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Telemedicine- An Innovating Healthcare System In India

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Telemedicine is a rapidly developing application of clinical medicine where medical information is transferred through the phone or the Internet and sometimes other networks for the purpose of consulting, and sometimes remote medical procedures or examinations. Telemedicine may be as simple as two health professionals discussing a case over the telephone, or as complex as using satellite technology and video-conferencing equipment to conduct a real-time consultation between medical specialists in two different countries. Telemedicine generally refers to the use of communications and information technologies for the delivery of clinical care. Telemedicine has been steadily gaining ground in the state with public-private initiatives touching the lives of rural people. It is important considering the fact that rural patients have to travel long distances and also incur additional expenses to have access to superspeciality medicare.

Keyword: Telemedicine, Health Professionals, Medical Community, Conferencing Equipment.

1. Introduction

Telemedicine is an upcoming field in health science arising out of the effective fusion of Information and Communication Technologies (ICT) with Medical Science having enormous potential in meeting the challenges of healthcare delivery to rural and remote areas besides several other applications in education, training and management in health sector. It may be as simple as two health professionals discussing medical problems of a patient and seeking advice over a simple telephone to as complex as transmission of electronic medical records of clinical information, diagnostic tests such as E.C.G., radiological images etc. and carrying out real time interactive medical video conference with the help of IT based hardware and software, video-conference using broadband telecommunication media provided by satellite and terrestrial network.According to World Health Organisation, telemedicine is defined as, “The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities”. Telemedicine literally means "distance healing" being derived as it does from

the Greek word "tele" meaning "distance" and the Latin term "mederi" meaning, "to heal". It employs information technology, through the judicious use of computers, related software, and telecommunication systems comprising of compatible telephone lines, fiber optic cables and satellite linkups, etc., to provide premium quality health care. Worldwide, people living in rural and remote areas struggle to access timely, quality specialty medical care, primarily because specialist physicians are more likely to be located in areas of concentrated population (i.e in the urban areas). Due to the innovations in computing and telecommunication technology, many elements of medical practice can be accomplished when the patient and health care provider are geographically separated. This separation could be as small as across town, across a state, or even across the world. Broadly defined, telemedicine is the transfer of electronic medical data (i.e high resolution images, sounds live video, and patient records) from one location to another. This transfer of medical data may utilize a variety of telecommunications technology, including but not limited to: ordinary telephone lines, ISDN, fractional to full T-1's, ATM, the Internet, intranets and satellites. Telemedicine is utilized by health providers in a growing number of medical specialties, including but not limited to dermatology, oncology, and radiology, surgery, cardiology, psychiatry and home health care. The benefits of telemedicine are many. Instant access to information, whether it is about a certain patient or a certain topic, can be essential or even life saving. The Telemedicine Research Exchange notes the story of a rural doctor who had never done an amputation before being helped through the procedure by a well-practiced physician over a video link. The two saved the life of the amputee, who did not have enough time to reach the larger facility. A multifold increase in efficiency for all types of medicine is another large benefit. Travel times for patients and doctors could be significantly reduced as well as research time and "paper handling" of medical records. Accuracy of diagnosis is always a major concern for the medical community. With telemedicine it will be easier for a doctor to get a "second opinion" on their diagnosis of a patient. With greater access to help, more patients will be treated correctly, the first time. This leads to more benefits like quicker average recovery time, less usage of needless medicines, and reduced costs to patients and hospitals. Self-help will increase with the online availability of so much medical information. Informed patients can result in eliminating needless visits to the doctor.

1.1 Types of Telemedicine[1,3,5]

Telemedicine process can be categorised in two ways i.e. technology involved and application adopted.

(a) Technology involved:

- **Real Time or Synchronous:** Real time telemedicine could be as simple as a telephone call or as complex as telemedical video conference and tele-robotic surgery. It requires the presence of both parties at the same time and a telecommunication link between them that allows a real-time interaction to take place. Video-conferencing equipment is one of the most common forms of technology used in synchronous telemedicine.
- **Store-and-forward telemedicine or Asynchronous:** It involves acquiring medical data (like medical history, images, etc) and then transmitting this data to a doctor or medical specialist at a convenient time later for assessment offline. It does not require the presence of both parties at the same time. Examples are tele-pathology, tele-radiology, and tele-dermatolgy.

