ICT for Primary Healthcare

A Report

(Excerpts of the report)

July 2005

The Core Group for leveraging Information and Communication Technology for Primary Healthcare constituted by Media Lab Asia

1. Dr. L. S. Satyamurthy, ANTRIX, ISRO — Chairperson
2. Dr. Devi Shetty, Narayana Hrudayalaya — Member
3. Dr. Anand Krishnan, AIIMS — Member
4. Dr. RP Bajpai, CSIO — Member
5. Dr. K.S. Iyengar, Byrraju Foundation — Member
6. Prof. Harish Karnick, IIT Kanpur — Member
7. Rep. Ministry of Health — Member
8. Sh. Nachiket Mor, ICICI Bank — Member
9. Sh. VB Taneja, Sr. OSD, MLAsia — Member
10. Sh. BS Bedi, DIT, GOI — Member
11. Dr. G.V Ramaraju, Media Lab Asia — Member–Secretary

The following Members were co-opted
1. Dr Prem Nair, AIMS Cochin
2. Dr D Gopinath, MSRMC
3. Dr Krishnamurthy Ramalingam, AIMS Cochin
4. Dr B. S. Nanda Kumar, MSRMC

The following members were invited
1. Dr. Arnab Sen, Apollo Health Street
2. Dr. Lavanian, Apollo Health Street
3. Dr. NK Singh, Televital
4. Sh. N. Krishnan, CDAC

1. Preamble

♦ **Inspired by recent advances in the delivery of health care and medical education through the use of Information and communications technology; Believing that the ICT enabled services for the health care, envisaged in the country should be available for the benefit of all people located in rural, remote and inaccessible places, and to further enhance its end-to-end capability,**

♦ **Recognizing the right to privacy and confidentiality in health matters,**

♦ **Recognizing the advancement in the information and communication technology in India, which is the forerunner for its adaptation for health care delivery,**

♦ **Recognizing the common interest of the health and community welfare of the people of India,**

♦ **Believing that the promotion of ICT for health care will contribute to the availability of quality health care to those in need irrespective of socio economic and geographical disparities,**

♦ **Desiring to contribute to broad international cooperation in the scientific, legal, and ethical aspects of the use of ICT for health care,**

♦ **Believing that such cooperation will contribute to the development of mutual understanding and to strengthen the friendly relations between states and people,**

♦ **Encouraging to provide continued support for the advancement of e-health leading to health Information System, Telemedicine/ TeleHealth, its applications and its greater relevance to India,**

♦ **Realizing that a set of guidelines for use of ICT for primary**

health care will go a long way in optimally leveraging existing technologies, while ensuring its continuity to the evolving and advancing technical innovations,

♦ **Realizing the necessity of delivering cost effective solution for ICT based health care delivery at primary level and indigenous enterprise for providing software/hardware for e-health programmes,**

♦ **Government of India is convinced that a set of standards and guidelines on ICT for primary health care be defined, that will further the goal of providing all people with a practically attainable standard of health care, which is sustainable in an integrated manner.**

♦ **Government of India believes that technology development projects and their field deployments would demonstrate the role of ICT in addressing the primary healthcare in a sustainable manner to improve awareness and ensure capacity building for societal benefits.**

As part of this endeavor, Media lab Asia of the Department of Information Technology (DIT), Ministry of Communications and Information Technology (MCIT), has taken initiative on the evolution and adaptation of ICT for primary health care under the broad development of e-Health initiative by setting up the "Core Group for ICT for Primary health care" to facilitate implementation of e-health systems using information communication technology (ICT) enabled services.

The Core Group consists of members drawn from different government and private agencies/institutions that have taken initiatives in the form of pilot projects for ICT enabled health care delivery with a mandate to evolve and submit a document on suitable standards and guidelines for the implementation of ICT enabled services for Primary Health Care.

3. Health and Wellbeing

From time immemorial man has been interested in trying to control disease. In ancient times, health and illness were interpreted in a cosmological and anthropological perspective. In the course of the evolution, which proceeded by stages, with advances and halts, health care has truly undergone a momentous metamorphosis. From the initial disease control phase to the present "Health for all" phase the journey has been truly remarkable.

The role of health as a means of economic advancement, although intuitively clear, has begun acquiring prominence especially in national developmental goals only in recent times. Health as an agenda in development is gaining ground in a very substantial way and the importance of health issues in non-health matters bear a testimonial to this change. This is also reflected in the VISION 2020 document which puts forth an ambitious agenda for health.

Health and health care though used interchangeably, need to be distinguished from each other for no better reason than that the former is often incorrectly seen as a direct function of the latter. Contrary to the popular conception heath is clearly not the mere absence of disease. Optimal health often confers on a person or groups, freedom from illness and the ability to realize one's potential to the fullest possible extent. Health is therefore best understood as the indispensable basis for defining a person's sense of well being.

Recent times have seen unprecedented advances in the healthcare sector, which originally was considered only as a service oriented public domain. With the entry of several private players the health care sector is gradually moving towards a consumer driven industry status.

3.1. The Primary Healthcare Scenario

3.1.1 Origin and Evolution

The origins of Indian health care system can be traced to the colonial medical services that emphasized costly high-technology, urban-based, curative care catering exclusively to the imperial men. When India became independent in 1947, we inherited health care systems modeled after the systems in industrialized nations. This led to a mismatch between service and demand as the existing problems of the time varied significantly from the available solutions.

