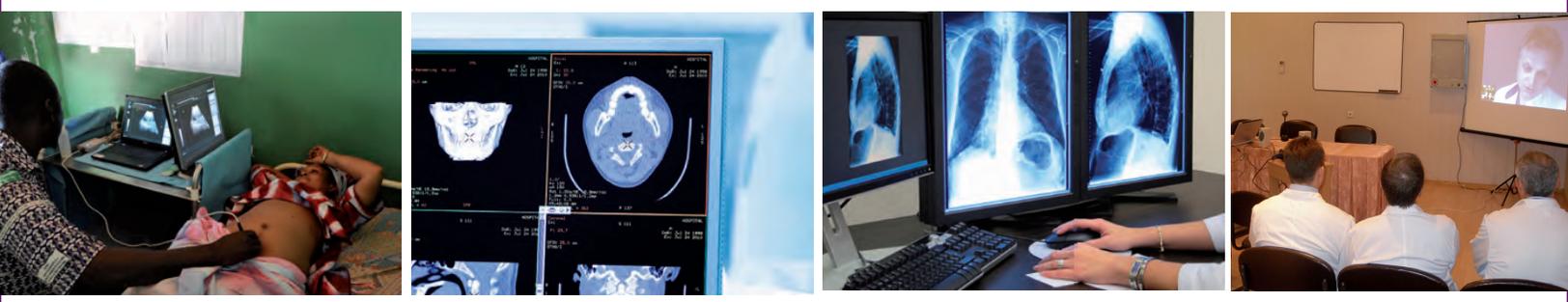




# Roadmap for Telemedicine

## Key considerations and Recommendations



A report by:  
The IWG ASIA Task Force on Telemedicine



## The Innovation Working Group (IWG)

The Innovation Working Group (IWG) was convened by the United Nations Secretary General (UNSG) in 2010 to use cost-effective innovation to accelerate progress on the health Millennium Development Goals (MDGs). Supporting the Global Strategy for Women's and Children's Health, the IWG is the global hub for innovation in the UNSG's Every Woman Every Child initiative.

The IWG is co-chaired by Tore Godal, Special Adviser on Global Health to the Norwegian Ministry of foreign Affairs, and Allan Pamba, Vice President Pharmaceuticals, East Africa and Government Affairs, Africa, at GSK. Project manager is Haitham El-noush at the Norwegian Agency for Development Cooperation (Norad), and the Secretariat is housed at the Partnership for Maternal Newborn & Child Health (PMNCH).

The IWG supports the initiation and scaling-up of innovations – whether they are technological, social, financial, policy or business-related. The IWG also supports and leads collaborative efforts among stakeholders in mHealth (mobile health, or health services supported by mobile communications technology).

The IWG consists of a broad network of interested parties with a small secretariat, working through partner organizations. It comprises members of governmental, inter-governmental and non-governmental organizations, as well as the private sector (both for-profit and not-for-profit), with everyone on an equal footing.

In 2013, IWG launched a regional hub in Asia, the Innovation Working Group Asia, to extend its global reach. The large numbers of women and children in Asia, together with dynamic financial, technological and social development, make a case for huge innovation impact potential. For more information on IWG, please visit [www.everywomaneverychild.org/resources/innovation-working-group](http://www.everywomaneverychild.org/resources/innovation-working-group)

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## Continua Health Alliance

Continua Health Alliance is the only organization convening global technology industry standards to develop end-to-end, plug-and-play connectivity for personal connected health systems. Our Design Guidelines and test tools expedite the deployment of personal connected health devices and systems that will dramatically improve health management, clinical outcomes and quality of life. At the same time, Continua Design Guidelines are proven to decrease time to market and reduce development costs.

Our focus is on creating a global market for personal connected health, working with a number of countries and national health ministries to support the development and implementation of groundbreaking national connected health initiatives. Continua is pleased to have an established presence in India, to advance end-to-end, plug-and-play interoperability in this important medical devices market. Continua is a strong voice for personal connected health technologies among employers, payers, regulatory bodies, government agencies and care providers, and we work collaboratively with advocacy, legislative and regulatory agencies on behalf of our membership.

Continua is pleased to carry forward our mission and represent our membership to support the efficient, cost effective and beneficial adoption of connected health in India.

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# 1. Executive summary

Healthcare delivery is set for a paradigm shift in the coming years. There is a distinct unfulfilled need to create new delivery models for providing affordable and prompt healthcare services to an ever-increasing world population. Augmentation of the traditional clinic and hospital-based model of healthcare with models that incorporate new technologies is the need of the hour. The deployment of information and communications technology for improving the reach and penetration of healthcare services, in the form of telemedicine and mobile health (m-health) services is a potential solution to mitigate strains faced by healthcare systems across the world. However, the implementation of such solutions is hampered by several challenges. Policy makers in the domain of healthcare are often challenged by situations of insufficient human and capital deficiencies. Core drivers of health demand such as patient demography changes, health awareness, shortage of workforce, expensive medical technology, limited penetration and uneven distribution of market power in the healthcare sector, all acting in concert, are increasing the pressure to change healthcare service delivery modes. The focus, therefore, has shifted to advanced information and communication technology (ICT) applications as an enabler of safe, efficient, well-coordinated and integrated health service delivery processes.

## Telemedicine and integrated care

Tele-health encompasses all applications of ICT towards interconnecting health service processes, health system stakeholders both at local and remote levels. Regional health networks, electronic patient record systems and electronic prescription to specialist applications are a few examples of tele-health applications. Tele-health helps health systems cope with the growing demands from ageing and immobile populations, chronic disease management and improving consumer expectations. However, despite the presence of evidence of the potential benefits from telemedicine from pilot projects, implementation of telemedicine solutions is still far away from the attention of market forces and policy makers. This report presents a roadmap for developing tele-health solutions that can be used as a guideline for implementing telemedicine -based healthcare in India.

## Building a telemedicine roadmap

The process of building a roadmap for m-Health/ telemedicine begins by describing the health system challenges and goals that technology can help to address. The strategic context was developed by researching the population health, current health system and development goals. It was deduced that some m-health/ telemedicine practices are technology driven, some are cost driven, some by the need of the population and some by market incentives. Considering these influences, the following strategy was drafted which ensures the vision to be grounded to the current health context.

## Understanding changes in health service demand

Progress in medical and health technology, improved living, burden of disease shifting from communicable diseases to management of chronic diseases, falling birthrates and therefore increasing ageing population and their related conditions together have contributed to an increase in long term healthcare costs. This report identifies the following health niches as national health priorities-

- Mother and child care
- Rural healthcare
- Trauma and emergency medicine
- Chronic diseases
- Geriatric care
- Mental healthcare
- Training of healthcare workers

## Analyzing resource considerations that are essential during any tele-health project

The stage focuses on identifying the resources that are required to deliver the vision. These include: human and technical resources, financial and organizational capabilities. Critical analysis of human resources towards health and welfare systems will aid in identification of who are the interested groups/candidates/organizational workforce standards. An insight into the financial resources gives an overview of whether an incentive or disincentive program is at place. With the study of organizational resources, it becomes possible to identify leadership and project implementation strategies of an organization, its investment strategies and workforce standards, infrastructure and services.

Further, understanding medico legal and regulatory policies for tele-health is essential as they can pose as critical barriers towards optimum utilization of tele-health. Best practices and opportunities must be identified for a conducive environment through comparative studies of various regimens.

## Current e-health status

The stage focuses on the already existing e-health/m-health components such as existing health information systems and sources, components that can be reused and shared. It will help refine the initial e- health/ m-health/ telemedicine vision.

## Mapping and implementation strategies

The strategies mapped, include:

- Need evaluation
- Care Service planning
- Risk analysis and business development
- Planning for technology
- Training site staff
- Technology testing
- Process evaluation
- Partnership development

## Building a roadmap for Telemedicine and mHealth - The Indian Example

As m-health/telemedicine strategy development processes vary considerably as per the specific healthcare problem in a country-specific manner, we have individually applied the implementation strategies mentioned above to the identified national health priorities. This approach would facilitate selection of telemedicine tools that are appropriate for the identified challenges by helping stakeholders in identifying obstacles and constraints and then apply the strategies to the health care priorities to overcome the health system constraints.

## Need for this report

Reforms in the healthcare sector are generating new care delivery approaches that align healthcare practices with patients, care providers, government and societal bodies. As an enabler of care reform goals, telemedicine is an essential component within future integrated care information systems. With traditional barriers and health priorities being identified, policy makers and organizations need to address existing challenges while developing telemedicine programs emphasizing on dynamic healthcare requirements, telemedicine benefits and leveraging current technologies and funding opportunities.

This report therefore aims to help identify the enablers and strategize implementation steps best suited for a country for a conducive telemedicine environment towards its increased acceptance and, design sustainable and scalable telemedicine programs through systematic and scientific evidence based research.

# Chapter 1 - Telemedicine in healthcare

Worldwide, various health systems are facing sustainability challenges to meet the healthcare needs of the growing population. This holds true especially in the rural and remote areas where demand for a reforms are needed in delivery of care and the enabling technologies to support their healthcare systems. Healthcare situations such as poor access to care, shortage of healthcare providers per patient, increased demand for care and unaffordable healthcare costs are creating a storm of challenges in this sphere. According to a report published by the United Nations Department of Economics and Social Affairs (3), the population of developing countries is projected to rise from 5.9 billion in 2013 to 8.2 billion in 2050. With reduced mortality and increased life expectancy, population growth is shown to be extremely dramatic, particularly in the age group of 60 or more.

The annual population growth pace during 2010- 2015 of 3.5% , is estimated to increase by an additional 2.9 % annually before 2050 (3). Further, the disease burden of non- communicable diseases is rising among adults as well (4). Emergences of growing cardiovascular diseases, diabetes, cancers and lower respiratory conditions now constitute the most common causes of death.

As the prevalence of chronic diseases increase with age, an increase in the 60-plus age group indirectly indicates growth in non-communicable chronic conditions in the future (5).

These statistics suggest an increase in the demand for innovative solutions to disseminate public health services. Moreover, lack of initiatives in mobilization or strengthening human resources, along with workforce shortages, are other major challenges that would be faced by developing nations towards building a sustainable and widespread health system. Approximately 0.91 beds per 1000 population is available in India when compared to global standards with 4 beds per 1000 (6). Further as estimated by WHO, by the year 2035, the world will be short of 12.9 million healthcare workers, the current status being 7.2 million across the globe (7).

These findings are important indicators of dynamic population demographics, workforce shortages and evolving health needs of the people. The above mentioned challenges, combined with existing financial pressures within the healthcare sector demonstrate that traditional delivery methods of health services alone will not suffice. Instead, an integrated approach towards disease prevention, enabling of independence in care and well-being of patients and encouragement of self-care and self-management by patients is required. With appropriate strategies, telemedicine has the potential to enable changes required to respond to these needs. This report is a recommendation document providing action plans for developing a telemedicine roadmap for policy makers and government regulatory bodies. Chapter 1 of the report provides extensive background information on tele-health applications. The report in the subsequent chapters describes in detail the tele-health implementation strategies and corresponding operational plan elements towards overcoming healthcare challenges.

## M- health for individuals

Transmission of medical imaging data and other such large data files from remote areas to high level medical centers is aided by m- health technology for rapid and better advancements in disease diagnosis and care (1).

A regional wireless networking system was established by Aravind eye hospital in Madurai, India. Across 31 dispersed eye care centers, the technology supported non doctor staff. An on- site staff member examines the patient and records inputs related to symptoms and patient experience. The next step is consultation with an ophthalmologist at a major urban hospital. If required, slit- lamp photographs of the eyes are also transmitted (2).

## 1.1 Tele-technology and healthcare

Information technology has immense potential for improving healthcare quality through innovative solutions in service delivery as well as in cost reduction. For instance, when utilized to its full extent, tele-health technologies maximize the use of existing healthcare professionals by allowing them to provide remote diagnosis, monitoring and prescription of treatment prescription to rural patients (8).

Telemedicine is an umbrella term referring to all systems, modalities and applications involved in personal delivery of health services to substitute for any exchange of information and communication in an electronic format. Telemedicine aids in electronic exchange of information and communication through (9-11):

- Provision of in-person contact between patients and healthcare providers.
- Communication among healthcare providers
- Contact between patient or healthcare provider with decision making and other support systems.

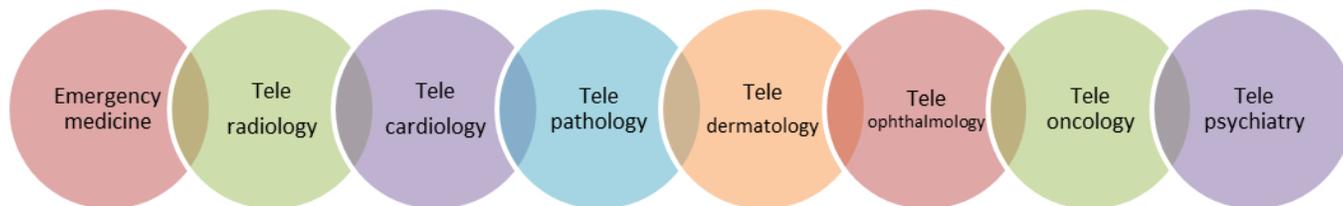
Some key tele-technologies and their advantages(12):

- Tele-care
- Tele-health
- Tele-consultations

Telemedicine technology	Purpose	Examples
<b>Tele-care</b>	With systems and sensors at home, tele-care enables independent living. Caregivers can be alerted through central monitoring systems that are connected to the sensors at home.	Used extensively for elderly patients. Also used for patients with mental disturbances, for example: dementia and learning disabilities. Tele-care technology includes monitoring systems for physiological parameters, door monitors and personal satellite locators. Sensors used for tele-care can detect fire, gas leaks, accidents and intruders as well.
<b>Tele-health</b>	Tele-health enables patients to monitor and self-manage themselves at home using electronic devices. The data collected can be transferred to a central monitoring system. Data collection is facilitated via devices that are installed in the patient's home connected to telephone lines or broadband services.	Devices such as digital thermometers, weighing scales, blood pressure cuff, and oxygen & pulse reader are used to take readings of required parameters and send automatically to central monitoring systems. Care givers can be alerted on significant changes in readings showing deteriorating conditions for early interventions.
<b>Tele-Consultation</b>	Communication between patients, clinicians or remote clinicians can be aided through video conferencing. Telecommunications therefore improves access to healthcare and enhances clinical outcomes.	<ul style="list-style-type: none"> <li>• Patients with limited access to travel e. g those in prisons or those who are immobilized due to other reasons are hugely benefitted with tele-consultation practices.</li> <li>• In case of stroke or burn management, tele-consultation systems facilitate immediate intervention.</li> <li>• Irrespective of geographical barriers, specialists can perform tele-consultation and tele-coaching activities.</li> </ul>

Telemedicine applications include technologies in the areas of emergency medicine, tele-cardiology, tele-radiology, tele-pathology, tele-dermatology, tele-ophthalmology, tele-oncology and tele-psychiatry. Further, health telematics has enabled provision of health services in areas with limited care providers. Areas such as rural health centers, ambulance vehicles, ships, trains airplanes and homes have been hugely benefitted by the provision of prompt and expert medical care (13).