1.2 Advantages

The main objetctive of telemedicine is to cross the geographical barries and provide healthcare facilities to rural and remote areas (health for all) so it is beneficial for the population living in isolated communities. Besides this other advantages telemedicine are

- Eliminate distance barriers and improve access to quality health services

- In emergency and critical care situations where moving a patient may be undesirable and/or not feasible
- Facilitate patients and rural practitioners' access to specialist health services and support
- Lessen the inconvenience and/or cost of patient transfers
- Reduce unnecessary travel time for health professionals
- Reduce isolation of rural practice by upgrading their knowledge through tele-education or tele-CME

The practice of telemedicine – through transmission of digitized data, audio, video and images – is getting popular all over the world as it provides hitherto unavailable access to tertiary level specialist healthcare even in geographically remotest areas without displacement of the patient, physician or the equipment. It is not only cost-effective to the patient but cost-beneficial to the society also. More and more doctors and patients are resorting to the use of telemedicine due to its advantages of convenience and cost-saving. The practice of telemedicine, however, has brought with it several complicated issues. These issues involve not only healthcare workers and consumers but the society, technologists and the lawmakers also. Those interested in the specialty of telemedicine need to address these issues.

1.3 Significance of Telemedicine[3,4,6,7]

1. By video, e-mail, telephone etc, consulting with doctors across, state, national, and international borders is now being done everyday. This teleassistance is rapidly growing.
2. Video conferencing for diagnosing or educational purposes. A doctor in one hospital can talk with a patient or doctor in another area to speed diagnoses and their accuracy. A surgeon can watch a procedure remotely and consult to make sure things go smoothly. Medical school students can learn medical procedures without having to be in the operating room.
3. **Sites** containing medical information are popping up on the web every day. One can go to find information on a certain condition or treatments, read up on medical interests, buy products, or even visit a "cyberspace telemedical office".
4. The use of telemedicine to reach undeserved areas such as rural sections of the country or military bases in other countries is a huge area being researched now. The benefits of these services could be amazingly far reaching.
5. Remote supervision of physicians' assistants or nurses can be done by means of telecommunications.
6. A highly controversial, but possible, use of telemedicine for the future is the establishment of large medical records databases.
7. An already extremely common use of telemedicine today, research databases such as Medline make medical research infinitely more efficient than before.

1.4 Application[7,8,9,10]

1.4.1 Tele-Health Care:

It is the use of information and communication technology for prevention, promotion and to provide health care facilities across distance. It can be divided in the following activities
-Teleconsultation
- Telefollow-up

1.4.2 Tele-Education:

Tele-Education should be understood as the development of the process of distance education (regulated or unregulated), based on the use of information and telecommunication technologies, that make interactive, flexible and accessible learning possible for any potential recipient.

1.4.3 Disaster Management:

Telemedicine can play an important role to provide healthcare facilities to the victims of natural disasters such as earthquake, tsunami, tornado, etc and man-made disaster such as war, riots, etc. During disaster, most of the terrestrial communication links either do not work properly or get damaged so a mobile and portable telemedicine system with satellite connectivity

and customized telemedicine software is ideal for disaster relief.

1.4.4 Tele-Home Health Care:

Telemedicine technology can be applied to provide home health care for elderly or underserved, homebound patients with chronic illness. It allows home healthcare professionals to monitor patients from a central station rather than traveling to remote areas chronically ill or recuperating patients for routine check-ups. Remote patient monitoring is less expensive, more time savings, and efficient methodology. Tele-home care virtual visits might lead to improved home health care quality at reduced costs, greater patient satisfaction with care, increased access to health care providers and fewer patients needing transfer to higher, more costly levels of care. A Computer Telephone Integrated (CTI) system can monitor vital functions of patients twenty four hours a day and give immediate warnings.

