Technology based Health care an Indian perspective : opportunities and challenges

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Abstract

Healthcare technology is in use for a decade or more in India. The use of technology in healthcare especially in public health is very common due to the recent development in Information Communication Technology. The cost of equipments in ICT in general are falling. But in healthcare, some of the equipments costs very high. Such equipments are commissioned in various locations in India. This includes some of the remote areas. The present talk is an attempt to assess the effect of such technology on the public health system. The utilisation of such systems depends on various factors. They include, costs involved in maintaining such systems, the benefits of such systems to the health personnel and the general population, what are the advantages of such systems over the traditional systems, what are the benefits of such systems on the administration, the impact on the managerial efficiency, how does the system address the HR needs in the public health, what the skills expected out of the health personnel and the general population for using such systems.

Recent trends in medical Technology
Telehealth

Application of IT in Healthcare and Medical Education is a nascent subject. The scope offered by IT in the areas of Telehealth and Medical Education are vast and their value is becoming increasingly important new low cost diagnostic tools. Significant steps in this area are the initiatives taken in the area of Telehealth in Gujarat and by Apollo in Andhra Pradesh. Kerala, with its compact size, good medical establishments and improving connectivity gains tremendously by extensive deployment of Telehealth network. As byproduct, the Online Education will gain deep roots. These have great potential in improving quality of life, and new areas of R&D activities and industry initiatives related to healthcare with far reaching implications for the economy.

Telehealth as a subject area and practice of medicine is fast growing. The key component is to place the appropriate tools and techniques of IT and Internet in the hands of doctors and patients. It enables quality healthcare at reduced cost to the patient by reaching healthcare to where he/she lives, in association with the doctors of the local Primary or Secondary Healthcare Centres or the large number of clinics in the smaller towns. These small clinics are helped by associating with the leading specialists/ superspecialists in the leading hospitals and medical establishments of the big cities. While the focus of the present project will be on this aspect, other modes of Telehealth will emerge and can be incorporated as and when they become available.

Telehealth has two major outcomes. The first is the modernization of the primary healthcare services. The second is the IT facilitation the Medical Profession and Education. The Telehealth network

equips the younger and less experienced medical professionals in the smaller countryside to gain immensely by the association with leading specialists and access to online medical information systems.

Studies show that patients with their family members visiting hospitals without prior appointment stay longer in the larger hospitals of cities adding to the severe problems of crowding. The specialists in the city hospitals treat all cases with equal importance. This at times minimises the attention, which ought to be given to more serious cases not given as the non-serious cases, which require few minutes' consultation. This forces hospital authorities to restrict patients without prior appointment.

Telehealth is using IT and communication for improving the quality of healthcare. Experience shows that appropriate use of Telehealth based consultation and referral system reduces travel and other hardships by bringing the services at the doorsteps of patients. In total this brings down the overall cost. This gives an opportunity for the Thus, it facilitates higher concentration on critical patients. This further allows a Doctor to spend more time on research and update the knowledge. On the other hand the Physician at remote centres get an opportunity to interact with specialists of tertiary care centre. The network makes the interaction easy and more organized, and generates a database for future decisions.

The network needed to support Telehealth also doubles in taking Online education in Medicine and related areas to the junior doctors and general practitioners in the primary health centres.

Online Medical Education

Other aspect of the facility is to enable online Online Medical Education. This will be supported by a facilitating institution with the value added services, educational technology services, content facility and reference materials.

Teleconsultation modalities and related studies This includes,

a. Telehealth services from one ReferralCentre to Remote Centre

b. Codify procedures, carryout impact studies and choice of cases and modalities for maximum impact with reduction in patient cost

c. Online Medical Education

The important component of the Telehealth project is Online Medical Education and Medical Reference systems. The Online Medical Education will be conducted time to time. The system provided for the Teleconsultation will be used for Online Medical in various specialties. Even to support the daily Consultations, Digital library will be created for Medical reference.

Health Information System

In Health Sector there are various departments. The Norms are different. There are various departments such as Laboratory, Radiology, Pharmacy and so on. Hospitals and Clinics are

composed interdependent departments.

Some composed of single occupation group (Pharmacy). Other may include individual from different occupations such as Nurses, Physicians, Clerk and so on. They all work together in a single department such as a health clinic.

Computerised Medical Information System

Computerised Medical Information systems are the "formal arrangements by which the facts concerning the health or health care of patients are stored and processed in computers. They are Comprehensive system coordinates patient care activities within the hospital by linking computer terminals in patient care areas to hospital departments.