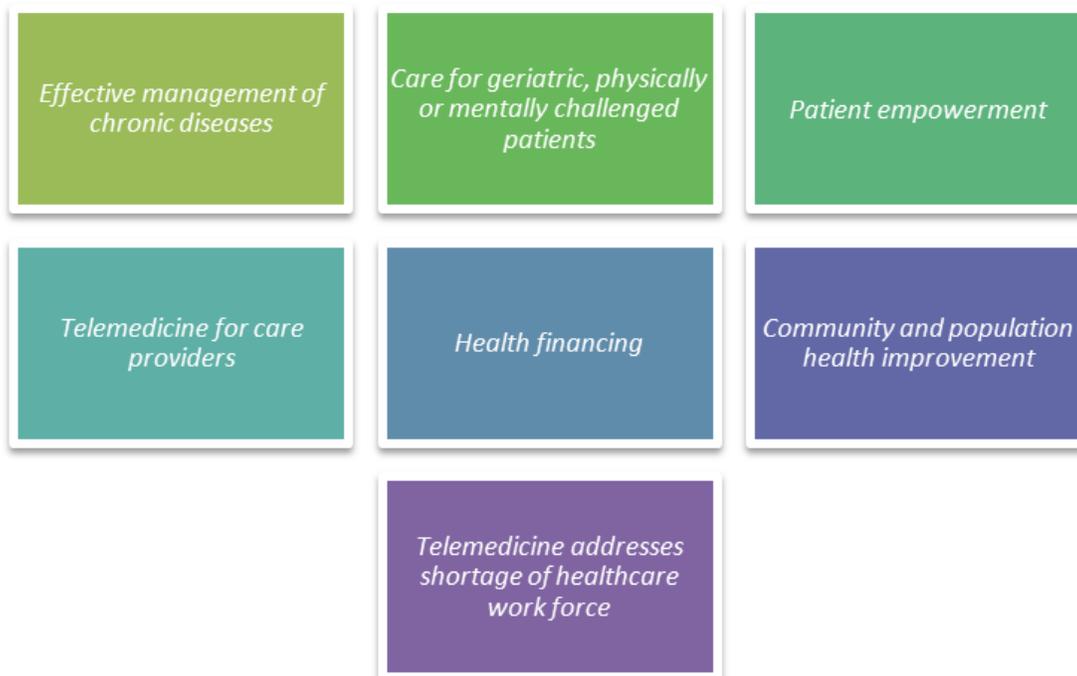
## Telemedicine applications



These telemedicine applications can be applied in geriatrics, mother and child care, mental healthcare, trauma and emergency care and rural healthcare settings. Some common m-Health and ICT applications in reproductive, maternal, new born and child health field (RMNCH) are (14):

1. Health education for pregnant women or new moms through provision of health information via SMS, IVR, audio media etc
2. Remote monitoring of patients through storing, transmitting and evaluating simple to complicated diagnostic tests
3. Mobile phone based registration system for identification and enumeration of patients for timely intervention and accountability
4. Availability of instantaneous patient data which is useful for health supervisors and policy makers
5. M-health allows health workers to electronically register their services and update patient information at the point-of-care delivery from the field
6. M-health facilitates electronic decision support through provision of protocols, algorithms and checklists, electronically.
7. Tele-technology and m-Health application allows providers to communicate across hierarchy through transformative applications in voice communication.
8. Planning and scheduling services- Examples include scheduling antenatal and postnatal care visits, alerting care providers on missed vaccination details etc.
9. M-health tools aid in tracking and management of stocks and supplies of essential commodities

## 1.2 Potential benefits of telemedicine



Effective management of chronic diseases: Long term treatment and multiple specialties are involved in the management of chronic conditions such as cardiovascular diseases, diabetes and chronic obstructive pulmonary diseases. Telemedicine allows frequent gathering of vital signs information and monitoring, which further facilitates the treatment team to decide on an early intervention(8). Additional benefits for patients with chronic conditions are-

- Tele- health instills confidence among patients towards self – management thereby reducing stress (12)
- Studies have reported that tele- health related quality of life was found to be comparable or better when compared to conventional medical treatments (12).
- Research has observed that better diabetic glycemic control can be achieved through tele- health (12).
- It has been published that heart failures and mortality due to chronic heart conditions can be reduced through tele- health by approximately → 30 % (12).
- Medical compliance and better management of complex drug regimens can be achieved through telemedicine (12).

**Care for geriatric, physically or mentally challenged patients:** Frequent visits to hospitals or physician clinics can be minimized using telemedicine. Telemedicine facilitates remote monitoring and e- mail information exchange for a timely patient intervention.

**Patient empowerment:** Telemedicine provides patients and care givers opportunities to play a greater role in their own care by raising the responsibility level of patients for better patient compliance.

Telemedicine for care providers (15) :

- A medical team can closely monitor patients through this embedded monitoring solution offered by telemedicine technology.
- Eases communication between primary and secondary healthcare sectors, permitting instantaneous transfer of patient information between practitioners (16).
- Patient educational sessions can be tailored based on medical teams collecting and integrating patient data.
- Integrating geographical information along with data mining and data fusion techniques, monitoring of deadly diseases and their migration patterns is possible.
- Care professionals can have access to up- to date case-oriented information through electronic search engines.(16). This can in turn aid in regular skill development as part of continuous education for care providers.

Health financing: Companies and insurers can manage healthcare costs using frequent remote monitoring techniques for patients which minimize the need for acute care intervention. This further encourages efficient deployment of healthcare professionals. Highly trained workforce can work as a pooled resource through remote analysis services aided by tele-technology solutions. An effective tracking of patients as well as healthcare workers can be achieved on an ambulatory basis where previously patients were to be monitored as inpatients. Given the high in patient costs, observation on an out-patient basis significantly reduces the healthcare spending. Moreover, where the current healthcare financing is disruptive, mobile and mobile technologies have enabled conditional reimbursements, tracking vouchers etc, convenient and cost friendly.

Community and population health improvement (8) : Telemedicine facilitates expedited exchange of information between multiple health organizations. Management of rare or unusual health conditions, chronic diseases or health crisis such as pandemics is possible through easy exchange of information. Moreover, awareness of any public health threats can alert care providers to make better decisions in such situations.

Telemedicine addresses shortage of healthcare work force (8): Better utilization of current workforce in hospitals, nursing homes or home care services can be achieved through telemedicine solutions such as teleconferencing, remote consultations etc. Potential shortages of care providers at remote areas can be alleviated through remote consultations by physicians or nurses located at better urban facilities.

Significant advances in wireless communications and network technologies in recent years have made a huge impact on m-health and tele-medical systems. Some applications of wireless telemedicine system are as follows:

	Health services	Data transmitted	Examples
<b>Cellular</b>			
	Emergency (17-25)	Electrocardiograph, Bio-signals, Blood pressure, Temperature, Oxygen saturation, Carbon dioxide measurement	Facilitates early hospital admission, ambulance triage support, ambulance neurological examination support, pre-hospital support, cardiac arrest treatment. Also facilitates video, audio and image communication
	Telecardiology (26, 27)	ECG, PhotoPlethismography	12- Lead ECG transmission, uses IS 54 and cellular telephone standards
	Teleradiology (28)		Facilitates personal distant assistant technology based CT tele-consultation
	Telepsychology (29)		Expedites support of patients with brain dysfunctions or disturbances
	Teleophthalmology (30)		Assistance in glaucoma screening
	Remote monitoring(31-33)	ECG and bio-signals	Disaster situation support, mobile telephony ECG transmission
<b>Satellite</b>			
	Emergency and remote monitoring (24, 34)	Blood pressure and ECG signals	Telemedicine support provision to aircrafts and ships Audio and image communication is possible
	Teleradiology (35, 36)		Ultrasound image compression. Services can be provided using spiral CT mobile vans
	Teleophthalmology (30)		Glaucoma screening using optical disc images
	Remote monitoring (37-40)	Blood pressure and ECG signals	Management of disaster situations, maritime telemedicine, basic telemedicine services, educators support, remote monitoring of cancer patients, monitoring of climbers hypoxia

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## 1.3 Application of m-Health in tele-medical systems

The term 'mobile health' or m-Health describes the use of mobile telecommunications and multimedia technologies such as mobile phones and tablet PCs in order to link a remote patient with a consulting physician / specialist doctor. Mobile health can be also described as a strategy dependent upon 'mobile computing, medical sensor and communications technologies for healthcare' (47) and thereby encompass other devices such as monitoring devices for physiological parameters, sensors, personal health devices and technologies for communication with distant doctors (48, 49). Significant advances in wireless communications and network technologies have had a huge impact on the current telemedicine systems. For example, smart intelligent sensors and drug delivery systems allow communication with a personal server which is a step in facilitating complete mobility for the patient while remaining in contact with his/her doctor(50).

Devices such as mobile phones and tablet PCs along with specific applications designed to cater to these devices, as well as others that facilitate distant delivery of healthcare can be categorized into:

- A. Devices and applications for facilitation of health management by the end-user
- B. Devices and applications for strengthening the healthcare delivery system

Applications for patient reminders of medication, appointment schedulers, calendars for compliance with a therapy schedule and personal monitors of parameters like blood sugar and blood pressure can be considered under category A. These devices and applications represent a huge opportunity for development of customized solutions that can help manage ill health as well as wellness for each patient. The adaptive nature of such devices and solutions can help to disseminate generic as well as personalized health advice even in remote locations.

Telecommunications strategies such as panic buttons to activate external assistance, secure wireless transmission of patient records or heart rate monitors that can dial for ambulance services based on patient parameters can be considered as m-Health solutions that can enhance the healthcare ecosystem. Smartphone or tablet applications that provide notifications of large-scale vaccination and therapy administration initiatives can also be included in this category.

A combination of such devices and smart phone applications can be employed to devise custom-built m-Health solutions. This mobility in healthcare through m-Health is derived using personal servers providing global connectivity to telemedical servers using a wireless personal area network (WPAN), wireless local area network (WLAN), or wireless wide area network (WAN). The emerging mass markets for cell phones and portable computing devices are the driving forces towards the development of an environment conducive towards establishment of m-Health solutions. This also represents an evolution of the previous generation of telemedicine systems.

Implementation of m-Health solutions is especially mandated for

- A. Professionals with high degree of physical mobility and travel
- B. Populations in remote and inaccessible areas such as mountainous terrain or coastal islands
- C. Geriatric individuals with limited mobility
- D. Populations such as tribal communities living within forests
- E. Individuals active in distant geographical locations owing to specialized nature of work

Development of devices and applications in the m-Health sphere has occurred rapidly. Deployment of such strategies has also been successful in ensuring wide-spread inclusion of children in the 'Pulse Polio' mass vaccination campaign in India (51).

Likewise, delivery of personalized healthcare advice for management of diabetes (GILC online, Brazil) has been facilitated by the use of m-Health solutions (49).

### Challenges in the deployment of m-Health solutions

Although the outlook for establishment of m-Health solutions is bright and positive, there are factors that have hindered large-scale adoption of m-Health technologies throughout the healthcare systems. These challenges include-

- Lack of standards for e- health services(50): Development of standards of care for e-health services is a challenge

in the near future. Although communication between a doctor and a patient can be facilitated by mobile access devices, the actual dissemination of advice has to be brought about in a manner that ensures optimal health outcomes for the patient.

- Absence of standards for linkage and compatibility between different telecommunication services, terminals, device standards and m-Health protocols.
- Expensive communication links between satellite and global mobile devices (50).
- Scarcity of global availability of 2.5 G and 3G services for e- Health services (50).
- Lack of integration between existing e- Health services and other information systems that are underdeveloped and not uniformly standardized (50) .

Another barrier for the inclusion of next generation m-Health systems is corporate / institutional expenditure. A potential pitfall that health delivery systems may face is best summed up in this equation: Current Organization+ New technology= Expensive Current Organization

The cost of implementation of m-Health solutions either with or in lieu of pre-existent telemedicine or traditional healthcare solutions is a significant challenge, especially in under-developed nations. A scrutiny of the whole system of care delivery processes, roles and responsibilities of team members, organization and structures including that of technology required to change this equation is mandated to tilt the balance towards profitability (52).

Inclusion of cell phone service providers and device manufacturers, as stakeholders in the development and deployment process for m-Health systems, might be a feasible approach to disperse the cost burden of an m-Health ecosystem. Additionally, innovations in work organization of health care professionals and inclusion of citizens/patients as active participants along with the specialized professional healthcare teams are possible ways to change the equation for the current healthcare systems.

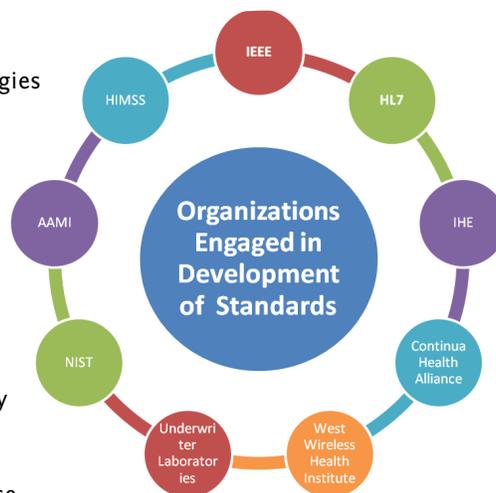
## 1.4 Interoperability for telemedicine technology

The range and diversity of digital devices and communication technology is a dual-edged sword. On one hand, multiplicity in digital technologies is beneficial because it creates opportunities for diversification, cost optimization and customization of solutions and architecture.