1.5 Physician/Patient Acceptance

Physicians and patients have unique technological resources available to improve the patient-physician relationship. It has been found that patients have no difficulty in accepting telemedicine program. The survey conducted by SGPGIMS tele-follow up program for the patients of Orissa state revealed that 99% patients were satisfied with using telemedicine technology. In almost all the cases the patients are more than happy and satisfied as they don't have to travel 1500 km to show their diagnostic reports to their doctors. In tele-consultation they were also happy that they get the specialist consultation and their cases has been seen by some expert doctors.However, some resistance is seen amongst doctors. Doctors in government sector tend to look upon telemedicine as an additional duty or workload. Therefore, there is need to weave telemedicine into the routine duties of the doctors. The private doctors sometime fear that telemedicine is likely to reduce their practice. They need to realize that this technology enhances their reach and exposure and is only likely to increase their practice further.

1.6 Availability of Technology at a Reasonable Cost:

It is myth that to establish a telemedicine platform is an expensive. The basic system needs hardware, software and telecommunication link. In all the areas there is a significant reduction in the prices. Most of these costs are well within the reach of most of the hospitals, and can be recovered by nominal charge to the patients and students in case of tele-education which would be much less than the physically traveling.

1.6.1 Accessibility:

Although information technology has reached in all corner of the country but the accessibility of people living in remote and rural area to the nearest health center (PHCs, CHCs or district hospital) may not be easy due to poor infrastructure of road and transport. It may be possible that the available telemedicine system in thee health centers may not function becaue of the interruption in power supply.

1.6.2 Reliability:

Some healthcare professionals has doubt about the quality of images transmitted for tele-consultation and tele-diagnois. In tele-radiology, telepathology, tele-dermatology the quality of image (colour, resolution, field of view, etc) should be international standards to avoid any wrong interpretation and mis-diagnosis. The delay in transmission of data may be of critical importance in tele-mentoring and robotic surgery and have to be reduced to the minimum.

1.6.3 Funding/ Reimbursement Issues:

There should be a format to calculate the investment and recurring cost of the telemedicine system. The insurance companies have to decide whether the cost of tele-healthcare should be reimburse or not.

1.6.4 Lack of Trained Manpower:

Telemedicine is a new emerging field, there is lack of training facilities with regards to

application of IT in the field of medicine. Most of the healthcare and IT professionals are not familiar with the terms commonly used in telemedicine such as HIS, EMR, PACS, etc. Telemedicine is also not the part of course curriculum of medical schools.

1.6.5 Legal & Ethical:

Telemedicine technology has been proved and established and its advantages and benefits are well known but still many healthcare professionals are reluctant to engage in such practices due to unresolved legal and ethical concerns. In case of a cross-border tele-consultation which country's litigation laws will be applied in case– those of the country in which the patient is living or those of the remote physician?

1.6.6 Privacy and Security Concerns:

There are many issue that should be considered regarding the security, privacy and confidentiality of patient data, in telemedicine consultations How are patients' rights of confidentiality of their personal data ensured and protected How to ensure security of the data and restrict its availability to only those for whom it is intended and who are authorised and entitled to view it? How to prevent misuse and even abuse of electronic records in the form of unauthorised interception and/ or disclosure?

1.7 Tele-Procutoring[12,15,16,17,18]

It is mentoring and evaluation of surgical trainees from distance with the involvement of broadband connectivity, power cams, and sophisticated videoconferencing equipment. A real time and live interactive teaching of techniques or procedures by a teleproctor to a student. The teleproctor is in one location and the student is in another.The teleproctor must have the ability to see the performance of the procedure or technique being executed by the student in real time. The teleproctor and the student must have the ability to verbally communicate during the session. Implicit in the definition of teleproctoring is that the teleproctor does not have the ability to physically intervene on-site and can therefore not assume primary patient care responsibility.

Appropriate use :

- Demonstration and/or teaching technique or procedures using inanimate trainers.
- Demonstration and/or teaching techniques or procedures using animate ex vivo models.
- Demonstration and teaching techniques or procedures on patients as an adjunct teacher when a qualified preceptor is on-site with the student.