These systems provide communicaitons networks between departments as well as storage and retrieval of medical information. Affect organisational features such as job design, work force compositional and organisational structure. Important Factors are attitudes of the physicians the nurses, medical and paramedical personnel and Skills

Health Administration and HIS

The Health Administration is Planning, Organising, Directing, Controlling, and Budgeting of Health related activities in a State.

The Scope of HIS

HIS is beyond the Health Administration including the Medical Information as the Health Sector include the Medical Institutions

IT and Health Communication

Computers and Internet used as a media for health. It is used for developing materials, for educating the people, and E-Governance.

Medical Informatics and Imaging Techniques

The advances in Information Technology have revolutionized the field of Radiology and Medical Imaging. Many of this gives an opportunity for the Computer Scientists and the Radiologists to work together for better patient care.

The technology requires people trained in acquisition, processing, interpretation, storage and communication of health-related and healthcare including imaging data, in both health education and research and in patient care. One limitation the field of research faces is getting people trained thoroughly in the scientific method of such technology in similar settings. One may have to design experimental studies, have a capacity to evaluate a system and having potential in preparing scientific or technical reports.
One should also have ability in understanding the scientific basis of clinical and engineering problems encountered in healthcare fields. It requires better understanding of the use of computers and knowledge-based computing methods appropriately.

This may have two types of approaches. One for the Healthcare professionals implementing IT in their work place and Computing professionals/engineers who are involved in developing systems and support.

There are specific areas of research identified. They are,

1. Computers for Imaging
2. Computers for Management in Health Care , Radiology and Hospital Information systems (RIS, HIS)
3. Computers and Networking in a Radiology Department
4. Computers in Radiotherapy and Nuclear Medicine
5. Operating systems
6. Post processing techniques
7. Computed Radiography
8. Functional MRI - Technique, paradigm designing and post processing techniques, Diffusion tensor imaging
9. Digital Mammography
10. Neuroimaging Informatics Cardiac Imaging Informatics
11. Standards for Imaging- DICOM, HL-7, HIPAA
12. PACS, Teleradiology
13. Internet Resources for technologists and medical professionals.
14. Costing and economics of a film less environment

There are some developments in this area. They are,

- Digital Images
- Image Acquisition
- Image Transmission
- Data Storage
- Magnetic Disks
- Magnetic Tape
- Magnetooptical and Optical Disks
- Read/Write Memory
- Data Display
- Computers and Networking for Radiology

A hospital information system (HIS) radiology information system (RIS) also text based. A PACS contains all the image-based information in the department of radiology. Health Level 7 (HL-7) Digital Imaging and Communications in Medicine (DICOM) protocol typically used by PACS and digital imaging modalities. Information systems (HIS, RIS, and PACS)

For these technologies one need to know some Languages and Databases
The databases within the PACS, HIS, and RIS are of two types: relational or object oriented. Relational database management systems (RDBMS) include two of the most prominent proprietary products. Object-oriented database systems appeared, in the early to mid 1990s, to hold great promise in health care. Much of what is done in radiology is more readily handled in a database if its components are

treated as objects, for example. Unfortunately, the rest of the world does not work well this way, so these systems have not supplanted RDBMS.

STORAGE AND ARCHIVING

Random-access memory (RAM) drives are spinning media rotating at 3,000 to 7,000 rpm; data are transferred via receiver floating above the magnetic disk. A redundant array of independent or inexpensive drives (RAID) group of hard disk drives. A magneto-optical disc (MOD) transmission of data. Compact disc recordable (CDR), which uses the type of CD familiar from audio applications, can accept data recorded by the user, but this medium is fairly slow. Digital versatile disc (DVD) been in common use for many years, but its density is now improving. Advanced intelligent tape (AIT) uses a different technology and has some RAM storage capabilities that allow it to remember where specific items can be found within the tape, making retrieval more efficient than for DLT. In the future, holographic storage may permit hundredfold improvements in density and transfer time, compared with CDR, at a cost comparable to that of CDR. Holographic memory may become available within a year, and it is likely to be incorporated in PACS within 3 years.

DISPLAY AND COMPRESSION

PACS NETWORKS

A PACS consists of workstations for interpretation; imaging modalities that gather CT, ultrasound, and MRI amounts, for the use of those without access to the network); image servers to transfer and hold information within the PACS; an archive of off-line information; and a RIS to track activity from a text standpoint. A network is needed to reach each of these devices.