By the mid-1970s there was a global change in the approaches to the health care systems and the international health agencies and experts began to examine alternatives to improvise health care delivery so as to reach it to those who needed it most. The impressive health gains in China as a result of its community- based health programs and similar approaches elsewhere stood in contrast to the poor results of disease-centered curative approaches. Thus the focus shifted from the narrow curative based systems to a more holistic and comprehensive preventive and promotive systems which in the long run provided more gainful returns.

Alma Ata Declaration:

"Health for all" was introduced to global health planners and practitioners by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) at the International Conference on Primary Health Care in Alma Ata, Kazakhstan, in 1978. The declaration was intended to revolutionize and reform previous health policies and plans used in developing countries, and it reaffirmed WHO's definition of health in 1946 which defines health as ***"a state of complete physical,***

mental, and social well being, and not merely the absence of disease or infirmity." This definition looked at health in a more holistic manner rather than a disease centered narrow focus reiterating the changes in health care systems globally. The conference declared that health is a fundamental human right and that attainment of the highest possible level of health was an important worldwide social goal.

To achieve the goal of health for all, global health agencies pledged to work toward meeting people's basic health needs through a comprehensive approach called **Primary Healthcare.**

Primary health care as envisioned at Alma Ata had strong sociopolitical implications. It explicitly outlined a strategy that would respond more equitably, appropriately, and effectively to basic health needs and also address the underlying social, economic, and political causes of poor health. It was to be underpinned by universal accessibility and coverage on the basis of need, with emphasis on disease prevention and health promotion, community participation, self-reliance, and intersectoral collaboration. It acknowledged that poverty, social unrest and instability, the environment, and lack of basic resources contribute to poor health status. It outlined eight elements that future interventions would use to fulfill the goal of health improvement: education concerning prevailing health problems and methods of preventing and controlling them; promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; maternal and child health care, including family planning; immunization against major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs.

3.1.2 Evolution of Public Health Care in India

India being the largest democracy in the world presents a unique case in terms of sheer size of its population characterized by heterogeneity in respect of physical, economic, social and cultural conditions. India's population rose from 361.1 million in 1951 to present billion plus (2001 census). On 2.4% of the land area, India supports more than 16% of the population of the world. 74.2% of India's populations live in villages. After independence, in 1951, India initiated the process of planned development to raise the living standards of its people and to open up for them new opportunities for a richer and more varied life. In this context health was perceived to be an important determinant of development.

Though the idea of Primary health centers date back to the recommendations of the Bhore Committee report in 1946 the actual programme of establishing Primary Health Centers in each Community Development Block, having a population of 60,000-80,000 was launched as an integral part of the Community Development Programme only on October 2, 1952. Each Primary Health Centre complex thus established consisted of main centre with 6 beds located at the Block Headquarters and 4 Sub-Centres. The staff comprised of one Medical Officer, one Sanitary Inspector and four Mid wives (ANM's) and two Ancillary personnel. The Centre was to be supported by district organization for referral consultation, laboratory, medical, surgical, nursing and administrative services.

3.1.3 Rural Health Care System

Progressive changes have been introduced in the programme over the sixth and seventh Five Year Plan period when national norms for population coverage were adopted. The National Health Policy was

officially adopted by the Parliament in 1983. "Health for All" principles and strategies were also incorporated in the 6th (1980-85) 7th (1985-90) Five. Year Plans. During the 8th Plan, the emphasis was mainly on consolidation of the existing health infrastructure rather than expansion. Present focus is on development of rural health infrastructure so as to provide Primary Health Care services to a majority of rural population, which had by and large remained neglected. The delivery of Primary Health Care is the foundation of rural health care system and forms an integral part of National Health Care system. For developing vast human resources of the country, accelerating socio-economic development and attaining improved quality of life Primary Health Care is accepted as one of the main instruments of action.

Primary Health Care is essential health care made universally accessible to individuals and acceptable to them through their full participation and at a cost the community and country can afford. (WHO-Alma Ata 1978)

In rural areas, presently the services are provided through a network of integrated health and family welfare delivery system. Health Care Programmes have been restructured and reoriented from time to time for attaining the objectives of "Health for All" by 2000 A.D. as envisaged in National Health Policy. Priority has been accorded to extension, expansion and consolidation of rural health infrastructure namely; Sub-Centres, Primary Health Centres and Community Health Centres. Primary Health Care pays particular attention to the point of initial contact between the members of community and the health services. Sophisticated and specialized needs are referred to secondary and tertiary levels. Despite this seemingly complex structure for delivery of health care in India, the distribution is largely heterogeneous and some parts of the country lacking even the basic services.

3.2 Public Health Care Infrastructure in India

The Government has started concentrating on the Organization of Health Care Administration in the Country. Ministry of health and Family Welfare is the apex executive organization dealing with the issues of Health and Family Welfare health and in the country as per the guidelines enshrined in the constitution of India and depicted in the National Health Policy and in accordance with the policy decisions of the Cabinet. Health is the state subject in India and the Ministry of Health and Family welfare acts as a Coordinator between the State Health departments, Planning commission, Central Council of Health etc. besides implementing various national programs and items under union's list and concurrent list. In the process it is aided by the Directorate General of Health Services.