1.8 Tele-Conferencing[15,18]

- Tele-conferencing is the discussion and interaction between doctors during workshop, conferences, seminar or continual medical education programs in a virual room environment. Live surgery demonstration or procedures can be transmitted through videoconference during these programs. One of the widely used technology it has now changed the concept of physical presence in any of the above events.
- Different kinds of teleconferencing modalities are now in use such as Interactive two way, one way broadcast, web cast etc Once the cost of broadband telecommunication comes down and internet technology is advanced more and more people would like to stay afoot at their place of work and participate in events remotely.

1.9 Tele-Consultation

Evaluation of patient(s), and/or patient data, and consultation regarding patient management, from a distant site, using a telecommunications interface. The teleconsultant, by definition, does not have the ability to physically interact with the patient, except through the telecommunications interface.

1.9.1 Appropriate Use:

- Initial urgent evaluation of patients, triage decisions, and pretransfer arrangements

for patients in an urgent/emergency situation
- Intra-operative consultations
- Supervision and consultation for primary care encounters in sites where an equivalently qualified physician/surgeon is not available
- Routine consultations and second opinions based on history, physical findings, and available test data
- Public health, preventive medicine, and patient education

1.10 Telemedicine In India: Current Scenario And The Future[12,19,13]

If the country has the dubious distinction of having one doctor for every 15,000 people, low-cost telemedicine modelRemote Healthcare Delivery Solutions is set to bridge the great Indian healthcare divide.The rural healthcare scenario is a complex interplay of various parameters that include affordability, availability of healthcare personnel and medicine, infrastructure, social security/insurance and viable, sustainable and scalable business models. With a population of more than 1 billion, of which nearly 72.2 per cent reside in rural areas, the Indian healthcare industry is faced with many challenges while extending its services, particularly to those living in rural and suburban areas of the country.India, with its diverse landmass and huge population, is an ideal setting for telemedicine. Telemedicine activities were started in 1999. The Indian Space Research Organization has been deploying a SATCOM-based telemedicine network across the country since that year. Various government agencies-Department of Information Technology and Ministry of Health & Family Welfare, state governments, premier medical and technical institutions of India-have taken initiatives with the aim to provide quality healthcare facilities to the rural and remote parts of the country. The Government of India has planned and implemented various national-level projects and also extended telemedicine services to South Asian and African countries. Efforts are taking place in the field of medical e-learning by establishing digital medical libraries. Some institutions that are actively involved in telemedicine activities have started curriculum and noncurriculum telemedicine training programs. To support telemedicine activities within the country, the Department of Information Technology has defined the Standards for Telemedicine Systems and the Ministry of Health & Family Welfare has constituted the National Telemedicine Task Force. There are various government and private telemedicine solution providers and a few societies and associations actively engaged to create awareness about telemedicine within the country. With its large medical and IT manpower and expertise in these areas, India holds great promise and has emerged as a leader in the field of telemedicine.Telemedicine has been trumpeted as the great health care hope for rural India, a technology that can transform the health statistics of remote India and medical practice in the country. The advantages of telemedicine are manifold. Taking a doctor to an area where there is no doctor. Taking medical help to patients where no medical help existed before. Diagnosing a medical condition before it becomes untreatable. Tele pathology, teleradiology, tele ophthalmology – these are all ways of accurately diagnosing diseases from a distance. They have moved beyond the pilot stage to actual implementation in different parts of the world, including India.Telemedicine consultations where a doctor remotely talks to a patient and advises (typically via a video conference link up) has had its share of controversy. If you can't touch a patient, how can you accurately diagnose his condition? Can a patient and doctor who see each other on a TV screen actually bond? Does the patient 'feel' he got a medical consultation? Is the doctor at the other end legally liable for diagnoses delivered via a telemedicine link.Several studies have been done to assess these issues. In a recent survey conducted in the United States, 85% of patients reported being satisfied with their telemedicine consultation. A similar study in Orissa reported a post-consultation satisfaction rate as high as 99%. So clearly, a telemedicine consultation can meet