On the other hand, the varied bouquet of information and digital technologies can pose a challenge for linkage between non-identical technologies deployed at various stages in large-scale telemedicine architecture. Integration, provision of bridge technologies / software and seamless operation of multiple devices and communication modalities is absolutely essential for successful implementation of telemedicine and m-Health ecosystems.

Telemedicine applications are not autonomous in a physically integrated e-Health domain, as far as their interoperability is concerned. Communication with other medical information systems such as Radiology Information Systems (RIS), Laboratory Information Systems (LIS) and Electronic Health Record (EHR) is required. Integration of all systems and applications is the next step towards interoperability which will allow these systems to operate as a continuum. Creation of updated and consistent medical files and supporting necessary mobility for both patients and medical personnel is aided through interoperable systems. Interoperability of diverse technologies is also essential to reduce time of delivery of healthcare. These interdependent systems must be designed as per defined interoperability standards as adherence to these standards and guidelines facilitate realization of the full potential of devised solutions for telemedicine. Some typical standards for different sub-systems of a telemedicine facility include data standards, data exchange messaging standards and medical image capture, storage and transmission standards (HL7, DICOM). Also, IT infrastructure technical standards for interconnectivity, interoperability and scalability are recommended standards for telemedicine facilities.

Various organizations are actively engaged in defining standards for interoperability between multiple components aimed at creating a better and efficient telemedicine environment. These standard-developing organizations have set the parameters due to their pioneering research in their respective fields (53).



## Standards for Interoperability of components of Telemedicine Systems

In order to identify and address potential challenges in communication and seamless integration between components of large-scale systems, standards and operational metrics have to be devised. There are several organizations dedicated to developing thought leadership in this arena. We have cited examples of such organizations to illustrate the nature of standards required for large-scale telemedicine systems.

HL7: Health Level Seven International provides frameworks and standards for digital exchange of information between healthcare systems. Improving knowledge transfer between healthcare providers, government agencies, the vendor community, fellow SDOs and patients is the primary aim of HL7.

HL7 standards facilitate communication between various systems that send or receive patient admissions/registration; discharge or transfer data, queries, orders, results, clinical observations, billing and master file update information. Primary issues that are addressed by HL7 standards are definitions of the data to be exchanged, timing of these exchanges and communication of certain application specific errors between applications. The standards also define the presentation of information.

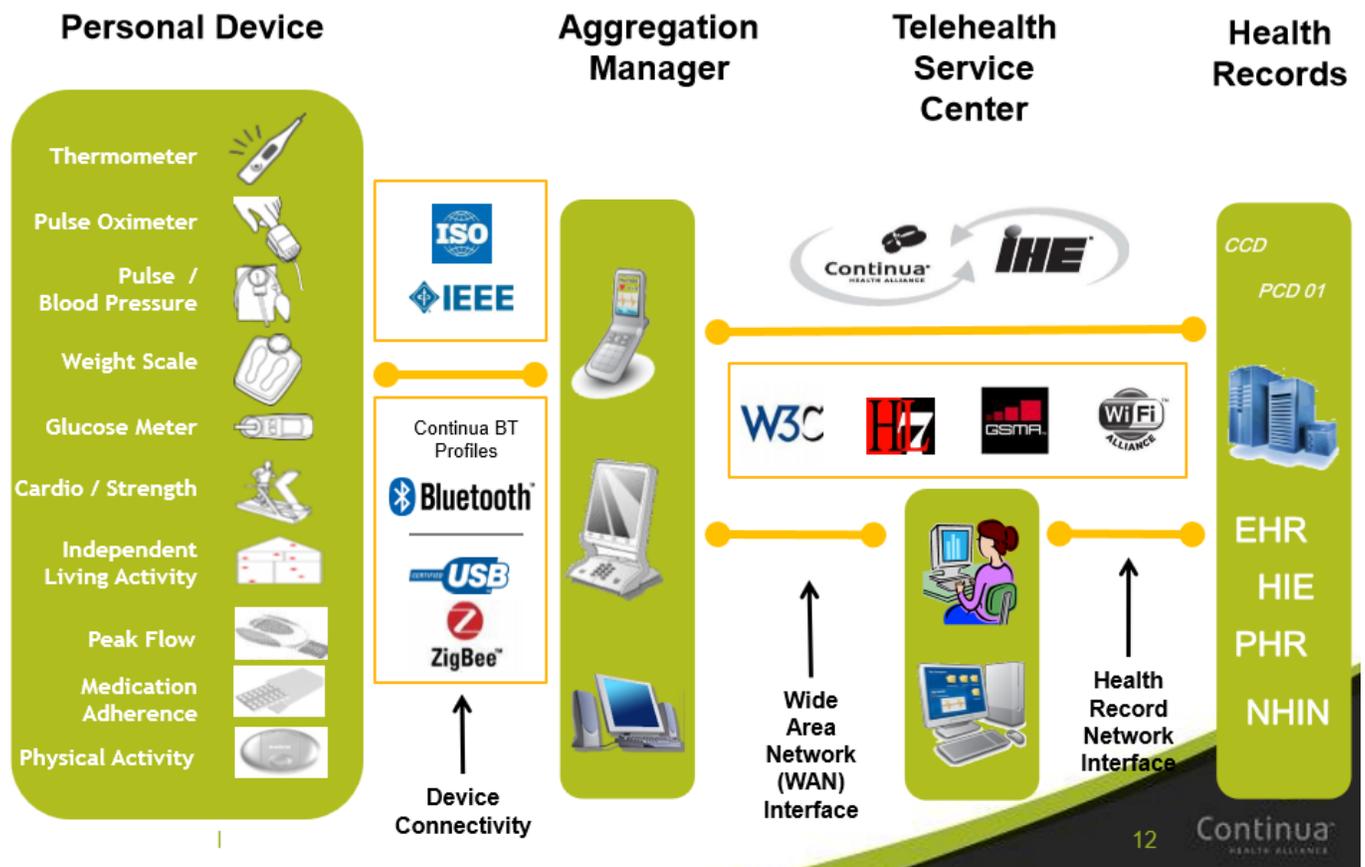
Continua Health Alliance: Continua Health Alliance is a consortium of over 200 companies dedicated towards ensuring interoperability of personal connected health solutions for better patient care. The principle is to extend and apply these connected solutions to enable independence and to empower individuals to better manage their health and wellness needs in a home based setting. Their core domain is in establishing design guidelines to manufacture home networks, health and wellness services and tele-health platforms. They also certify products enabling recognition of interoperability of devices through display of their logo after certification. It also collaborates with government regulatory agencies and leaders in healthcare industry.

The three primary focus areas of continua health alliance for improving personal healthcare are health and wellness, disease management and aging independently.

Continua’s objective is to form an ecosystem of connected technologies, which will enhance the efficiency of exchanging healthcare data. The foundation of this network is based on a set of interoperability guidelines which designate how devices manufactured by multiple companies can co-operate. The first set of Continua standards focus on particulars of available standards of Bluetooth, USB, IEEE 11073 and HL7 that will facilitate the patient to monitor weight, blood pressure, glucose, oxygen levels and share the data with their physician. Till date Continua has selected standards for their appropriate interfaces as described in the table below.

Interfaces	Standards
Device Connectivity <ul style="list-style-type: none"> <li>• Personal area network(PAN)</li> <li>• Local area network(LAN)</li> </ul>	<ul style="list-style-type: none"> <li>• ISO</li> <li>• IEEE</li> <li>• Bluetooth</li> <li>• Bluetooth Low Energy</li> <li>• USB</li> <li>• ZigBee</li> </ul>
Wide Area Network Interface	Combination of Ethernet, Wi-Fi and cellular interfaces such as GSM
Health Records Standards	Integrating the Healthcare Enterprise (IHE) Cross-Enterprise Document Reliable Interchange (XDR)  Health Level 7 (HL7) Personal Health Monitoring (PHM) Report

## The Continua Network Architecture



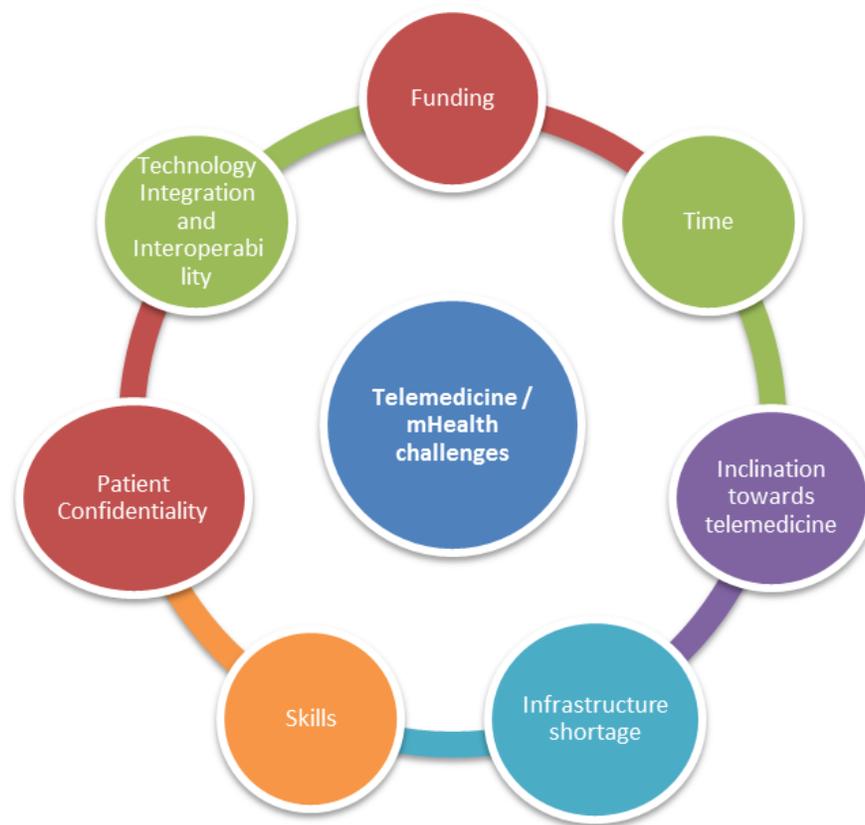
Source: The Next Generation of Healthcare: Personal Connected Health & Wellness [www.continuaalliance.org](http://www.continuaalliance.org)

DICOM: Digital Imaging and Communications in Medicine describes the means of formatting and exchanging medical images and image related information to facilitate the connectivity of medical devices and systems. The DICOM Standard is endorsed by the National Electrical Manufacturers Association (NEMA) and is a result of joint efforts of users and manufacturers of medical imaging and healthcare information technology. For example, DICOM/ISO 12052 and NEMA/MITA sets guidelines for image and clinical information interchange for image and radiotherapy. The key advantage of DICOM standards is that it allows interoperability between devices from different manufacturers. Image acquisition devices such as Computer Tomography, image archives, hard copy devices and diagnostic imaging workstations from different vendors can be connected and integrated with multiple information systems.

Broadly, telemedicine has seen massive diffusion over the past decade. Countries which are yet to adopt it are on their way to establishing and developing telemedicine programs. It challenges the traditional arrangement of physical presence between the patient and the care provider for a service delivery. However, due to mixed evidences on efficacy of telemedicine services there are significant gaps in the existing evidence base, especially in areas where telemedicine is used and where the use is supported by strong evidences. But despite of this mixed or inconclusive evidence on clinical efficacy, telemedicine has consistently received rave reviews on patient satisfaction. Studies have shown good levels of patient satisfaction with a positive feedback on use of tele-consultations and videoconferencing services in varied circumstances (54, 55).

## 1.5 Telemedicine challenges

As discussed in Section 1.2, telemedicine presents various health service delivery advantages of better access and improved health outcomes. A national study on telemedicine conducted in Australia revealed key observations that affect telemedicine adoption:



**Funding:** A lack of health economic evidence for telemedicine solutions limits procurement by public and private health providers and wider integration into the health system. Donors and institutional investors are typically funding similar projects in the same country, increasing the fragmentation and lack of interoperability. An inadequate understanding of the value drivers and incentives to healthcare workers for conducting telemedicine consultations hinders the adoption of this technology among healthcare providers. Scarcity in provision of financial and/or non-financial incentives for staff for conducting tele-consultations remotely also contributes to the lack of integration of this system in the healthcare scenario.

- **Time:** Often tele-consultation time for physicians exceed by approximately 15 minutes depending upon the specialty than when compared to traditional consulting. Further, time taken to master the technical aspects regarding telemedicine consultation is significantly long, which is another reason for a low level penetration of this technology.
- **Skills:** The competence acquired by urban or rural doctors to understand the technical aspects of tele-consulting is another adoption barrier identified.
- **Infrastructure shortage:** Poor internet access in rural areas, lack of broadband connectivity, poor procurement of necessary equipment such as computers, cameras and software has limited telemedicine adoption.
- **Inclination towards telemedicine approach:** Some doctors (old practitioners) may have an inclination for traditional approach which further prevents the acceptance of telemedicine technologies.
- **Patient Confidentiality:** Tele-health poses security issues which may present risk to patient data. Confidentiality issues while data capture, communication, data review and storage are encountered in a telemedicine facility. (56)

- Technology Integration and Interoperability: Other barriers that needs to be addressed for telemedicine adoption to occur are issues with technology integration, interoperability and standardization (57)
- Prohibitive regulation: Regulation that is either out-dated or prohibitive does not adequately identify areas of patient and provider risk and risk mitigation for telemedicine services.

Adoption of telemedicine is still underdeveloped and through new research directions, the challenges need to be addressed prior to setting objectives and designing action plans (58).