The Primary health Care infrastructure has been developed as a three tier system and is based on the following population norms:

S.No.	Health Care facility	Population Covered		Average Number of Villages Covered
		Plains	Hilly Areas	
1.	Sub Center (SC)	5,000	3,000	4.27
2.	Primary Health Center (PHC)	30,000	20,000	25.55
3.	Community Health Center (CHC)	1,20,000	80,000	200.7

Source: Ministry of Health and Family Welfare- 2001

3.2.1 Sub- centres (SCs)
Sub Centre is the most peripheral contact point between Primary Health

Care system and the community. It is manned by one Multi Purpose Worker (M) and one Multi Purpose Worker (F)/Auxiliary Nurse Midwife (ANM). Nearly 97,757 Sub Centres established after 1st April 1981 are funded by Ministry of Health & F.W., out of a total number of 1,33,498 Sub Centres functioning in the country. Rest are being funded under the state Minimum Needs Programme

3.2.2 Primary Health centers (PHCs)

PHC is the first contact point between village community and Medical Officer. village coverage. These are established and maintained by state Governments under the Minimum Needs Programme (MNP). A PHC is manned by a Medical officer supported by 14 Para- Medical and other staff. It acts as the referral unit for 6 sub Centres. It has 4-6 beds for patients. The activities of PHC involve curative, preventive, promotive and Family Welfare services. There are about 23,000 PHCs in the country now.

3.2.3 Community Health centers (CHCs)

CHCs are being established and maintained by the State Governments under Minimum Needs Programme. It is manned by 4 Medical Officers (Specialists) i.e. Surgeon, Medicine, Gynecologist and Pediatrician supported by 21 Para-medical and other staff. It has 30 indoor beds with one Operation Theatre, X- ray, and Labor Room and Laboratory facilities. It serves as a referral Centre for 4 PHCs.

Despite this seemingly well established infrastructure, our villagers' health is poor. In this context it is essential that we leverage the impressive gains being made in the Non-health sectors into issues of 'Community Health' or 'Public Health'. We need to implement strategies which would bridge the divides and ensure equity in distribution of available resources over the entire spectrum.

In one of the studies conducted at a PHC in Karnataka (2003), 47% of the population depended on the government PHC for their healthcare needs. Also, the same study points out that 14% of the patients travel 9-15 kms, 31% travel 35-45 km and a huge 55% travel more than 55 km for accessing secondary and tertiary services.

Hence it is imperative to adopt and implement technology based health care delivery systems to enhance reach and accessibility for rural population.
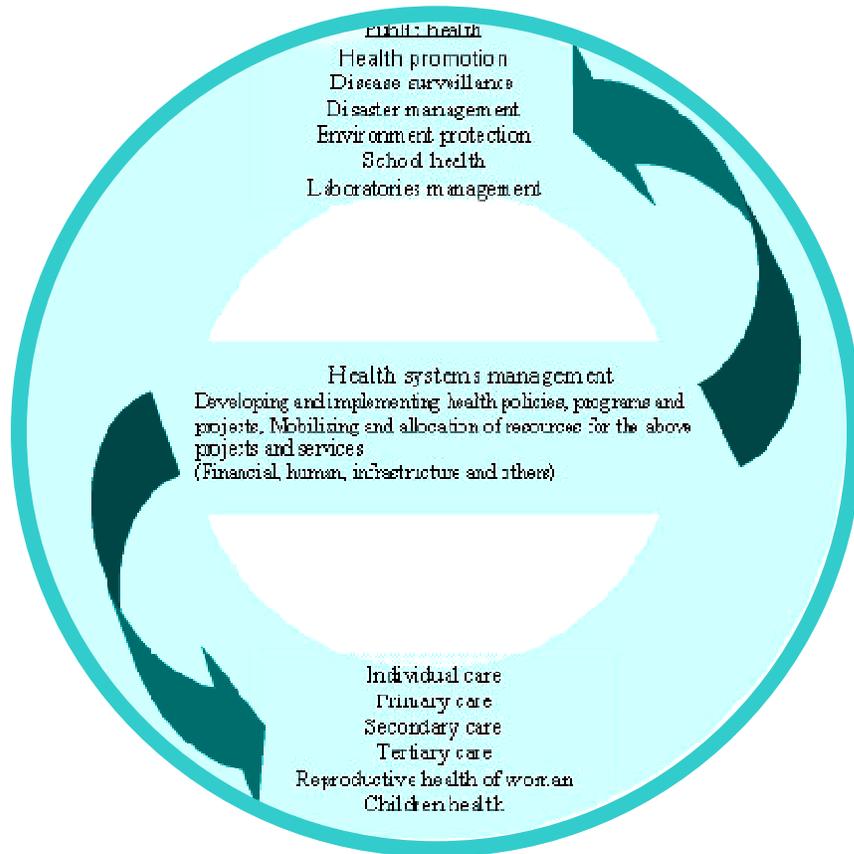
3.3 Health Management Information Systems (HMIS) - A brief overview

Health management requires the monitoring of the health status of the population, the provision of services as to the coverage and utility, drugs stocks and consumption patterns, equipment status and availability, Finances, personnel on a regular basis. This requires timely and accurate information from various sources. Accurate, relevant and up-to-date information is essential to health service managers if they are to recognize weakness in health service provision and take actions that will improve service delivery. Accordingly, the development of effective information systems is a necessary precursor to managerial improvement. *A health information system (HIS) is a process whereby health data (input) are recorded, stored, retrieved and processed for decision-making (output).*

Decision making broadly includes managerial aspects such as the planning, organizing and control of health care facilities at the national, state and institution levels and clinical aspects which can be subdivided into (I) providing optimal patient care, (ii) training of medical personnel to generate appropriate human resources, and (iii) facilitate research and

development activities in various fields of medicine.