A network consists of two or more computers connected by a cable so that they can exchange information. The Internet is a great example of what a network is: hundreds of millions of computers, connected by cables, to form the largest network in the world. A network interface allows a computer to accept a signal from a cable (a conduit that carries a signal of any kind). Two computers, so equipped, become nodes on a network, able to communicate and to share information.

The type of cabling used depends upon what will be transmitted through the conduit. If electrons are being transmitted, they can travel by coaxial cable, thin coaxial cable, and unshielded twisted pair (UTP). Also known as 10-base T, UTP is used throughout most institutions. It is available in five categories, of which Category 5 is fastest (and most suitable for PACS). If photons are being transmitted instead of electrons, fiber-optic cable is used. Theoretically, fiber-optic cables can transmit 100 to 200,000 megabits per second (although no devices now transmit rapidly enough to make the highest speeds practical). There is also growing use of electromagnetic radiation to transmit data through air.

NETWORKING DEVICES

A hub is a device that connects several computers and that can be used for UTP networks. Hubs are very commonly used, and a modern hub contains a repeater to amplify signals, allowing transmission to be sent a longer distance once signal cannot pass through more than three hubs; if an entire building

is to be connected to a network,for example, smaller hubs on each floor may be connected to a large hub in the basement. Networking devices (in addition to hubs and repeaters) All computers have an Internet protocol (IP) address. All information packets have sender' s and receiver's line can cause collisions that slow the network as a whole. Switches open the packets and memorize where the senders are located. This allows them send packets their destinations instead of toward all nodes, reducing network traffic. Routers have the capabilities of hubs and switches, but they are also able to determine what type of data is being sent within each packet. Unlike switches, they have their own IP addresses; they are able to direct Gateways can, in addition, repackage packets in a way that permits two different network protocols, such as DICOM PACS and a RIS, for example. A firewall is a security-conscious router or gateway that is used to connect the local-area network to the Internet; by preventing certain packets from entering or the it protects the data from unauthorized access. Without a firewall, the LAN becomes a part of the Internet.

The mass market for consumer electronics has allowed medical imaging to be based on commercial computer technology. Health care was, in essence, waiting for the information commodities of the public to reach the level of power needed for radiology; in many respects, this has come to pass, and progress continues. Prices are decreasing while performance increases. The Internet will have the same effect on medical networks. The future is clearly digital.
Modern, standard networks have made PACS practical, and switching technology has solved the problems inherent in the point to point nature of PACS architecture. Ethernet and ATM protocols can sustain even heavy PACS traffic. Standard cabling using Category 5 UTP or fiber-optic cable is sufficient for PACS speeds.

The advent of industry-wide networks themselves, but there is no reason to do so. Hospital information-systems engineers, networking subcontractors, and PACS vendors are all able to create networks that meet PACS needs, provided the department understands those needs and the options available to meet them.