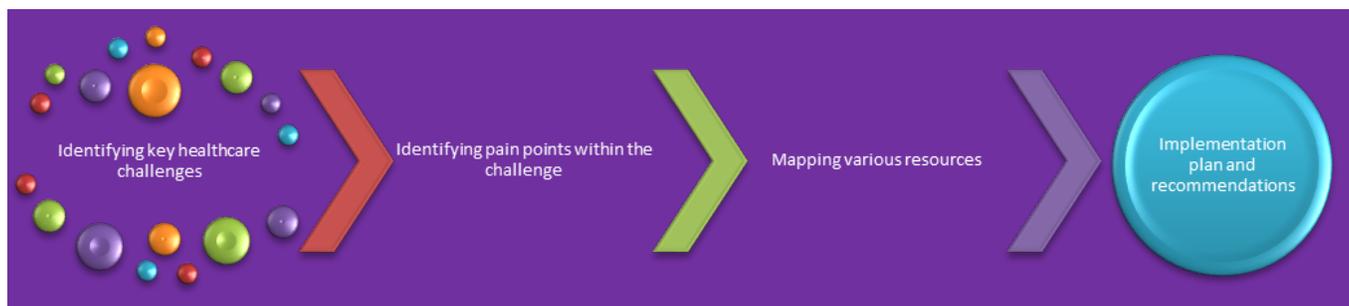
- Determining the value of telemedicine for users is crucial in its adoption. For example, acceptance of popular imaging technologies such as CT and MRI clearly indicate that if users, especially care providers, require a particular technology and are confident about its advantages, adoption of technology will be substantial.
- Sustainability of telemedicine services is dependent on critical volumes of adoption because of the high volume, low margin business model of mobile and ICT sector. The rate of adoption also differs with different technologies and delivery strategies. However, the S- shaped logistic growth curve for adoption of innovative technologies across industries is also applicable to health technologies. Accordingly, different adopters use the technology at different times. Large scale data collection regarding adoption of telemedicine would lead to better understanding while building strategies for future applications in telemedicine.
- Provision of evidence with respect to cost- effectiveness of the technology for the society is essential for its widespread adoption.
- Suitable financial and professional incentives for healthcare providers by the government will define advantages to care providers upon using the technology, further facilitating diffusion of technology across the board.

## Chapter 2 - Building a Telemedicine Roadmap

This recommendation document aims at developing a national telemedicine strategic action plan based on;

- Step 1- National health priorities
- Step 2- Available potential human resource and technical resources
- Step 3- The current e- health/ m-Health environment
- Step 4- Mapping and implementation of strategies

The context of strategy development for telemedicine implementation and recommendations include:



### 2.1 Identification of key healthcare challenges and pain points

Identification of healthcare goals and challenges aids in focusing areas where telemedicine and m- health will have the most impact. While there are many other existing healthcare challenges, the identified national health priorities on integration with and telemedicine and m-Health technology will have the biggest impact which can further be used as a basis towards

developing the tele- health implementation strategy. Following are the key healthcare challenges of the developing world with their respective pain points.

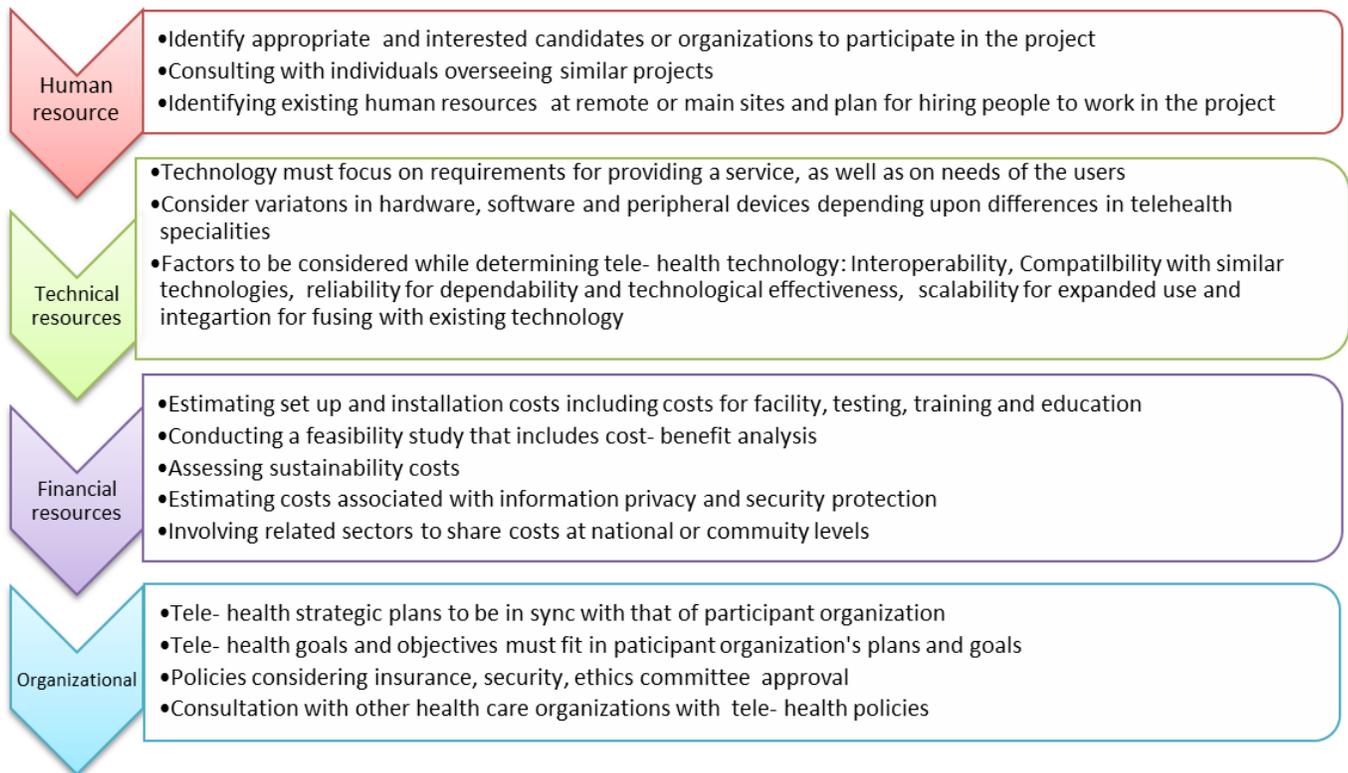
#### National healthcare priorities



## 2.2 Resource Mapping and Key considerations for a tele-health project

Identification of elements that influence the likelihood of increased tele-health adoption is the most appropriate approach increasing the probability of a tele-health project to succeed. Determining the resources and subsequently ensuring their optimum use towards effective project implementation and its sustainability in addition contributes heavily to the success. Following are the primary resource components that are essential to be considered during a tele-health project:

- Human resources
- Technical resources
- Financial Resources and
- Organizational Capabilities



### Human resource consideration

Human interaction and its inter-relationships largely determine the success of any tele-health project. Assessing and determining the current level of health providers and their respective turnover rates is essential while considering human resources for tele-health projects. Other prime HR considerations include:

- Knowledge and prior experience of the provider with tele-health projects
- Requirement information of any additional staff
- Identification of staff that require training.
- Identification of vendors or site coordinators for training site staff
- Assessment of user and provider prerequisites

## Technical resources

Tele- health technology selection should depend on, and must focus on both, provision of a particular service, as well as on the needs of patients, health care providers and administrators. The best-fit technology must be sought depending on project requirements. Evidence based and diligent technology selection would avoid expensive investments on technology. Technical considerations include:

- Identification and assessment of existing telecommunications infrastructure
- Contacting individuals or sites who have prior experience with tele-health application technologies for project needs
- Contracting an independent and neutral vendor consultant for tele-health recommendations
- Identification and assessment of best suited telecommunication links to suit the tele-health application
- Determination of specific project requirements such as video conferencing room or mobile units
- Due to the dynamic nature of technologies, sources of such tele-health equipment must be closely evaluated

### Commonly used telecommunication and network technologies for tele-health (59):

Telecommunication and network technologies enable linking multiple tele- health sites facilitating data transfer between such sites. Five standard commonly used media used in tele- communications technology for transmitting information are: satellite, copper wire, fibre- optic cable, co- axial cable and microwave. Currently used common network technologies include:

Telephone	Internet	High speed digital networks or broadband technology	Dedicated point-to-point and multi-point facilities
<ul style="list-style-type: none"> <li>•Analogue telephone lines or plain old telephonic system</li> <li>•Integrated service digital networks and such narrow- band dial up digital telephone lines</li> <li>•Mobile phones</li> </ul>	<ul style="list-style-type: none"> <li>•Internet modems</li> <li>•Digital subscriber line or xDSL</li> <li>•Guaranteed and non-guaranteed packet-switched networks</li> </ul>	<ul style="list-style-type: none"> <li>•Asynchronous transfer mode (ATM)</li> <li>•Integrated service digital networks</li> <li>•Local area network</li> </ul>	<ul style="list-style-type: none"> <li>•Landlines</li> <li>•Satellite</li> </ul>

## Financial resources

Estimated costs to the funding organizations for a project is critical to make the set- up and provision of tele-health services meaningful and sustainable. Financial resource planning should include:

- Estimates of set- up and installation costs of technology and telecommunications to be acquired for a smooth transition activities
- Capital cost estimation for staff, hardware and software, re- engineering hospital facilities, licensing fees, direct project costs and its assessments is vital. Other miscellaneous costs such as labor, telecommunication technology usage fees (monthly or on the basis of rate per minute), training costs, skill main tenance costs, administrative costs etc can be major components in tele - health projects overall costs
- It is essential to identify a sustainable funding source prior to commencing a telemedicine project
- As part of indirect project costs, funding from external sources such as grants, loans, risk capital may be considered. It is of relevance especially during times of financial deficiencies



- Legislative requirements for provision and maintenance of current information privacy and security protection orders must be considered
- Sharing of costs or resources between parties at national, provincial or community level must be considered while developing a unified cost plan
- Conducting a feasibility study such as cost- benefit analysis will aid in a better understanding of the project proposal and its magnitude for service planners and towards arrangement of alternate funding resources

## Organizational considerations

Human relationships and effective organizational infrastructure greatly influence the success of a tele- health project.

- Already existing strategic plans and goals of the organization must be evaluated for their feasibility to accommodate tele-health.
- Similarly, identification and amendment of existing policies must be considered.
- Consultation with experienced tele- health care organizations for policy development is essential.
- While developing organizational policies, credentialing mechanisms for participating organizations must be identified.
- Determination of existing organizational resources and devices for self-governing a tele-health project is crucial to a project's success.

### **Telemedicine implementation success also depends on user and provider considerations.**

Large scale inclusion of users of tele-health, such as patients, clients, doctors and nurses, other allied health service professionals and administrators determines the success of tele- health project through acceptance of the technology and increased usage. The primary barrier to acceptance of the technology resides with patients and doctors who may be reluctant to accept the new technology due to their reliance and confidence on traditional mode of care. Hence, a common opinion while implementing telemedicine adoption strategies is to make the technology more user- oriented with primary focus on providing quality health care. However, there is an apparent need to ensure the users of provision of high- quality care with access to reliable health information.

**Consideration of consumers of healthcare services:** Tele- health awareness and education to the patients, clients or other health service consumers will increase technology acceptability. Following must be considered to ensure health services consumers are provided with quality services-

- Adoption of tele-health applications according to individual patient's needs.
- Training for patient, families or care givers must be provided for an enthusiastic attitude and necessary skill development required to use tele- health system.
- Patient privacy and standard consent protocols must be considered.
- User satisfaction surveys must be conducted on an ongoing basis.

**Doctors and health care providers:** Skepticism associated with the concept of tele-health is common among care providers. Clinicians must have clinical confidence on the ability of technology to provide ample and high quality information required for an efficient clinical decision making. To overcome these challenges there is a need to

- Encourage clinicians to include tele- health sessions by providing appropriate education and training along with any technic or administrative support.
- The location and user convenience must be taken into account for tele- health equipment placement.
- Client records specifying end- usability, quality assurance and any other legal requirements must be considered.
- Methodology of provider satisfaction surveys must be designed for a periodic analysis.

## 2.3 E- Health status

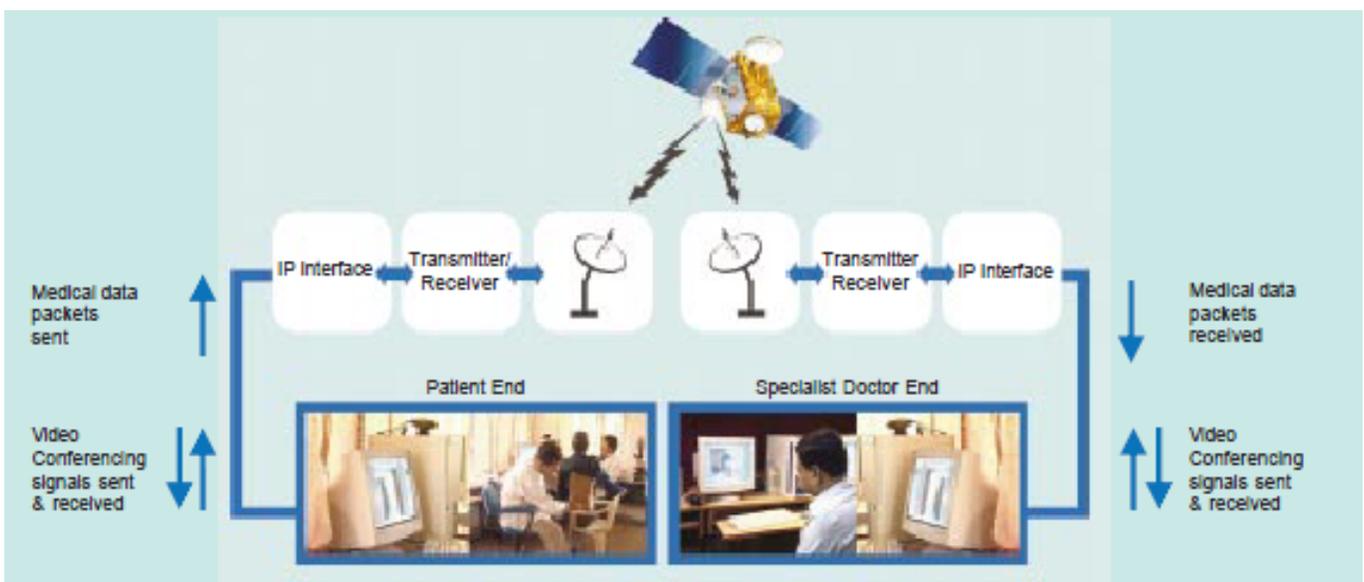
Information and technology (IT) has been a late entrant in the field of healthcare in India. With the establishment of large corporate hospitals strong IT solutions were implemented in the latter half of 90's. With the government owning approximately 66% of the Indian hospital market share, the IT enabled healthcare segment is going through revolutionary changes. With an array of IT products available in the field, major players such as CDAC, Wipro, TCS and Siemens information system dominate the market. CDAC was the pioneer in developing hospital information system (HIS) in India. Their solutions include: HIS, Picture Archival Communications System (PACS) and solutions for telemedicine (60).