Public health
Health promotion
Disease surveillance
Disaster management
Environment protection
School health
Laboratories management

Health systems management
Developing and implementing health policies, programs and projects. Mobilizing and allocation of resources for the above projects and services
(Financial, human, infrastructure and others)

Individual care
Primary care
Secondary care
Tertiary care
Reproductive health of woman
Children health

4. Core Group Discussions and Findings

The Core Group discussions took place at different centers namely DIT Delhi, ISRO HQ Bangalore, Narayana Hrudayalaya Bangalore, AIMS Kochi.

As a part of the background, for the discussions by the core group a brainstorming session was conducted at ISRO Bangalore, organized by the Community Health Department of MSRMC. The participants included specialist doctors from different departments of MSRMC, Senior Health Administrators from Karnataka, and ISRO officials.

The brainstorming discussions covered the need and rationale for technology adaptation of ICT for Primary Health Care, based on the diseases pattern with opinions from different fields of Medicine like Community Health , General Medicine, Surgery, Gynecology and Obstetrics, Pediatrics and Neonatology, ENT, Ophthalmology, and Pharmaceuticals and drug distribution.

Two background papers were submitted to the Core Committee, by Community Health Departments of MSRMC (based on the brainstorming discussions) and the other by AIIMS, New Delhi.

The Core Group discussed:
- Existing healthcare infrastructure established by Government, the initiatives by NGO and the private sector
- The Opportunities and issues in leveraging ICT for primary health care
- The importance and requirements of Telemedicine and the present pilot projects in Telemedicine

- The value of ICT enabled health management information systems for decision support
- Connectivity requirements, standards and interoperability aspects

During the course, the existing governmental healthcare infrastructure in terms of PHCs, CHCs and District hospitals; the Healthcare Kiosks e.g. Byrraju Foundation in Andhra Pradesh; the model of Narayana Hrudayalaya in Karnataka for providing healthcare related to heart diseases and using the power of video conferencing; the mobile healthcare delivery by Rama Krishna Mission and the experiments of Media Lab Asia –IIT Kanpur hub; attempts for development of integrated biomedical kits; MLAsia -AIIMS Delhi experiments of using handheld devices for data collection and decision making; the ISRO's and DIT's Telemedicine initiatives; the efforts of Shramik Bharti- UP, SEWA- Gujarat, Shankara Netralaya- Chennai , SGPG- Lucknow, Amrita Institute of Medical Sciences-Kochi, MSRMC- Bangalore and CSIO - Chandigarh efforts in equipment development, were discussed.

Based on the detailed discussions and deliberations a general consensus on the requirement of ICT for primary health care was evolved with the following recommendations.

4.1 Information and Communication Technology for Primary Health Care- including Telemedicine/ Tele-health

The requirements of the rural health care infrastructure at the Primary level are both unique and complex, with its inherent set of strengths and weakness. Presently there is a vast nationwide public healthcare infrastructure already established in our country. This infrastructure

can be fortified by augmenting them with ICT technologies   and services to   address   primary healthcare more effectively.

Apart from the public sector we have a large and diverse Private/NGO sector addressing healthcare delivery considerably. It is pertinent and important   to take this into consideration in identifying the ICT requirements for strengthening primary healthcare such that the same may be suitably adapted in different settings with minimal changes.

Presently the focus on healthcare is mainly on curative medicine.   It is important to take a holistic view and address promotional, preventive and curative healthcare. This needs to be further emphasized, especially in the private sector to ensure that the private/NGO sector participates more effectively in preventive and promotive healthcare for the healthcare programme to be effective.

The healthcare delivery models could be different in different regions of the country based on the local factors. It is necessary to take cognizance of this factor in designing solutions.
The major elements of opportunities for ICT and other advanced technologies in the primary health care are:

- Telemedicine and Tele-health services
- Healthcare data   management
- Information systems
- Appropriate data collection devices   and analysis tools
- Appropriate and affordable biomedical equipment for grass root deployment
- Video/multi-modal conferencing and e-connectivity
- Appropriate legal and administrative framework

In this context ICT provides an excellent tool for enhanced public – private partnership   in healthcare delivery and optimal utilization of the skills and infrastructure.