patient expectations. In terms of legal liability, however, this remains a grey area. In fields such as teleradiology, the radiologist who is giving the report based on the images transmitted to him is legally liable. However, in telemedicine consultations, where a doctor does not necessarily have all the clinical data available to him, the legal liability issue is more fuzzy.Using newer technologies in the field – telemedicine boxes and software rather than just a video conferencing link – has increased the clinical value of the consultation. The 'tools' of telemedicine e.g. digital stethoscopes and otoscopes, oxygen saturation probes (to assess the oxygen level in the patient), blood pressure monitors etc. have made the telemedicine consultation more scientific and data based.The biggest advantage of telemedicine is that it takes the doctor to places where no doctor has been before. And in a vast country such as ours where large tracts of the country have patients but no doctors, telemedicine truly has the potential to change lives.So why is it that it has not had a huge impact in the country? Granted there have been some hospital groups making an effort in this direction and the Government of India via ISRO has been very keen to roll this out all across the country. Still, there are several reasons why telemedicine has not been able to occur on a giant scale in India:

1.10.1 Infrastructural issues

Infrastructural issues such as poor bandwidth in some areas; expensive bandwidth in others.

1.10.2 Implementation issues

Implementation issues are a major hindrance. In order to implement telemedicine, training is needed at the village end for technicians, IT staff, and local doctors. At the consulting doctor's end, a lot of pushy administration and coordination is required. The devil is in the implementation. If done effectively and consistently, telemedicine can truly be transforming.

1.10.3 Acceptance

For a village doctor and villager, using high end technology may be too inhibiting and radical. However, once the benefits are seen, the acceptance rate will likely be high such as has been seen with mobile telephony and rural internet services.

1.10.4 Viability issues.

Viability issues, So far, in India, telemedicine has been largely a free offering by large hospital groups. While part of their CSR, it also has the effect of improving their bed occupancy in cases when a 'tele'patient requires hospitalization and becomes a 'real' inpatient. Large hospitals are in a position to offer these services at no extra charge because they use in-house expertise to deliver them. However, since these in-house specialists work in a busy hospital setting, making time for telemedicine consultation becomes an issue. The fact that the consultations are free also reduces the incentive to make this a high throughput service.The biggest waste in the world is the difference between what you are and what you could be. This epitomizes telemedicine in our country. In my mind, telemedicine in India can be a health innovator and affect real change in the medical scenario of our country….if done well, using multiple hospitals/centers in the country, and on a large scale.In order to do this, the Government, via ISRO connectivity, should connect up all district and village level hospitals to the closest tertiary care centers. The private sector can be used effectively – every private hospital can be connected to one remote site thus distributing the load of patients, rather than a handful of hospitals linking up to all the remote sites.Technologies for telemedicine designed by innovative majors (such as Cisco technologies) should be low cost, easy to install and use and should be able to work on low cost bandwidths. Public interest campaigns to increase awareness of the benefits of telemedicine would help. A standardized training program for all telemedicine providers and users would be helpful in ensuring the link ups occur rapidly and the centers stay connected without the 'network going down'.A viable model wherein a small cost is paid for the telemedicine consultation would make this a long term successful model of health care delivery. An appointment system that allows