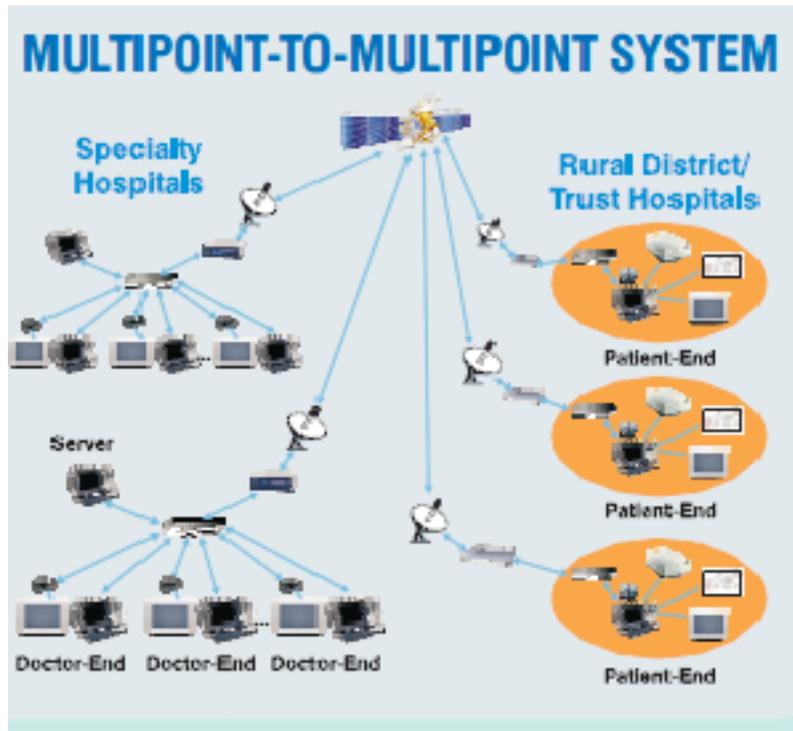
However, the proliferation of IT enabled services in India for healthcare service delivery is relatively less when compared to the demand of its population. The availability of IT infrastructure, high bandwidth connectivity and availability of medical professionals is limited and only scalable in the urban centres. As per a 2011 study conducted by ITU (61), there exists diverse usage scenarios in health delivery as applied to population diversity in India making service delivery mode complicated. Telecom connectivity is an issue, irrespective of its diffusion in the Indian market. It has reached only 175 million of the 750 million accompanied by people residing in the rural areas. Cellular coverage too suffers from poor quality of service. Moreover, familiarity with cell phone usage is more when compared to usage of computers, making identification of best suited services difficult. Similarly, data security is another matter of contention that prevails in the current e-health scenario. Data security is adopted through virtual private network (VPN) or HTTPS protocols, encryption, access controls, device level data security etc. However, hospitals continue to be reluctant to link to external systems, suspecting data privacy and security issues. Similar is the issue with interoperability of medical devices which continue to limit the connectivity within and between healthcare centers. Further, lack of standard semantic interoperability, uniformity of medical terminology, ID systems etc have all contributed to decreased adoption of telemedicine among healthcare providers and hospitals.

Current environment for tele-healthcare concept, however, is a favorable setting with both government and private agencies venturing into it. Indian and international companies are proving their presence through multiple hardware and software solutions for tele-healthcare. Efforts towards setting up standards and IT enabled healthcare infrastructure in the country are in process.

### An ISRO example of telemedicine technology

Satcom: Communications technology such as satellite communications (Satcom) combined with information technology has benefitted rural and inaccessible areas seeking healthcare services in India. As healthcare in India is a state concern and is managed by respective state governments, the Satcom based telemedicine technology was introduced in various parts of the country through pilot projects. The technology uses customized hardware and software at the patient's and doctor's end. The equipment is connected through a very small aperture terminal (VSAT) system which is controlled by Network Hub Station at ISRO. Transfer of medical images, patient information and video conferencing is enabled through this technology.





Source : Telemedicine enablers through space, ISRO (62)

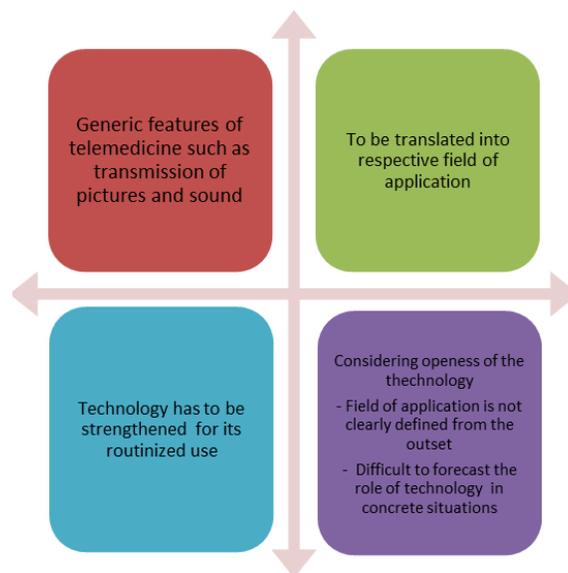
ISRO's telemedicine initiatives concentrate primarily on:

- Connecting rural/ remote hospitals to super specialty hospitals
- Providing connectivity for Continuing Medical Education
- Providing technology and connectivity for mobile telemedicine units in remote areas.

Department of Information Technology (DIT) with ISRO and public and private organizations have initiated various telemedicine projects in different parts of the country of which, DIT facilitated initiatives in technology development and initiation of pilot schemes

## 2.4 Mapping and implementation strategies

Implementation of telemedicine includes all activities and processes required to be carried out towards institutionalizing the technology as a stable organizational entity.



## Questions to be asked for a successful implementation:

### Tele health application

What is the proposed telehealth application?- diagnostic and treatment, consultations, home health monitoring, prescriptions, continuing medical education

### Place of service provision

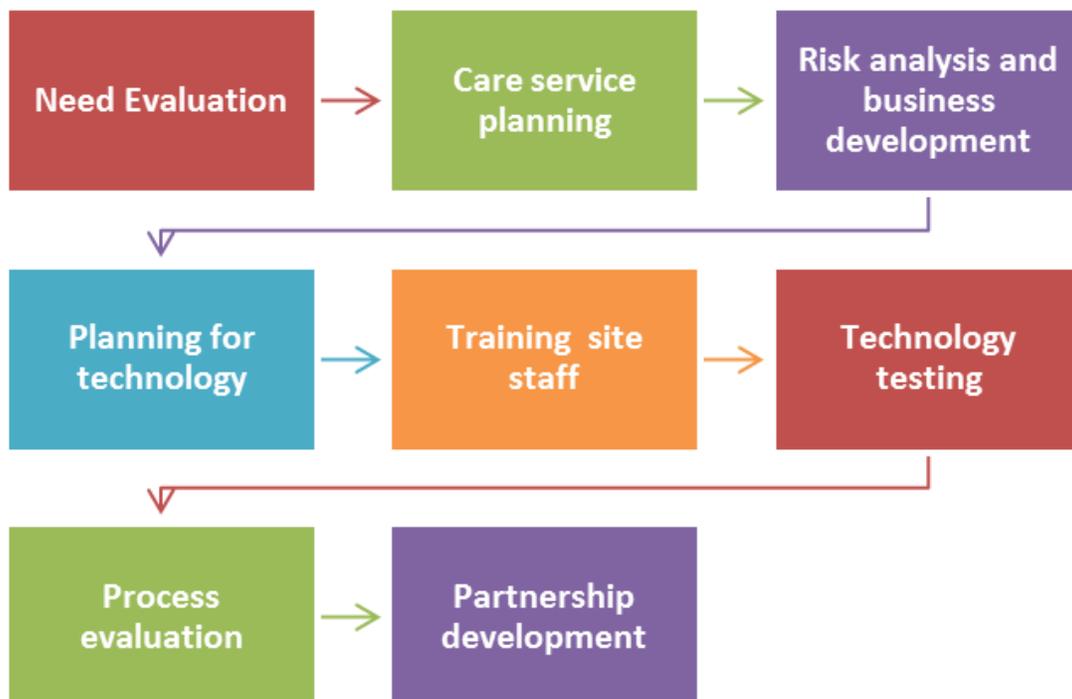
Where is the proposed place of service provision?- in- house facility, within a medical system, regional, across states, international

### Operation

How does the telemedicine model operate?

### Major steps in the implementation process

The following steps are discussed in detail in Chapter 3 of the report which is applied individually for all the above mentioned national healthcare priorities.



## Checklist for issues to be finalized for any telemedicine project implementation

Any tele-health project improves, and most likely changes significantly throughout the project lifecycle. Here is a brief checklist that will need to be finalized for implementation of your telemedicine project:

1	Is the healthcare service-delivery problem clearly stated?
2	Was the need assessment process undertaken?
3	Is the project based on the collected evidence for efficacy for the condition in question?
4	Is a lead staff and agency identified?
5	Did Steering group establishment take place?
6	Is there a tele-health strategy at place?
7	Are key priorities identified?
8	Is there a balance between many smaller unspecialized sites and few specialised site?
9	Is the marketing plan ready for tele-health in the area?
10	Is the training plan for staff ready?
11	Is the plan to overcome potential barriers from staff ready?
12	Is the organization's management aligned with the tele-health strategy?
13	Is the design of tele-health service delivery plan (service evaluation versus random controlled trials, community versus hospital base, short- term versus long term monitoring using tele-health) ready?
14	Is approval granted from government regulators or authorised bodies for confidentiality and access and data sharing?
15	Is the project ethics committee approved?
16	Is the tele-health service being covered by legislators and regulators?
17	Has the project funding been secured?
18	Is the service level agreement with the service provider at place?
19	Is the funding recurrent?
20	Is the supplier finalised?
21	Is there dedicated staff for managing or co-ordinating tele-health project?
22	Are computers accessible for the staff for monitoring patients remotely?
23	Are the patients with tele-health equipment provided with adequate educational support?
24	Are individual patients provided with alert limits?
25	Is there an adequate arrangement for installation of tele-health equipment?
26	Is there adequate storage facilities arranged for unused telemedicine equipment?
27	Are the tele-health equipment tested for compatibility with local landline telephone providers?
28	Are potential software problems considered?
29	Is the decontamination process-plan for tele-health equipment specified?
30	Are the decontamination processes appropriate?
31	Are manuals for the entire system, roles and responsibilities and performance indicators at place?
32	Is there a consideration for pilot scale study before a large scale tele-health implementation study?
33	Is there a plan for receiving feedback from patients and carers?
34	Is the benefit/outcome evaluation for tele-health measures clearly stated?
35	Is the plan for publishing results of the tele-health project specified?

Source: Key Challenges in the development and implementation of tele-health projects (63)

# Chapter 3 The Indian Telemedicine Roadmap Example

## Introduction

Chapter 3 of this report provides an example of developing a national telemedicine roadmap with a collection of Indian case scenarios. Amongst the numerous national health priorities that the government and other healthcare advocacy agencies in the country have identified and listed, IWG for the purpose of this report has selected seven healthcare areas to portray the application of telemedicine in public health.

Selected areas are,

- Mother & Child Health
- Rural Healthcare
- Chronic Diseases
- Geriatric Care
- Mental Healthcare
- Trauma & Emergency Care
- Training of healthcare workers

The detailed explanations of these healthcare areas constitute chapter 3 of this report.

## 3.1 Mother and child health

Health risks associated with pregnancy and child birth are high among developing nations of the world. Estimates suggests that on an average 1, 500 women die every day due to pregnancy and child birth related complications in Sub-Saharan Africa and South Asia. According to UN inter- agency estimates of 2005, 99% maternal mortality occurred in developing nations. Approximately, 250, 000 maternal deaths occurred in sub- Saharan Africa. Another one third (187,000) took place in South Asia. It was estimated that 22 % of the global total of maternal death occurred in India alone. Further, the neonatal mortality rate in India in the year 2004 was estimated to be 39 per 1000 live births (64). Growing socio-economic inequities, limited access to maternity and child care services along with a decentralized mechanism of health care management have complicated the efforts of the country to supervise and regulate maternal and child care services.