4.2 Strengthening of Healthcare Infrastructure

- It is possible to establish health care information systems linking all levels of health care centers for   quick   data collection, compilation and access for decision support.
- Telemedicine is establishing itself strongly as an augumented or supplementary method   of healthcare delivery. Given the fact that India has large healthcare infrastructure but   expert doctors are not available   at rural locations, telemedicine techniques   needs to be used effectively   to provide better healthcare in rural locations.
- India is   progressing fast in telecommunications including fiber, wireless and satellite sectors which can be fruitfully leveraged for healthcare information systems and delivery through telemedicine.
- Inventory management including the stock position, operational status of the equipment are important parameters for facilities management.
- Availability of this information would facilitate optimal utilization of resources.
- The availability of networks, connectivity and telemedicine framework would foster public-private partnership in very effective manner for healthcare delivery through telemedicine and improved   access to the resources in the network.

5. Core Group Recommendations on the requirements at different levels of Public Healthcare system

Since the requirements may vary in the process of technology adaptation with the latest innovations making the existing ones redundant, the Core Group debated on the essential and desirable equipment and systems at different levels of public healthcare system looking at the present scenario and what is required for ICT enabled healthcare system. The recommendations of the Core group regarding the requirement at various levels of healthcare delivery are as follows:

5.1 Sub Centre Level:

The common types of health problems dealt at Sub centre level are as follows:

- Women's Health: Antenatal and Postnatal cases follow up of female family planning acceptors. , Reproductive tract Infections (RTIs).
- Children's health or minor illnesses in adults: Acute Respiratory tract infections, Diarrhea, injuries, skin infections, fever etc.
- Adult Health – major diseases as a part of the National Health Programmes: Tuberculosis, malaria, Hypertension and Diabetes – an emerging problem.

5.1.1 The essential and desirable ICT systems for a Sub centre

S.No.	Present Scenario	ICT Solution
1.	Large amount of time is spent in collection, compilation and analysis of data manually resulting in inordinate delay. Health workers at sub centre levels are ill equipped for providing awareness and education programmes on healthcare.	• Handheld computer devices for data collection can replace the present existing manual registers/books. • The Hand held computer devices can enhance data collection and compilation. • The work plans for the health workers can be generated and provided on the handheld devices. • The hand held computer can update the database at the Primary health center PC periodically. • Where ever connectivity is available the hand held computer can update the PHC PC, real time after data collection by the health care worker, thereby reducing the time for data collection and data compilation at the PHC.

- It is   desirable to have a PC at Sub centre for maintenance of local database, patient's history especially high risk groups e.g. pregnant women so that it can be accessed by health workers.
- The patients have to go long distances due to location and accessibility issues
- Also there is difficulties for the health workers with little training, poor diagnostic skills and inadequate knowledge of therapy
- It is necessary to provide the health workers at least with minimum facilities handheld devices, communication and connectivity facilities to contact the higher level centers through telephone and email etc.
- The Core Group also noted the earlier experience of Media Lab Asia and AIIMS Delhi in using the handheld devices for data collection and compilation. The experience showed the importance of these devices, but there are technical problems like low battery usage time etc.   It is important to look at holistic solutions in adopting technologies and solutions for rural and field usage and specific technology/product development   activities are required.
- The Core Group has come with the following recommendations as regards to essential and desirable requirements at Subcentre level. The essential items indicate the minimum ICT requirements and the desirable items indicate the optimum requirements at various levels for effective utilization of ICT for healthcare in the public health system.

5.1.2 Essential and desirable ICT infrastructure at Sub-center

Essential:	Desirable:
- Handheld device for field	- A PC with Printer and

data collection, compilation with algorithms for provision of basic care and data transfer capability with PC • A Telephone link, land line /mobile to PHC for consultation • Portable Digital weighing machine for weight measurement of babies and mothers	Web enabled digital Camera • Digital Stethoscope • Digital Glucometer • Higher telecommunication Connectivity such as e-mail facility to PHC • Handheld devices for healthcare education and training with multimedia capability

5.2 PHC level

The types of health problems dealt with at PHC are as follows:

- Maternal and child Health and family planning: Antenatal care, conduction of normal deliveries , immunization of infants and children
- Communicable diseases: Acute respiratory tract infections, Diarrhea, Malaria, tuberculosis, parasitic infections.
- Non –communicable diseases: hypertension, diabetes, Coronary Heart Disease
- Ophthalmic services : Refraction testing
- Others: Injuries, minor procedures such as incision and drainage, abscess drainage, animal bites.

- Primary Health Centre is the focal point of the public health care system responsible for primary patient care, administration of public health programmes and MIS reporting.
- It is the ideal place to acquire patient demographics.
- ICT can be used for effective administration of public health programmes, inventory management at PHC.
- **Hence the PHCs need to be integrated into Healthcare Management Information Systems along with medical consultation and treatment through Telemedicine especially in the Government Health Care Systems**

5.2.1 Essential and desirable ICT infrastructure at Primary Health Center (PHC):

Essential:	Desirable:
- PCs with printer & Web camera - Digital Weighting machine - Digital Stethoscope - Digital ECG machine - Digital Glucometer - Diagnostic test kits (blood grouping/Rh/HCG) - Pulse Oximeter - Mercury Sphygmomanometer for recording and manual entry of Blood Pressure data or Digital Sphygmomanometer	- Digital Microscope - Digital X-ray - Digital Ultrasound (Strongly desirable. May be a low resolution one)

for digital transmission of Blood Pressure data • Video monitors for healthcare education and training • Video conferencing through web cameras or professional systems. • Connectivity to Community Health Center (CHCs), District Hospitals and State/tertiary hospitals. • Computerized Inventory Healthcare management information system	