patients to book their 'doctor visit' rather than have to wait for a doctor would help improve usage of the system. Also a 'pusher' is needed in every telemedicine center to ensure that after the link up is done, the telemedicine link is actually used on a daily and sustained basis. And finally, data collection on daily utilization, diagnoses made and treatment plans changed would help to measure success and impact and provide direction for the future.After the success ofits telemedicine model in India and abroad, healthcare major Apollo Hospitals is all set to start 'Telemedicine 2.0.'. "Telemedicine 2.0. is a step towards integrating healthcare delivery model with the new age technology. Through this initiative, we are trying to make telehealth a more user-friendly by providing the services on mobile phones and tablets," K Ganapathy, president, Apollo Telemedicine Networking Foundation, and director of Apollo Tele Health Services, told Business Standard."We are also integrating telehealth with the hospital management system, electronic medical records (EMR) of the hospitals, and mobile personal health records to make healthcare more affordable," he said. Apollo is currently pilot launching the 'Telemedicine 2.0.' across five tertiary hospitals in Hyderabad and Chennai. "With the success of the pilot, we will launch this service across Apollo's telemedicine centres in the country," he added. Telemedicine is a process through which patients can consult doctors located at very distant places through electronic mediums without visiting them. "Around 80 per cent from India's population has no direct physical access to specialist healthcare. So, we are working on new models with the help of technology to reach out to more people," he said. The telemedicine has a huge market potential. "In India alone, if we cover 10 per cent of the market, it will be more than 40 million consultations from suburban and rural India per year," he said. So far, Apollo has done 75,000 tele-consultations in 25 specialties."Apollo is also conducting a market study on attitudes and behavioral responses of the public towards accepting the mobile phone as an enabler for healthcare by taking 2,500 people from across the country," he said. Apollo Telemedicine, being the oldest multispeciality telemedicine network in South Asia, currently has 125 centers including 15 centres in international markets. It has commissioned three centres in Nigeria last week and signed a memorandum of understanding (MoU) to set up 25 centers in Africa. Telemedicine is a potentially miraculous method that promises improvements to healthcare delivery systems, bettering quality and access. Interest in the field has increased dramatically in India. It is not just private healthcare institutions that are investing in creating of new telemedicine solutions, the central and the state governments are also showing interest. The Planning Commission has made numerous suggestions for using telemedicine solutions, during the 12th Five Year Plan period, for improving healthcare services in the remote parts of the country. If Planning Commission has its way, healthcare practitioners could be using software applications such as Skype for telemedicine.The Planning Commission report says, "Computer with Internet connectivity should be ensured in every primary health centre within this Plan period; sub-centres will have extended connectivity through cellphones, depending on their state of readiness and skill set of their functionaries. The availability of Skype and other similar applications for audio-visual interaction makes telemedicine a near-universal possibility and could be used to ameliorate the professional isolation of health personnel posted in remote and rural areas." The health ministry has also identified telemedicine as a major thrust area. Only 25 percent of India's specialist physicians reside in semi-urban areas, and a mere three percent live in rural areas. As a result, rural areas, with a population approaching 700 million, continue to be deprived of proper healthcare facilities. Further the availability of hospital facility is very low in rural areas. Thus, the early successes of telemedicine pioneers have led to increased acceptance and proliferation of telemedicine."

1.11 Marketed Scope and Oppurtunity of Telemedicine In India[22.23]

Telemedicine has various aspects including Teleconsultation, Telediagnosis, Tele-education, Teletraining, Telemonitoring and Telesupport and incorporates complete information about patients' medical record (in the same hospital or any virtual hospital online). Telemedicine system is well suited for disaster management as it is even more reliable, than the physical system.Indian Telemedicine market is estimated to be $7.5 million and is expected to grow at a CAGR of around 20 per cent over the next five years.It is estimated that 1.5 lakh people are benefited of telemedicine every year.

1.12 Major Players in Telemedicine Sector

Among the private: The Apollo Telemedicine Enterprise Ltd. (largest telemedicine provider), Narayana Hrudayalaya, Asia Heart foundation, Escorts Heart Institute, Arvind Eye Care etc.Among the public: AIIMS Delhi, PGI Chandigarh, SGPGI Lucknow.Increased use of wireless and web-based services & adoption of 3G and HSPA has given a boost to the market in recent years making it a key growth drivers.Major roadblocks for Telemedicine would be shortage of computer savvy healthcare personnel, high capital requirement (approximately $10,000) and less replicability. KTwo Technology has been selected by Keonics, a Karnataka government owned enterprise, to set up a telemedicine delivery system in 212 Primary Health Centres, 38 District Hospitals and a central unit in Patna. It was the State Health Society of Bihar which awarded the National Rural Tele Medicine Ayush Network (NARTAN) project to Keonics that in-turn partnered with KTwo to initiate the deliverable solutions.Now KTwo with its flagship product Kshema, Unified Healthcare System, would provide and set up telemedicine systems on a Build Own Operate and Transfer (BOOT) model for three years. It would establish a command and control center in Patna to oversee the complete operation manned with video conferencing facilities.It was in 2007, KTwo set up a Kshema kiosk in Karnataka, Maharashtra and other states to provide medical diagnostic facilities to check blood pressure, body temperature, ECG, urine analysis, blood sugar. The kiosk could also offer an audio video consultation at Point-of-Care with a doctor at an urban or semi urban centre for tele-consultation. Kshema captures electronic medical record of each patient and transmits clinical information over a network to offer tele-consultation."Kshema which means well being in Sanskrit offers cost efficiency making it an ideal solution for use in urban and rural areas where healthcare delivery systems is critical.This is a revolutionary technology and with its patent pending software algorithms, Kshema can also help detect communicable diseases like tuberculosis and malaria using its image processing techniques in less than 30 minutes at Point-of-Care across 250 locations in Bihar. In addition it would use a differential diagnostics software to detect ailments with symptoms captured at the Kiosk by a paramedical staff without the help of a doctor.The software consists of modules for Electronic Health Records, pathology, radiology and vital signs monitor which has the ability to automatically identify details and transmit the information to the doctor through broadband or wireless connectivity. There is also simple solution for paramedic to record the patient condition which is transferred to a remote district/city health center with a doctor who could the prescribe medication."With the healthcare delivery systems being overloaded in the India and China, it is imperative to have efficient and cost-effective systems and processes. We have managed to take the first step in this direction. Building better forward and backward linkages through a superior referral system would help the secondary and tertiary care facilities to become more manageable, preventing them from being over burdened,"The shortage of doctors at the rural healthcare centres and poor infrastructure require a system which can address these issues and help provide quality healthcare to the patient through implementation of technology.