### Improving mother and child health through telemedicine:

Healthcare delivery interventions	
Provision of improved antenatal and post natal services	<ul style="list-style-type: none"><li>• Strengthening the referral system through ICT</li><li>• Early identification and timely referrals of high risk patients</li><li>• Early decisions to move patients to bigger facilities using tele- technology</li><li>• EMR system to record clinical details</li></ul>
Provision of improved infant and child care services	<ul style="list-style-type: none"><li>• Mobile vehicles for efficient immunization programs</li><li>• Early identification of at- risk patients and their timely referral</li></ul>
Provision of HIV counseling and testing during pregnancy to prevent mother to child transmission	<ul style="list-style-type: none"><li>• Monitoring and evaluation systems for HIV counseling and testing</li><li>• Transportation systems for at- risk patients</li><li>• EMR system linked to EHR for pregnant women and neonates to record clinical details</li><li>• Early identification and efficient referrals of high risk patients</li></ul>

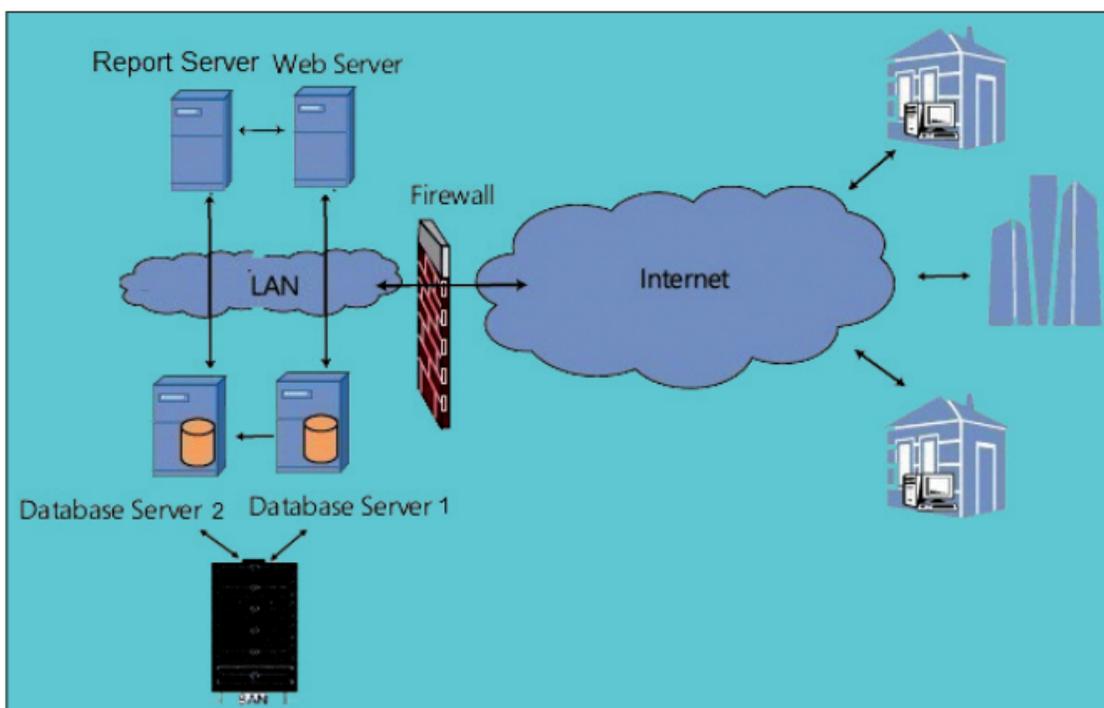
Expert support provision at remote localities	<ul style="list-style-type: none"> <li>• Provision of mobile clinics</li> </ul>
Effective ambulance services	<ul style="list-style-type: none"> <li>• Effective patient transport system</li> <li>• Emergency medical services</li> </ul>
Encouraging community health workers towards provision of post natal care remotely	<ul style="list-style-type: none"> <li>• Communication and exchange of data via cell phones by community health workers</li> </ul>
Encourage public health education	<ul style="list-style-type: none"> <li>• Educational information for public through TV, satellite broadcasting, cell phones radio, websites etc</li> </ul>

An example of tele-health technology initiative by Government of India for Mother and child care improvement

In an effort to reduce existing maternal mortality rate and infant mortality rate, Department of Health and Family Welfare India in association with National Informatics Center (NIC), has developed Mother and Child Tracking system (MCTS) under the National e- Governance Plan. MCTS facilitates universal access to maternal and child health services. This system not only allows healthcare providers for efficient use of the technology, but, also enables empowerment of patients.

Main features of the application includes the following (65):

- The web based database application tool of MCTS permits real time entry of information related to pregnant women and children. Information can include maternal and child care services provided by or received, at any public or private care facility.
- The tool enables generation of a work plan for base level service providers in identification of high risk patients or those in need of specific services.
- Mobile based SMS technology is used to ease information exchange between policy makers, health managers and administrators at different tiers of the health care delivery system.
- SMS alerts and educated patients on different services or regarding services that are pending.
- Pregnant women can register in MCTS and can empower themselves with information on the best service required. Tracking scheduled services also is facilitated by MCTS technology.
- Information on scheduled vaccinations can be retrieved using this technology.



Application architecture of MCTS technology

### **Government initiatives for optimizing efficiency of the technology:**

- Data entered by MCTS is verified by call centers established at Ministry of Health and Family Welfare (MoHFW).
- Government has facilitated SMS communication of monthly work plans to accredited social health activists (ASHA) in English and Hindi.
- Mother and child registration status and telephonic verification status is sent to senior officials in the NRHM.
- State and district e- mission teams to be constituted for a regular monitoring of implementation progress.

## **Telemedicine implementation considerations for mother and child care improvement**

### **Need evaluation**

**Patient need evaluation:** Maternal mortality rate, Infant mortality rate, skilled personnel for labor, mother and child care services

**Care provider's need:** Travel distance between facilities, reduced manpower for the healthcare needs, lacking specific skills

### **Questions to be considered during need evaluation**

What does a clinician or a nurse need to make care delivery more effective and efficient?

What information and communication does a referring physician need?

Is there a need for clinicians to travel between facilities?

Is the organizational investment planned?

### **Care service plan**

**Identification of services-** Expert obstetric services, management of neonatal and childhood illnesses, early detection of high risk pregnancies and neonates, mother and child nutrition, vaccinations

**Source of medical services-** Accredited Social care Activists (ASHA), Telemedicine equipped First referral units

**Mode of delivery of services-** EHRs, empowering primary health centers, community health centers and district hospitals.

Provider location and patient location must be clear

Guidelines and protocols towards delivering these services must be specified

Equipment for audio video streaming and ultrasound imaging, blood pressure, pulse rate and body weight monitors to be specified.

Protocols for referring patients by primary care provider, scheduling tele-health examination through videoconferencing, communicating with remote site staff, examination between patients and physicians must be specified.

Maintain relationships with other service facilities. Alliances with primary mother and child care clinics, assisted living facilities, labor homes and other home care agencies which can bring valuable assets to the organization. Similarly, alliances with major employers in the region can facilitate sharing of resources further reducing capital investment.

### **Risk analysis and business development**

Developing a business plan is critical for sustainability of the program

This would include, all possible increases and decreases in cost , increase in revenue and risk assessment

It is recommended to evaluate the business plan prior to considering the technology. Plan to include communications to Gram Panchayats, pregnant women and their families, primary nursing homes and specialty centers.

### **Planning for technology**

Consider listing the priorities in Step 1

Develop specification for the equipment- Include patient operation from home if applicable, obstetricians/nurses operations, report generation, performance quality. Personal digital assistants (PDAs) or smart phones can be used to alert registered parents regarding due immunization schedules or immunization campaigns for their children.

Consider collaborating with an experienced tele-health consultant at this point  
 Invite vendors for demonstrations and performance testing of products  
 An organization can consider loaning a product for a period of two to four weeks. The site staff can get trained with the equipment at work. Thus, observation from both the patient and the staff can be evaluated.

### Training site staff

Operational trainings for remote physicians, nurses and patients

Considering training the referring providers with respect to function of tele- obstetrics and its potential benefits to the patients. Training for ASHA’s can be considered in order to provide consultation and educating pregnant women, their families and new mothers, across distances within multi-clinic systems.

### Technology testing

Perform a pilot program by limiting the number of patients and staff members.  
 Pilot services can be provided in one or two clinics.

### Evaluation

Evaluate patient, provider and organization centric outcomes.

## 3.2 Rural healthcare

The public health system in India is divided in to a three tier network comprising sub- centers, primary health centers and community health centers. Sub- centers are the primary point of care for patients with primary and community centers delivering health services to rural India. However, in spite of the extensive infrastructure and accessibility, quality and affordability are major problems affecting nearly 72% of India’s population which live in rural areas (66) .

Improving rural healthcare through telemedicine

Healthcare delivery interventions	Tele- health opportunities
Improving healthcare access	<ul style="list-style-type: none"> <li>• Linked EMR with EHR</li> <li>• Improved referral system</li> <li>• Mobile clinics for routine screening and need based visits</li> </ul>
Specialist support for isolated health professionals	<ul style="list-style-type: none"> <li>• Communication and data exchange facilitated through videoconferencing, teleconferencing and webcasting</li> </ul>
Better management of adverse events	<ul style="list-style-type: none"> <li>• Provision of e- mail based or web-based tele- radiology solutions</li> </ul>
Improved child and maternal health services	<ul style="list-style-type: none"> <li>• Early identification of high risk patients through periodic screening</li> <li>• HIV counseling and testing</li> </ul>
Management of communicable diseases	<ul style="list-style-type: none"> <li>• Communicable disease surveillance technology</li> <li>• Educational programs for high risk population such as tobacco users and tele- counseling sessions</li> </ul>
Community educational healthcare programs	<ul style="list-style-type: none"> <li>• Periodic educational campaigns emphasizing on hygiene, mother &amp; child nutrition among others</li> </ul>

## Tele- health success so far in improving rural health

Major thrust and support is being provided by DIT through organizations such as ISRO with projects and systems support by various medical institutions such as AIIMS, PGIMER, SRMC etc. Corporate hospitals such as Asia Heart Foundation, Apollo Hospitals, and Fortis etc. have taken significant initiatives with respect to introduction of telemedicine systems in various parts of the country. Funding initiatives of DIT has aided in dissemination and connection of premier medical institutions with various state level hospitals, also, development of telemedicine software systems, the prominent ones being, Mercury and Sanjeevani developed by C- DAC.

Tele- health system was implemented towards diagnosis and monitoring of tropical diseases in West Bengal through low speed WAN which was developed by Weibel (Kolkata), IIT, Karagpur and School of Tropical Medicine, Kolkata with support from two district hospitals and funding aided by DIT.

Similarly, telemedicine set-up for establishment for an Oncology Network was funded by DIT. Services included cancer detection, treatment, pain relief, patient follow-up and care continuum in nodal centres of Regional Cancer Centre (RCC). In similar lines, several state-level Telemedicine network in Kerala, Tamil Nadu, Haryana and Punjab have tested telemedicine implementation through their pilot projects.

As a result of proof- of- concept technology demonstration in the year 2001, ISRO established remote health facilities in 60 rural healthcare centers connected to 20 super specialty urban city hospitals. The Andaman and Nicobar telemedicine project facilitated linking G. B. Pant Hospital at Port Blair with Shri Ramchandra Medical College and Research Institute, Chennai. In another similar effort, Narayan Hrudayalaya got linked with several district hospitals in Karnataka to provide access to high quality healthcare remotely. Data shows that more than 25, 000 patients by year 2006 got benefitted through tele- consultations and further follow-up treatments (67) .

## Telemedicine implementation for rural healthcare improvement

### Need evaluation

Patient need evaluation- Infant and maternal mortality rate, Communicable diseases, Trauma and rural emergency care  
Care provider's need- Travel distance between facilities, reduced manpower for the healthcare needs, lacking specific skills

### Questions to be considered during need evaluation

What does a clinician or a nurse need to make care delivery more effective and efficient?  
What information and communication does a referring physician need?  
Is there a need for clinicians to travel between facilities?  
Is the organizational investment planned?

### Care service plan

**Identification of services-** Connectivity between primary/community health centres to district or state super specialty hospitals, mobile telemedicine units

**Source of medical services-** Community health workers, physicians, tele- health organizations

**Mode of delivery of services-** EHRs, empowering primary health centres, community health centres and district hospitals.

Provider location and patient location must be documented with clear specifications of patient facilities

Guidelines and protocols towards delivering these services must be specified  
Equipment for audio video streaming and ultrasound imaging, blood pressure, pulse rate and body weight monitors to be specified.

Protocols for referring patients by primary care provider, scheduling tele-health examination through videoconferencing, communicating with remote site staff, examination between patients and physician must be specified.

## Risk analysis and business development

Developing a business plan is critical for sustainability of the program.

This would include, all possible increases and decreases in cost, increase in revenue and risk assessment.

It is recommended to evaluate the business plan prior to considering the technology. Plan to include communications to Taluk Panchayats, primary / community health centre, and district/state hospital.

## Planning for technology

Consider listing the priorities in Step 1

Develop specification for the equipment

Technology facilities to be considered for primary/ community health centres include, selective medical, medico- IT equipment, connectivity requirement (ISDN, Leased line, VSAT, Broadband, wireless technology)

Technology considerations for mobile telemedicine units include an automobile vehicle with space for tele- consultation, patient examination and for carrying out investigation procedures like scan and x- ray. IT compatible medico- IT equipment, computer hardware/ software platform (PC, server, switch etc), IT electronic equipment

Connectivity/ bandwidth requirements include ISDN, leased line, VSAT, broadband wireless, point- to- point video conferencing system.

Consider customizing mobile units to be deployed. Ex: boat (applicable for regions such as Kerala, Assam), Camel Carts (deserts of Rajasthan) etc. Application specific mobile units can be configured.

Consider collaborating with an experienced tele- health consultant at this point

Invite vendors for demonstrations and performance testing of products.

An organization can consider loaning a product for a period of two to four weeks. The site staff can gain trained with the equipment at work. Thus, observation from both the patient and the staff can be evaluated

## Training site staff

Operational trainings for remote physicians, nurses and patients

Considering training the referring providers with respect to function of application specific tele- health and its potential benefits to the patients

## Testing technology implementation

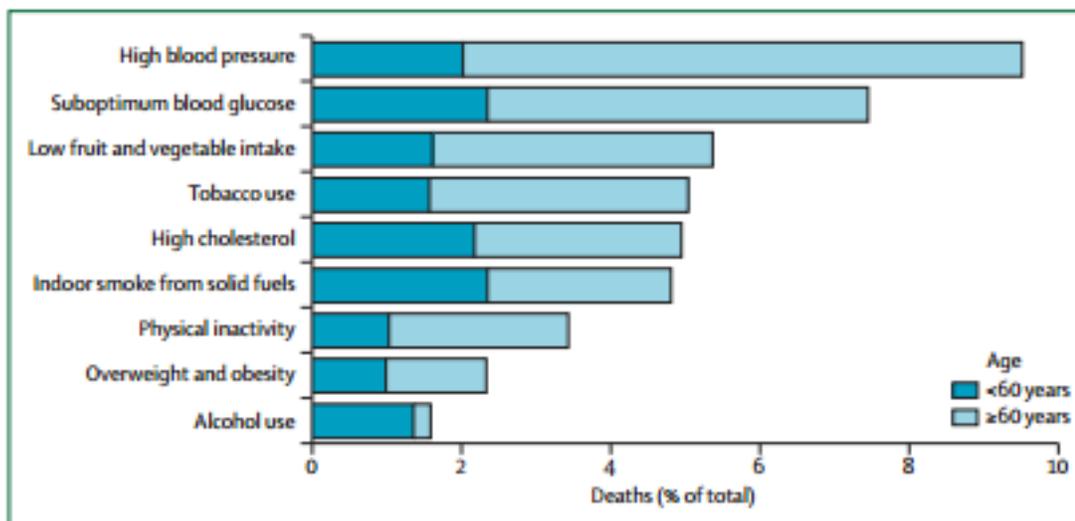
Perform a pilot program by limiting the number of patients and staff members  
Pilot services can be provided in one or two clinics

## Evaluation

Evaluate patient, provider and organization centric outcomes

# 3.3 Chronic diseases

Of the estimated 10.3 million deaths that occurred in India in 2004, 5.2 million were due to chronic conditions. With increase in elderly population in the next 25 years, the total number of deaths associated with age related chronic conditions is also projected to increase.