5.3 CHC Level

Types of health problems dealt with at the CHC /District hospital level as follows:

- High risk pregnancies: PIH, Mal-presentations, obstructed labour, PPH. Operation Theatre available and surgeries are done including emergency surgeries like caesarian
- Child Health : Neonatal care, LRTIs', severe dehydration due to diarrhea, meningitis, encephalitis, bronchial asthma

- Adult diseases: Communicable diseases like HIV/AIDS ,COPD, Non- communicable diseases like diabetes, hypertension, cancer, mental health problems, orthopedic problems, neurological diseases, skin diseases, eye/ENT/dental problems
- Other: Accidents and poisonings
- Conducting of major and minor surgeries

The Core Group recommends that the CHC would have the facilities of PHCs and additional equipments for healthcare delivery and information systems.

5.3.1 Essential and desirable ICT infrastructure at Community Health Center:

Essential	Desirable
- All the systems as at PHC indicated above - Diagnostic kits - Cardiac monitor - ICT augmented Operation theater - Good communication and connectivity facilities like email, fax and video conferencing - Good telemedicine facilities	Since the CHCs prevalent in some states have enhanced facilities as compared to PHC's, the desirable features could be the facilities as available at the District Hospitals

6. Core Group Summary Recommendations

6.1 Healthcare Management Information Systems

- The Core Group recommends computerized and connected HMIS linking the PHCs, CHCs, District hospitals and state hospitals and health administration departments for planning, decision support, monitoring, education, training and disease surveillance.
- The system may preferably be browser based and web enabled for access through web. The PHCs would be data entry points. Handheld devices would be used to collect data from Subcentres.
- The subcentre data on the handhelds would be transferred to the computer based databases at the PHCs. Where connectivity is available from subcentres to PHCs, the data would be transferred through the network at subcentre itself.
- The HMIS may preferably include hospital inventory and hospital management systems for PHC and higher level centers.
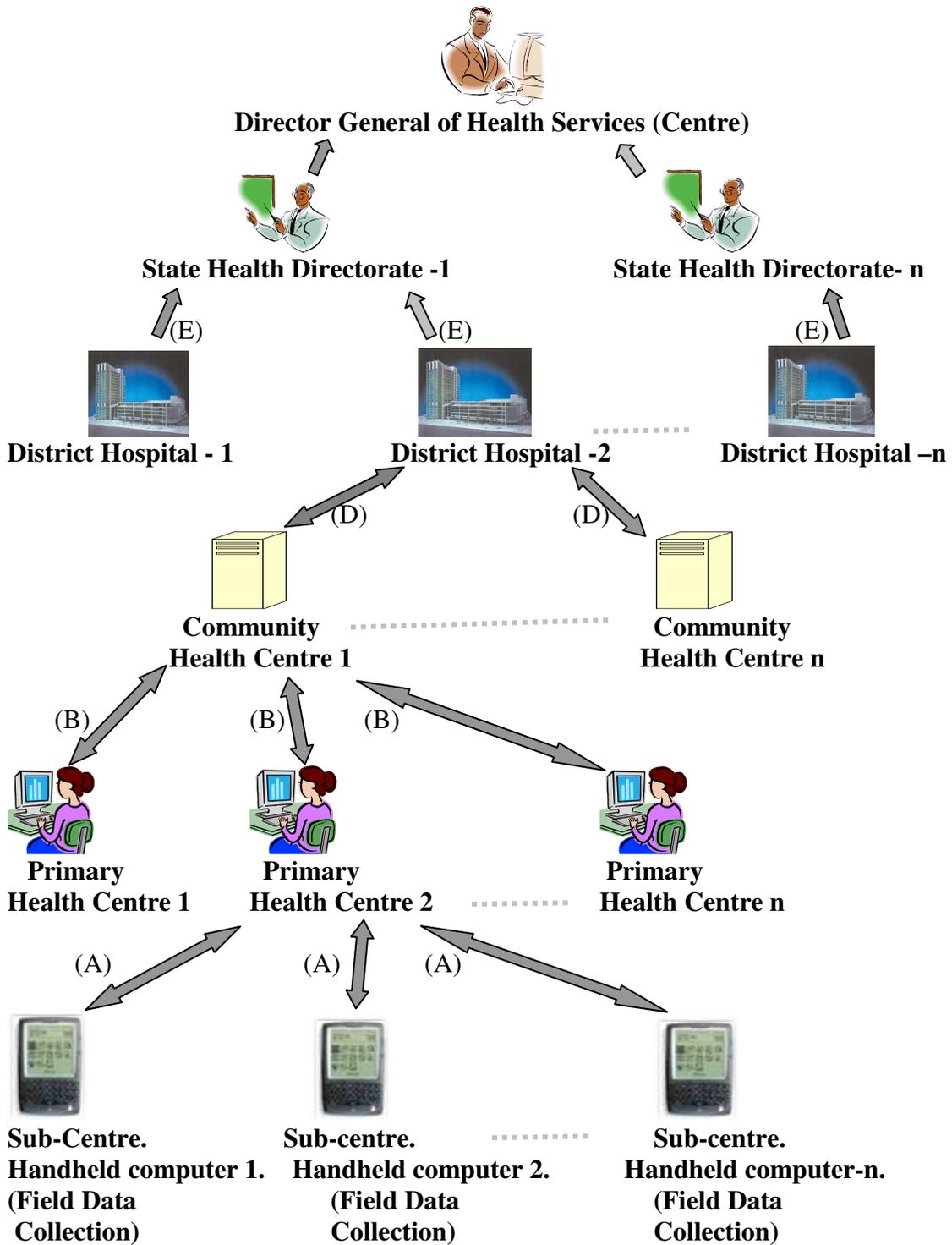
Health Management Information System

