods where Protection against Feeder fiber cuts is required
- High availability GPON for businesses with path and equipment protection

* Splitter located in remote CO, pole mount, Strand mount, pedestal, below grade etc

Advantages:
- Protection Up sell for business
- Protection for feeder fiber cuts
- Efficient use of distribution fiber
- Accommodates basic churn
- Few types of splitters

Disadvantages:
- May have some stranded drops
- Feeder fibers must be diversely run
Education & Training
Tele-education & Telehealth Services
Community Outreach Programme & Public Health Services
Telemedicine Deployment under PPP Model
PPP Models in Practice; Uttarakhand

Department of Medical Health and Family Welfare (DoMH&FW), Government of Uttarakhand proposes to implement the Tele Medicine in Uttarakhand under PPP Mode.

Expression-of-Interest (EOI) is invited from suitable company’s/organizations/consortiums fulfilling the relevant pre qualification criteria for Implementation of Tele Medicine in Uttarakhand in Public Private Partnership (PPP) Mode.

Contact:
Director General, Directorate of Medical Health and Family Welfare,
Near IT Park, Danda Lakhond, Sahastradhara Road,
Dehradun, Uttarakhand,
Phone no: 0135-2608942, Fax no. 0135-2608746
Odisha has adopted ICT as development tool

- Odisha, the first state in the country has adopted ICT as a state development tool for providing healthcare services at the door step of the citizen.

- OTTET in collaboration with Govt. of Odisha and National Resource Center for Telemedicine & Biomedical Informatics at SGPGIMS, Lucknow under PPP mode
Uttaranchal Mobile Health Clinic
Opportunities and Challenges
Opportunities

- Vast and diverse geography with dominant rural population
- Disparity in healthcare infrastructure
- Low cost local technical solution & ICT expertise
- Fast adoption of Mobile technology (Crossing 927 Million)
- Successful pilot projects
- Policy on adoption of ICT in service delivery 12th Plan
- Budget Allocation under National Rural Health Mission
- National Knowledge Network (NKN)
- National Optic Fiber Network (NOFN) reaching 250,000 grampanchayat (Village Level Administration Point).
- National eHealth Authority
- Digital India Campaign
Challenges 1

• Evaluation & Identification of Best Telemedicine Practices
• Confidentiality & Security of Personal Health Record
• Credentials and competence of the remote physician
• Legal, ethical and social issues yet to be addressed
• Broadband internet yet to be operational in Rural
• NGN like Wi Max and 3G not widely available
Challenges 2

• E-health adoption by stake holders
• e-Health Program sustainability Models
• Inter-operability of e Health system
• Integration into prevailing Health System
• Development of National e-Health Observatory
• Capacity Building in e-health System
• Research & Development in e-health technology and system appropriate for local situation with global impact
Video Demonstration

Module I: Pack/Suitcase Telemedicine
Module II: Teleconsultation Process
Thank You

School of Telemedicine & Biomedical Informatics
National Resource Center : MCIT & MoH&FW, Govt. of India
www.sgpgi-telemedicine.org | www.stbmi.ac.in | www.nrct.in

Virtual Tour