Source: Deaths attributed to chronic disease risk factors in India (68)

Among the chronic conditions, cardiovascular conditions such as coronary heart diseases are the leading cause of deaths in India. It is estimated that Indians have more likelihood of development of such conditions with an early onset of disease. The other most common cause of disease burden in India is attributed to chronic obstructive pulmonary disease.

### Telemedicine for chronic diseases (69, 70)

Healthcare delivery interventions	Tele- health opportunities
Provision of improved care for diabetes and related complications	<ul style="list-style-type: none"> <li>• Retinopathy screening through e-mails</li> <li>• Home telemedicine system for periodic monitoring</li> <li>• Self-management through informed collaborations and educational opportunities</li> <li>• Enhanced data sharing between remote care providers</li> </ul>
Physician support	<ul style="list-style-type: none"> <li>• Patient specific electronic chronic patient record (ECPR)</li> <li>• Sharing ECPR among care professionals from different organizations</li> <li>• Ubiquitous ECPR for convenient access by care providers</li> </ul>
Patient care	<ul style="list-style-type: none"> <li>• Direct access to specialized nurse or case manager through telephone, text messaging or video conferencing for solutions and advice.</li> <li>• Remote monitoring through tele-monitoring of biomedical parameters with monitoring results integrated in ECPR</li> <li>• Tele-consultations or tele-visits using video-conferencing</li> </ul>
Patient education	<ul style="list-style-type: none"> <li>• Interactive CD-ROMs and websites</li> <li>• Discussion rooms</li> <li>• Access to educational materials from home</li> </ul>

## Telemedicine implementation for chronic disease management

### Need evaluation

Patient need assessment- Chronic disease management, efficient home monitoring  
Care provider's need- Travel distance between facilities, reduced manpower for the healthcare needs, lacking specific skills

#### Questions to be considered during need evaluation

1. What does a clinician or a nurse need to make care delivery more effective and efficient?
2. What information and communication does a referring physician need?
3. Is there a need for clinicians to travel between facilities?
4. Is the organizational investment planned?

### Care service plan

**Identification of services-** Connectivity between primary/community health centers to district or state super specialty hospitals, home monitoring

**Source of medical services-** Community health workers, physicians, tele- health organizations

**Mode of delivery of services-** EHRs, mobile phones, call centre based applications, tele-consultations

Provider location and patient location must be documented with clear specifications of patient facilities

Guidelines and protocols towards delivering these services must be specified

Equipment for chronic conditions management may include usage of digital weighing scales, blood pressure cuffs, pulse reader etc which needs to be specified.

Protocols for referring patients by primary care provider, scheduling tele-health examination through videoconferencing, communicating with remote site staff, examination between patients and physician

### Risk analysis and business development

Developing a business plan is critical for sustainability of the program. This would include, all possible increases and decreases in cost, increase in revenue and risk assessment. It is recommended to evaluate the business plan prior to considering the technology. Plan to include communications to Primary/ community health centre, district/state hospital

### Planning for technology

Consider listing the priorities in Step 1

Develop specification for the equipment

Technology facilities to be considered for primary/ community health centres include, selective medical, medico- IT equipment, connectivity requirement (ISDN, Leased line, VSAT, Broadband, wireless technology)

Consider collaborating with an experienced tele- health consultant at this point

Invite vendors for demonstrations and performance testing of products

An organization can consider loaning a product for a period of two to four weeks. The site staff can gain trained with the equipment at work. Thus, observation from both the patient and the staff can be evaluated

Consider organizational challenges such as SMS gateways compatibility with the region. Also, identification of Voice over Internet Protocol (VoIP) providers for IVR calls

### Training site staff

Operational trainings for remote physicians, nurses and patients

Considering training the referring providers with respect to function of application specific tele- health and its potential benefits to the patients

### Technology testing

Perform a pilot program by limiting the number of patients and staff members

Pilot services can be provided in one or two clinics

### Evaluation

Evaluate patient, provider and organization centric outcomes

Key process measures for evaluation may include: satisfaction and utilization of tele counseling, SMS and IVR by patients as well as providers.

## 3.4 Geriatric care

The National Health Profile 2010 and the Central Bureau of Health intelligence revealed a significant increase in life expectancy at birth in India. It has increased from 59. 7 years in 1991- 95 to 62. 6 years in 2002- 06 for males. In females, an increased life expectancy was observed from 60. 9 years in 1991- 95 to 64. 2 years in 2002- 06. This increase in life expectancy leads to an increased geriatric population with specific health service delivery requirements (66). Increasing number of this population has a direct impact on demand for health services with an increase in degenerative diseases of the aging and changing lifestyles. The elderly population is prone to communicable and non- communicable diseases, which is further compounded by impairment of vision, hearing, stability management and such sensory functions.

Telemedicine opportunities for geriatric care

Healthcare delivery intervention	Tele- health opportunities
Geriatric care	<ul style="list-style-type: none"> <li>• Expedited referrals from general physicians or specialist practitioners</li> <li>• Home monitoring by nurse or clinical psychologist</li> <li>• Geriatrician review</li> <li>• Hand held mobile cell phones (HMC) for assessment by geriatricians or psychiatrist</li> <li>• HMS follow up</li> </ul>

### M- health/ telemedicine implementation plan for geriatric health

#### Need evaluation

**Patient need assessment-** Access to healthcare, Independent living for the elderly, Home health monitoring

**Care provider's need-** Travel distance between facilities, reduced manpower for the healthcare needs, lacking specific skills

#### Questions to be considered during need evaluation

1. What does a clinician or a nurse need to make care delivery more effective and efficient?
2. What information and communication does a referring physician need?
3. Is there a need for clinicians to travel between facilities?
4. Is the organizational investment planned?

#### Care service plan

**Identification of services-** General medicine for the elderly, orthopedics, ophthalmology, ENT services, tele- psychiatry, medication monitoring and management, home safety and monitoring for the elderly.

## Technology testing

Source of medical services- Community health workers, physicians, tele- health organizations

Mode of delivery of services- EHRs, m- health services through home monitoring, Tele- ophthalmology, tele- psychiatry etc.

Provider location and patient location must be documented with clear specifications of patient facilities

Guidelines and protocols towards delivering these services must be specified.

Tele- health monitoring devices for diabetes, hypertension, chronic heart failure and such chronic conditions to be considered. Personal Digital Assistants (PDA), mobile phones can be used as tools for medication monitoring.

Protocols for referring patients by primary care provider, scheduling tele-health examination through videoconferencing, communicating with remote site staff, examination between patients and physician

## Risk analysis and business development

Developing a business plan is critical for sustainability of the program. This would include, all possible increases and decreases in cost, increase in revenue and risk assessment. It is recommended to evaluate the business plan prior to considering the technology. Plan to include communications to old age homes / community health centre, district/state hospitals

## Planning for technology

Consider listing the priorities in Step 1

Develop specification for the equipment

Technology facilities to be considered for primary/ community health centers include, selective medical, medico- IT equipment, connectivity requirement (ISDN, Leased line, VSAT, Broadband, wireless technology)

Technologies that can be considered for geriatric care management include: Health monitoring devices, tools for storing health information, personal emergency response systems, fall detection devices, passive sensor- based activity monitors, automated reminder systems for medication monitoring and management.

IT compatible medico- IT equipment, computer hardware/ software platform (PC, server, switch etc), IT electronic equipment. Connectivity/ bandwidth requirements include ISDN, leased line, VSAT, broadband wireless, point- to- point video conferencing system. Tele health kiosks can be installed at senior citizen wellness centers.

Consider collaborating with an experienced tele- health consultant at this point

Invite vendors for demonstrations and performance testing of products

An organization can consider loaning a product for a period of two to four weeks. The site staff can get trained with the equipment at work. Thus, observation from both the patient and the staff can be evaluated

## Training site staff

Operational trainings for remote physicians, nurses, patients, geriatric healthcare workers

Considering training the referring providers with respect to function of application specific tele- health and its potential benefits to the patients

## Technology testing

Perform a pilot program by limiting the number of patients and staff members  
Pilot services can be provided in one or two clinics

## Evaluation

Evaluate patient, provider and organization centric outcomes

### 3.5 Mental health care

Conditions such as mental health and wellbeing are the most neglected when compared to any other health care service. This situation is common, particularly in rural areas, where access to health care is a challenge accompanied by the fact that mental health status is often associated with social stigma. This matter is of serious concern with the National Rural Health Mission failing to address it effectively. Further, the performance of National Mental Health Program has been uneven over the years. The efficiency of District Mental Health Program is also questionable with only 125 districts covered under the program out of 626 districts in India (71).

Recent statistics suggest that, considered as one among the non-communicable diseases, mental illness claims 26 % share in the burden of disease in India. Projections suggest that there would be a sharp increase in the trend in the coming years. It is estimated that by the year 2020, the health burden due to mental disorders will increase to 15 % of disability-adjusted life years (DALY) (71).

Telemedicine opportunities in psychiatric care (72)

Healthcare delivery intervention	Tele- health opportunities
Primary care	<ul style="list-style-type: none"> <li>• Video links for remote psychiatric consultations</li> <li>• Video links for remote joint assessment with primary care teams or general practitioners</li> <li>• Remote psychiatric assessment for prisoners</li> <li>• Expedited patient referrals</li> <li>• Linking general practitioners acute ward to psychiatric intensive care units</li> </ul>
Discharge planning	<ul style="list-style-type: none"> <li>• Video links for ease in discharge planning of a patient</li> </ul>
Educating Community care workers	<ul style="list-style-type: none"> <li>• Training village level community activists on importance of mental health and identification of high- risk patients.</li> </ul>

#### Telemedicine implementation considerations for mental healthcare management

##### Need Evaluation

**Patient need evaluation:** Depression, anxiety, other neurological diseases management.

Access to expert care with minimum time spent on travel or transfers

**Care provider’s need-** Travel distance between facilities, reduced manpower for the healthcare needs, lacking specific skills

##### Questions to be considered during need evaluation

1. What does a clinician or a nurse need to make care delivery more effective and efficient?
2. What information and communication does a referring physician need?
3. Is there a need for clinicians to travel between facilities?
4. Is the organizational investment planned?

##### Care service plan

**Identification of services-** Connectivity between primary/community health centers to district or state super specialty hospitals

**Source of medical services-** Community health workers, physicians, tele- health organizations

**Mode of delivery of services-** EHRs, High definition video conferencing

Provider location and patient location must be documented with clear specifications of patient facilities

Guidelines and protocols towards delivering these services must be specified

Equipment for audio video streaming and other vital sign monitors to be specified.

Protocols for referring patients by primary care provider, scheduling tele-health examination through videoconferencing, communicating with remote site staff, examination between patients and physicians to be specified

### **Risk analysis and business development**

Developing a business plan is critical for sustainability of the program. This would include, all possible increases and decreases in cost, increase in revenue and risk assessment. It is recommended to evaluate the business plan prior to considering the technology. Plan to include communications to Primary/ community health centre, district/state hospital, mental health centers

### **Planning for technology**

Consider listing the priorities in Step 1

Develop specification for the equipment

Technology facilities to be considered for primary/ community health centers include, selective medical, medico- IT equipment, connectivity requirement (ISDN, Leased line, VSAT, Broadband, wireless technology)

IT compatible medico- IT equipment, computer hardware/ software platform (PC, server, switch etc), IT electronic equipment. Connectivity/ bandwidth requirements include ISDN, leased line, VSAT, broadband wireless, point- to- point video conferencing system.

Consider collaborating with an experienced tele- health consultant at this point

Invite vendors for demonstrations and performance testing of products

An organization can consider loaning a product for a period of two to four weeks. The site staff can get trained with the equipment at work. Thus, observation from both the patient and the staff can be evaluated

On- site IT support for tele- video connections is important. All video- conferencing solutions for mental health management should be performed through technology and transmission lines with high encryption levels and reliability

### **Training site staff**

Operational trainings for remote physicians, nurses and patients

Considering training the referring providers with respect to function of application specific tele- health and its potential benefits to the patients

### **Technology testing**

Perform a pilot program by limiting the number of patients and staff members

Pilot services can be provided in one or two clinics

### **Evaluation**

Evaluate patient, provider and organization centric outcomes

## 3.6 Trauma and emergency care

One of the leading causes of morbidity and mortality worldwide is traumatic injury, with adequate data being elusive. Moreover, trauma is the fourth highest cause of death in the world. Deaths due to injury are more each year (9% of annual global mortality) when compared to a combined effect of acquired immunodeficiency syndrome (AIDS), tuberculosis (TB) and malaria. Further, about 1.2 million people get killed annually due to traffic crashes alone, with 50 million people succumbing to significant injuries and disabilities leading to tens of millions of emergency room visits and hospitalization (73, 74). Moreover, disasters both natural and manmade (wars, terrorism etc) too contribute to increasing numbers of people visiting emergency rooms and hospital for care. Hence whether intentional or unintentional, injuries are critical healthcare concerns of the world. With unequally distributed emergency and trauma care, risks of injury, as well as, costs incurred to the society, is enormous

Telemedicine for trauma and emergency care management

- Enhanced action for specialty consultation
- Enables virtual addition of a trauma specialist to a rural emergency and trauma care team
- Improved communication and care continuum
- Aids in a timely intervention for better care of patients with improved outcomes and reduced cost
- Cost reduction through efficient use of transportation systems, reduction in unnecessary transfers of patients, reduction in length of stay

### Telemedicine implementation considerations for trauma care centers

#### Need Evaluation

**Patient need evaluation:** Immediate intervention, Reduction in unnecessary transfers, Improved health outcomes

**Care provider's need-** Travel distance between facilities, reduced manpower for the healthcare needs, lacking specific skills

Questions to be considered during need evaluation

1. What does a clinician or a nurse need to make care delivery more effective and efficient?
2. What information and communication does a referring physician need?
3. Is there a need for clinicians to travel between facilities?
4. Is the organizational investment planned?