(A) Electronic data transfer by bringing handheld computer to PHC / transfer through
network wherever possible.
(B), (C), (D), (E) e-connectivity (wired/wireless)

6.1.1 Modules on the handheld devices for data collection

The data collected at Subcentres with handheld devices would consist of the following modules:

- Surveillance module
- Birth & death module (demographic module) with cause of death
- Immunization module
- Health programme module
- Communicable diseases module
- Non-communicable diseases module
- Work plan module
- Other Module as required by a particular State

Fig: Health modules on handheld devices

6.2 Telemedicine for Primary Health Care

- Telemedicine would be a supplemental and/or augmented alternate mechanism for primary healthcare delivery. The Core Group recommends that telemedicine facilities be available up to PHC level.

- Video conferencing is considered as an essential facility the basic facility for telemedicine. Tele-consultation through video conferencing would form an important component of telemedicine. It is known that 90% of the cardiac problems would not require surgery and could be addressed through tele-consultation and suitable management.

- The Core Group recommends graded biomedical facilities for normal healthcare and telemedicine at different levels of public healthcare system.

- Low Cost Biomedical equipment need to be sourced/ developed suitable for telemedicine use in rural conditions considering weather, power supply conditions, ease of operation and maintenance and affordability.

- Telemedicine provides an opportunity for integration of public – private/ NGO medical infrastructure for quality healthcare delivery. The telemedicine systems may preferably be web enabled. In the long run, there could be facilities to choose from a number of available alternatives based on cost of service, quality, choice of hospitals and doctors.

6.2.1 Te-Prescription

- In the practice of telemedicine, prescription by doctors from remote locations becomes an important factor. Availability of technology for prescription from remote locations and the legal aspects of it are important issues that need to be addressed.

6.2.2 Mobile and portable models for Telemedicine

- Mobile hospital / mobile Telemedicine is a very effective way of providing Health Care to the rural and remote population including the emergency medical services during disaster management and relief

- Mobile medicine and mobile telemedicine systems in certain scenarios would be viable for healthcare delivery where the same system can be used at different locations

- Mobile telemedicine and Telehealth is very effective for eye care especially with regard to mass eye screening for related to common morbidities like visual sight problems, cataracts and blindness due to conditions such as Glaucoma and Diabetic Retinopathy

- Mobile systems can provide sophisticated facilities to rural locations on time shared basis.

- When connectivity is available through satellites or wireless, it is also possible to provide telemedicine services linking to the tertiary hospitals. This needs looking into issues related to equipment for mobile systems, connectivity for mobile systems etc.

- Integrated/modular systems combining individual biomedical tools into integrated systems offers cost effective and compact solutions which would suitable for mobile systems and also for PHCs and Health Kiosks

6.3 Connectivity

- Connectivity forms the most important component for ICT enabled healthcare for health management information system, telemedicine, inventory management etc. The requirements are both for online interactions and store and forward data transfer.

- For store and forward data transfer a bandwidth as low as 32 kbps may be sufficient at the PHC level

- Video conferencing is the primary requirement for telemedicine which also normally needs higher bandwidth connectivity for quality of service. At the Primary Health Care level a low bandwidth 128 kbps maybe sufficient for normal video conferencing. However of availability of higher bandwidth can enhance the quality of Video Conferencing

- Better packaging with advanced compression techniques could help to decrease the bandwidth requirements.

- An intelligent combination of wired (fibre), wireless (WiFi and Wimax) and satellite technologies would meet the requirements of connectivity.

7 Core Group Recommended activities and project ideas for Media Lab Asia

The Core Group contemplated on the activities and projects Media Lab Asia may take up for bringing the advantages of ICT for primary healthcare. The following ideas have emerged:

7.1 Handheld devices for field data collection: The utility of handheld devices for healthcare data collection especially at Subcentre level has strongly been emphasized by the Group. It is required to develop both appropriate & affordable handheld hardware and suitable software for data collection. These devices should be suitable for rural use with enough of battery power, capability to interface to PCs, laptops etc for data transfer. These devices may also have network capability so that the data can be transferred where ever network is available. One handheld device may be available for one Subcentre. USB based pen-drives may be used to hold data pertaining to each village/Subcentre. The details of the application software would be worked out and developed by the projects initiated by Media Lab Asia. Use of GIS is also recommended for analysis and decision support at a later stage. The work taken up by Media Lab Asia and AIIMS Delhi for development of application software for health data collection with handheld devices was noted by the Core Group.