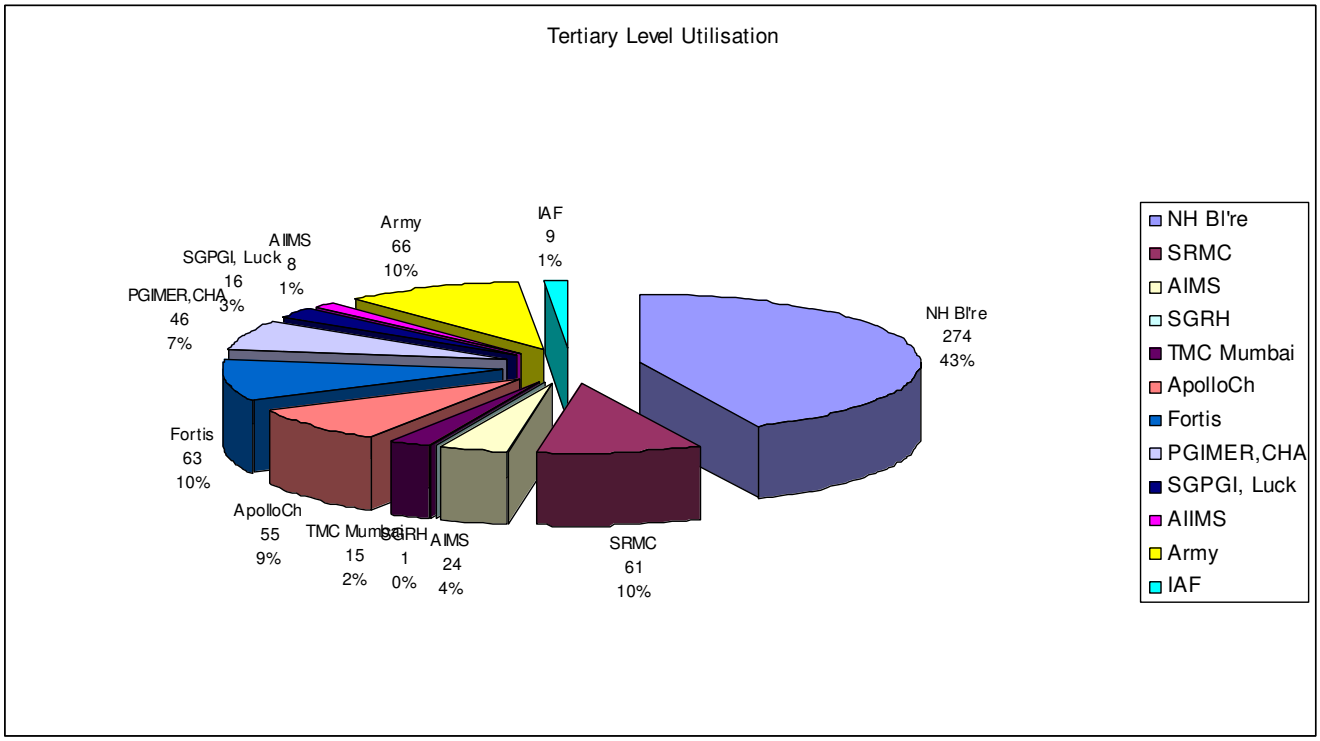
fMRI

The goal of functional neuroimaging is to map the activity of the living brain in space and time. The gold standard for measuring brain cell activity is direct and invasive electrical recording of membrane potential of individual neurons; however, such measurements are limited to certain experimental conditions. The objective of functional magnetic resonance imaging (fMRI) the brain corresponding to specific tasks or stimuli. Interest in fMRI is growing rapidly since it is noninvasive, provides excellent resolution, and can be performed on widely available instrumentation. Therefore, fMRI can be expected to play an increasing role in the neurosciences, as well as clinically in the diagnosis and therapy of brain disorders.

The reality

TeleMedicine
In total number of consultations 78 % are from private agencies

In total number of consultations 22 % are for the common ailments
In case of the costs are concerned the cost saved is cost spent



Ref: Telemedicine User Meet 2007 published by ISRO, India

What is the benefit?
How much popular is the technology?
Whether the people are benefited?
What is the impact of Telemedicine on the community?
Whether it is really useful technology and achieved the objectives?
Why it is not successful?

What is next?
How to use these technologies for the new avenues?

If the above are not useful, what are emerging technologies in healthcare?

What are the skills required for the above technologies?

TM failures reasons

1.Qualified personnel
2.More responsibility to physicians
3.utilization is very low among more than 60% of hospitals(less than 20 consultations per month)
4.Only private players taking more interest

5.moneywise no saving as per the survey more than 50 % metioned they did not save money on Cme
6.on the treatment depends much on other factors such as availability of personnel, qualifications, system failures and so on.
7.No support after installation
8.cme just uses the vc and no tool to followup
9.it is not organised properly
10.egov not a popular using these systems

Other technologies

Medical Imaging

1.Availability and accessibility is very limited
2.the precision is very low (less than 1.5 testla)
3.no software to further process or manipulate the results
4.incompatibility or network externalities such as one's out put is not playable in other systems this ultimately lead to use of hard copies
5.Untrained man power
6.many govt medical colleges do not have facilties such as MRI- first one just come in Kozhicode last month
7.Pvt medical college do not have them at all
8.paramedical staffs not available for those mentioned technologies
9.expensive technologies- no indegenous technologies
10.expensive to train the personnel
11.brain drain
12.non availability of computer science support

Other IT related technologies

HIS
PACS
Virtual Labs
Expert Systems
Online healthcare systems
Digital Library solutions
Learning management system solutions
Embedded systems
Object Orientation
Peripherals

Storing, retrieval and processing

Bioaustronautics

Functional neuroimaging

Molecular imaging

Biomedical informatics

Robotics – less invasive surgeries

Medical clinical imaging informatics

Cracking the codes of disease with information technology
AI in healthcare

Decision support- biomedical

RFID

Web2.0 / 3.0

Limitation

Vendor driven