#### Care service plan

Identification of services- Trauma evaluation, specialized assessment for patients in remote areas, assistance in triage decision making, identifying candidates for admission to local facilities, eliminating unnecessary transfers.

Source of medical services- Rural physicians, trauma specialists, nurses, tele- health organizations.

Mode of delivery of services- Inter- hospital telemedicine, connectivity between a pre- hospital and hospital setting, deployable mobile telemedicine systems

Design trauma management protocol

Provider location and patient location must be documented with clear specifications of patient facilities

Guidelines and protocols towards delivering these services must be specified

Equipment for audio video streaming and other vital sign monitors to be specified.

Protocols for referring patients by primary care provider, scheduling tele-health examination through videoconferencing, communicating with remote site staff, examination between patients and physicians to be specified

## Risk analysis and business development

Developing a business plan is critical for sustainability of the program. This would include, all possible increases and decreases in cost, increase in revenue and risk assessment. It is recommended to evaluate the business plan prior to considering the technology. Plan to include communications to remote emergency care settings / community health centre, district/state hospital and regional traffic control centers.

## Planning for technology

Consider listing the priorities in Step 1

Develop specification for the equipment

Technology facilities to be considered for primary/ community health centres include, selective medical, medico- IT equipment, connectivity requirement (ISDN, Leased line, VSAT, Broadband, wireless technology)

- Ensure broadband connectivity to allow trauma surgeons for video, audio and vital sign access in trauma and emergency rooms of remote locations
- Establish connectivity between ambulances and emergency rooms
- Video, audio and data access in emergency vehicles with externally mounted cameras to operate in conjunction with highway cameras

IT compatible medico- IT equipment, computer hardware/ software platform (PC, server, switch etc), IT electronic equipment. Connectivity/ bandwidth requirements include ISDN, leased line, VSAT, broadband wireless, point- to- point video conferencing system

Consider collaborating with an experienced tele- health consultant at this point

Invite vendors for demonstrations and performance testing of products

An organization can consider loaning a product for a period of two to four weeks. The site staff can get trained with the equipment at work. Thus, observation from both the patient and the staff can be evaluated

## Training site staff

Operational trainings for remote physicians, nurses

Considering training the referring providers with respect to function of application specific tele- health and its potential benefits to the patients

## Technology testing

Perform a pilot program by limiting the number of patients and staff members.

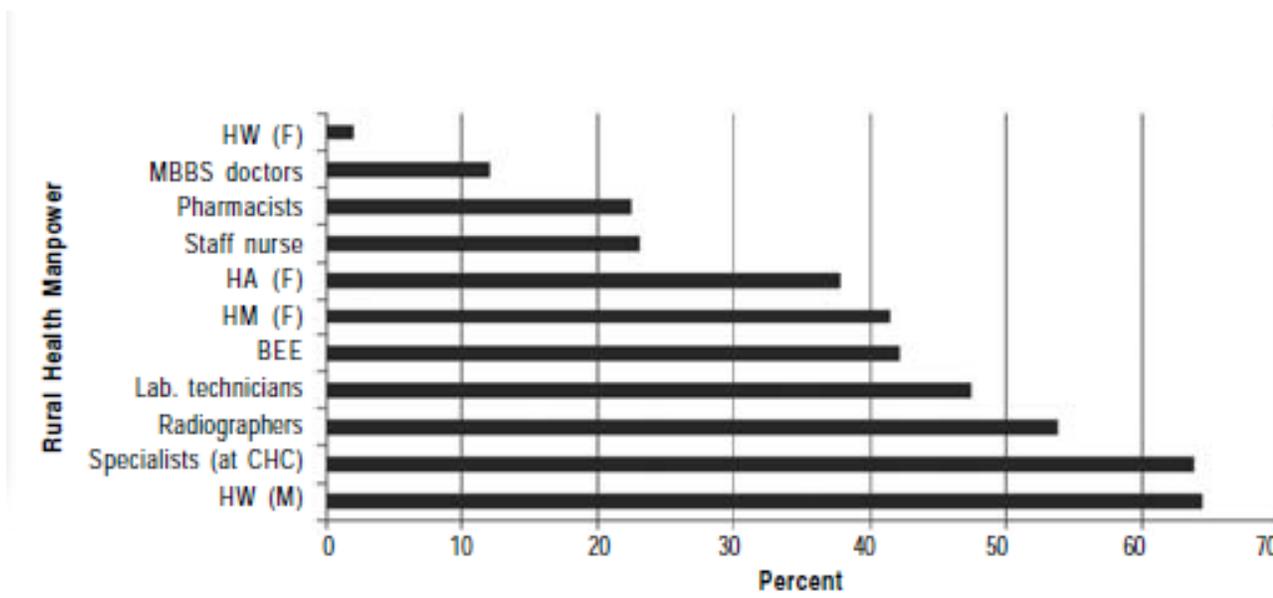
Pilot services can be provided in one or two clinics.

## Evaluation

Evaluate patient, provider and organization centric outcomes

## 3.7 Training healthcare workers (HCWs)

Health services workforce is described as ‘heart of the health system in any country’. In India there exists an imbalance in the distribution of this workforce in the urban- rural health system. Moreover, there is a dearth of reliable sources towards estimation of care distributors throughout the country which creates an uncertainty while evaluating their numbers. A deficit of 2866 doctors in primary health centers (PHC) prevail, versus the requirement being 23 887, as per the current scenario in the rural healthcare system. Also, there is a 23 % shortfall of nurse midwives or staff nurses at the PHC or at community health centre level (CHC) (75). Further, disparities in rural economic income, inadequate rural health professional training sites coupled with lower reimbursement levels make it further challenging to recruit HCWs to rural communities.



Shortfall in rural health manpower (Rural Health Bulletin, Ministry of Health and Family Welfare, Government of India, 2011). HW(F)-Health worker(female), HA(F)- health assistance (female), HA(M)- Health assistance(male), BEE- Block extension educator, HW(M)- health worker (male). Source: India's health workforce: Current status and the way forward (75)

### Role of telemedicine

Telemedicine aids in capacity building with increase in recruitment and retention rates of HCWs in rural areas. It is achieved by allowing easy connection and monitoring of patients at the same time granting opportunities to non-physician care providers to practice in more areas while being advised by physicians. This technology allows availability of specialists, also, supports remote care providers. Further, m-learning promotes access to educational content, hence, reduces isolation of remote healthcare workers. It facilitates interactive post- graduation education experiences assisting in continuing medical education for these professionals.

### Telemedicine implementation considerations towards training HCWs:

#### Need Evaluation

**Care provider's need-** Travel distance between facilities, reduced manpower for the healthcare needs, lacking specific skills

#### Questions to be considered during need evaluation

1. What does a clinician or a nurse need to make care delivery more effective and efficient?
2. What information and communication does a referring physician need?
3. Is there a need for clinicians to travel between facilities?
4. Is the organizational investment planned?

## Care service plan

**Identification of services-** Training primary health centre physicians on specific diseases, telemedicine equipment

**Source of medical services-** Community health workers, physicians, tele- health organizations

**Mode of delivery of services-** Webinars, telemedicine , e- collaborations with organizations Design trauma management protocol

## Risk analysis and business development

Developing a business plan is critical for sustainability of the program. This would include, all possible increases and decreases in cost, increase in revenue and risk assessment. It is recommended to evaluate the business plan prior to considering the technology. Plan to include communications to Primary / community health centre, district/state hospitals.

## Planning for technology

Consider listing the priorities in Step 1

Develop specification for the equipment

Technology facilities to be considered for primary/ community health centres include, selective medical, medico- IT equipment, connectivity requirement (ISDN, Leased line, VSAT, Broadband, wireless technology)

IT compatible medico- IT equipment, computer hardware/ software platform (PC, server, switch etc), IT electronic equipment. Connectivity/ bandwidth requirements include ISDN, leased line, VSAT, broadband wireless, point- to- point video conferencing system.

Consider collaborating with an experienced tele- health consultant at this point

Invite vendors for demonstrations and performance testing of products

An organization can consider loaning a product for a period of two to four weeks. The site staff can get trained with the equipment at work. Thus, observation from both the patient and the staff can be evaluated

## Training site staff

Operational trainings for remote physicians, nurses

Considering training the referring providers with respect to function of application specific tele- health and its potential benefits to the patients

## Technology testing

Perform a pilot program by limiting the number of patients and staff members

Pilot services can be provided in one or two clinics

## Evaluation

Evaluate patient, provider and organization centric outcomes

## Chapter 4 - Conclusion

Convergence of future wireless communications with network technologies around mobile health systems accompanied by increased availability of enhanced data rates will reshape the mechanisms of existing health-care delivery routes. Barriers are and will be present along the process of development while adopting and using this technology in clinical practice. In spite of this limited growth and evidence base, tele- health has a considerable potential, especially for individuals with cardio vascular diseases, diabetes, dementia and other such chronic conditions. However, the following points must be considered before developing a tele- health program:

Large and expensive projects without being tested in small scale pilot studies should be avoided.

Identification and prioritization of needs should be set through intimate collaborations between care providers, local authorities and community representatives and stakeholders.

Examples from other successful implementation programs must be considered to plan projects. Recognizing the limitations and having a focused approach towards disease oriented programs, specifically pertaining to child and adult illnesses, chronic disease management or management of non-communicable diseases, maternal and reproductive health and communicable disease management will drive us towards an adequately functioning, integrated primary care delivery platform such as telemedicine. Successful and sustainable implementation of tele- health is only possible if there is integration with e- health initiatives, policy goal settings and addressing policy barriers.

Also, demonstration of the applicability and cost-effectiveness of telemedicine in healthcare is critical in determining the future of telemedicine implementation. Using the evidence of telemedicine benefits and cost effectiveness ensures investment planning up ahead. Gathered evidence must not only focus on socio economic benefits but also towards telemedicine applications in an organizational context for a model setting. A comprehensive approach towards evidence gathering from large scale pilot projects and systematic reviewing techniques will provide indicators related to successful deployment of tele-health technology. Gaps in evidence base can be analyzed and the impacts can be then tailored act.

Best practices and opportunities must be identified for a conducive regulatory and legislative environment through comparative studies of various regimens. Advocating tele-health through awareness campaigns and facilitating exchange of information between key stake- holders also has an impact to the future of telemedicine adoption.

A constant exchange of information and dialogues can drive potential innovations and bring organizational reforms. It can also help in reducing resistance to change by instilling a sense of ownership among stakeholders further facilitating the adoption and acceptance of a new service delivery mode.

Further, to maintain a high quality of service, security and privacy policies must be introduced. The quality and effectiveness, procedures and techniques involved must be evaluated on a periodic basis to maintain high quality service. Success of the strategy therefore, depends on degree of integration of the technology with core health services delivery modes than as a sole mode for delivery of care.

# Glossary

## Bandwidth

Bandwidth is the capacity of an electronic transmission medium to transmit data per unit of time. The higher the bandwidth, the more data can be transmitted. Typically measured in kilobits per second (Kbps) or megabits per second (Mbps). Standard telephones are low bandwidth devices (maximum bandwidth = 33.6 Kbps). Cable television uses high bandwidth (up to 140 Mbps).

## e- Health

A term used in different ways by different people but generally thought of as the use of telecommunications to advance health and healthcare in any form.

## Information and Communications Technology (ICT)

The application of modern electronic and computing capabilities (technology) to the creation and storage of meaningful and useful facts or data (information), and to its transmission to users by various electronic means (communication). The ultimate goal is for ICT to transform data into information, and information into knowledge.

## Internet

A loose aggregation of thousands of computer networks forming an enormous worldwide WAN (although some would not use the term WAN for this generally low-bandwidth system).

## ISDN

Integrated Services Digital Network is a low-to-medium speed technology for digital telephony. Usually transmits at 64-128Kbps, although higher speeds are possible.

## Local area networks (LANs)

A series of computers that are connected so they can share information without going through the Internet; a LAN is its own network distinct from the Internet or other networks.

## m- Health

Mobile Health, or m-Health, can be defined as medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, tablets, personal digital assistants (PDAs), and other wireless devices.

## PACS

Picture Archiving and Communication System, an image system that embraces all modalities (X-ray, CT, MR, nuclear medicine, ultrasound) and links users with display workstations over a high-speed network to an image server, an archive, printers, and radiology information systems (RISs).

## POTS

Plain Old Telephone System- The analog, public switched telephone network in common use throughout the world. It's also known as Public Switched Telephone Network (PSTN).

## Store and forward

Creating data— an image such as an X-ray or an audio or video clip — then electronically sends to a storage site where it can later be accessed by a clinician for review.

## Telemedicine

As currently defined in COMAR 10.32.05: the practice of medicine from a distance, in which intervention and treatment decision and recommendations are based on clinical data, documents, and information transmitted through telecommunications systems.

## Tele-health

Often used as a synonym for telemedicine, and also includes non-clinical practices such as continuing medical education and nursing call centers (American Telemedicine Association). It is the use of telecommunication techniques for the purpose of providing telemedicine, medical education, and health education over a distance.

## Tele-care

Tele-care is a term given to offering remote care of elderly and vulnerable people, providing the care and reassurance needed to allow them to remain living in their own homes. Continuous, automatic and remote monitoring to manage the risks associated with independent living (American Telemedicine Association).

## Tele-monitoring

The process of using audio, video, and other telecommunications and electronic information processing technologies to monitor the health status of a patient from a distance (American Telemedicine Association).

## Video conferencing

Real-time, usually two-way transmission of digitized video images between two or more locations.

## WAN

Wide Area Network- Wider in geographic scope than a LAN. Provides digital communications (voice / video / data) over switched (ISDN, switched 56) or unswitched (fractional T1, T1) networks.

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