Fig: Health worker collecting data in the field

7.2 Handheld devices for awareness, health education and training

The Core Group recommended that handheld devices may also be used for displaying awareness programmes for preventive and promotive aspects by the health workers to the villagers in small groups when she/he visits the house-holds. Such hand held device for playing video files need to have graphics facility and CD driver interfaces, audio/video output drivers for showing these programmes on TV monitor for large groups. The handheld devices can also be used for monitoring of health workers by supervisors and for making alerts regarding public health emergencies.

Fig: Health education and awareness creation with handhelds

7.3 Health Management Information Systems (HMIS)

The Core Group strongly recommends establishing HMIS across the public health system and include private hospitals and institutes in this endeavour. The HMIS is essential for   decision support in planning, disease surveillance, preventive and promotive and rehabilitative healthcare and inventory management.   The PHCs and higher level hospitals would form the HIS network. The system would include data compilation, report generation, activity generation,   analysis and warning generation.   Use of GIS is recommended for analysis and

decision support as additional tool. It is required to develop and put together HMIS software and systems to enable this activity. The existing products may also be explored for adoption and integration for this purpose. A few small to medium scale field deployment projects may be taken by Media Lab Asia to test and demonstrate the utility and viability of these systems. The idea/proposal of C-DAC Tiruvananthapuram for developing and deployment a HMIS over the Akshaya network is noted by the Group and recommended to be developed into a project.

7.4 Telemedicine and Hospital Management Systems

7.4.1 Telemedicine

The Core Group recommends that telemedicine facilities need to be established at PHCs and telemedicine offered at PHCs from CHCs, District and state level hospital, medical institutions and those in the private/NGO sector. The telemedicine would include video conferencing, transmission of all or some of ECG, Digital X-ray and heart beat, digital ultrasound and other basic data. There is a requirement of web enabled/browser based, affordable and appropriate telemedicine software. The existing initiatives of C-DAC and IIT Kanpur could be explored for initial applications and the commercially available software could also be explored. The biomedical equipment at the PHCs and other higher level centers need to provide digital outputs suitable for telemedicine. The equipment recommended for PHCs and other centers is given elsewhere in this report.

Video conferencing forms the most important component of the doctor –patient interaction for telemedicine. Quality video/images would be required for some of the applications like skin diseases,

critical visual observations etc.   This can be supported by advanced transmission of high quality images off-line.

7.4.2 Hospital Management and Inventory Management System (HMIMS)

HMIMS is a component of effective telemedicine system with data on availability of doctors, specialists,   biomedical equipment, supplies and their status. As the PHCs would be equipped with PCs, it is possible to establish hospital management and inventory management systems. These can be used for patient registration, record maintenance and budget management, inventory management, hospital administration etc. A HMIMS needs to be designed based on the structure of the PHCs and higher level centers, products developed and field tested.

7.5   Biomedical Equipment Development

The Core Group recommends positioning of specific biomedical equipment at different level of public health system. This equipment is required for stand alone usage and also for telemedicine. These equipments have to be appropriate for rural use at the centers with low power consumption, ease of operation and maintenance locally, low cost and suitable to local weather conditions. Most of these equipments should be able to generate digital output so that these can be integrated for telemedicine.

 The Core Group also felt that it is required to develop these equipment at a fraction of the cost these are available now.   Some of the individual equipment can be combined into integrated system with   much cost reduction due to shared computing resources. Some of the equipment identified for development is:

- Digital X-ray

- Digital microscope
- Digital ultrasound
- Digital weighting machine
- Digital Stethoscope
- Digital ECG machine
- Digital Glucometer/strips/Insulin pump

The Core Group also felt that it is also needed to develop affordable patient care and monitoring systems for secondary and tertiary care hospitals. The above equipment only lists the basic equipment required for primary healthcare. It is also important to understand the requirements dynamically and take up development activities. The advanced technologies like MEMS, nano-technology and biotechnologies need to be exploited to develop techniques, devices and systems for medical diagnostics and cure, patient care and disease surveillance.

7.6 Patient Health Records and Patient ID

The core Group felt that there is a need to maintain patient's health records, but systems need to be developed with enough data security and to avoid unauthorized access to patient's records. Smart card is considered to be one of the options for maintenance of patient's data by the patient himself and for patient's identification.

7.7 Mobile Healthcare Delivery

The Core Group recommends that a few deployment projects may be taken up by Media Lab Asia to test models for primary healthcare delivery including telemedicine through mobile systems. Wireless and other connectivity technologies may be used for tele-consultation on-the- fly and for mobile telemedicine equipped with some high end

systems for diagnosis. The project of Media Lab Asia and IIT Kanpur where portable systems are being used for mobile telemedicine through an entrepreneur model is recalled. AIMS Kochi and Amrita Vidyapeetham are interested to experiment with mobile systems with wireless connectivity for   specialized rural healthcare.   The Committee recommends that these ideas may be developed into projects.

7.8 Standards and Standardization

The Core Group   felt that the national/international standards be followed while designing and   developing   equipment, products and systems.   The Core Group also emphasized standardization of data collection and felt that rather than placing an entirely new system of data collection, the present formats may be suitably modified as that would improve acceptance.   The interoperability issue needs to be kept in mind while designing the systems.