1.13 India Innovating Toward Affordable Healthcare[16,17,19]

In a country that has just three per cent of its physicians living in rural areas and 25 per cent in semi-urban areas, telemedicine has become a godsend amongst hospitals eager to figure out a way to cost-effectively serve a population starved of medical care. Telemedicine allows doctors—there are just 2.5 lakh of them produced every year in the country versus the 7 lakh that it needs—to attend to multiple patients all across the country, or even the world, without ever leaving their hospitals. A doctor can diagnose a patient, prescribe medication and treatment, or simply educate a patient on a particular issue without having the patient spend time and money travelling to a major town for a diagnosis. Hospitals benefit by being able to distribute their brand to areas that could soon become important revenue centers. Despite the growth of medical tourism in India, remote villages in the country are still lacking chemist shops, let alone a clinic. For the wider masses, healthcare services remain prohibitively expensive.Although the government has set up over 22,000 primary healthcare centers in villages across India, these often remain just structures as doctors, radiographers, pathologists, etc, are hard to find. The good doctors prefer to work in the larger cities where there are better facilities and remunerative jobs."The primary healthcare centers are not economically viable," said Vijay Simha, CEO of One Breath, a startup developing a low-cost, portable ventilator for launch in 2013. He was speaking at a panel discussion at the TiEcon Delhi 2012 conference held in New Delhi over the weekend.According to Simha, several hospitals in India have ventilators that do not function, and most cannot even afford a ventilator. This has led to higher mortality rate."India has the opportunity to leapfrog all models of healthcare," said Ajay Bakshi, CEO of Max Healthcare."Don't just look at what Max Healthcare, GE, Philips, etc, are doing and say this is what Indian healthcare is going to be. It's an open field and we need to get innovative," added Bakshi, whose company runs a leading chain of hospitals in India.He pointed to some examples of how innovative approaches were being adopted by entrepreneurs to reach out to communities across India, and how high-end healthcare players were making top-of-the-line healthcare more affordable.For instance, Philips Healthcare now has an innovation campus in Bangalore that is developing products for use in small towns and cities.In another example, social enterprises such HealthPoint Services India (HSI) are taking quality healthcare to rural India. The organization owns E Health Points (EHP), which provides rural villages with clean drinking water, medicines, diagnostic tools, and advanced telemedical services--that bring a doctor and modern, evidence-based healthcare to their community.

1.14 Improving Primary Healthcare

EHP has entered into a public-private partnership (PPP) arrangement with the Punjab state government to have tertiary care facilities in cardiac care, oncology, neurology and orthopedics and trauma."We run primary healthcare centers in villages in Punjab that have a population of 4,000 to 10,000 people," said Amit Jain, CEO of EHP. At EHP, most of the diagnostics tests are provided at high discounts compared to those at the nearest towns and cities.Similarly Eye-Q Super-specialty Eye Hospitals is providing eye care at affordable rates in small towns and cities across north India."We do cataract surgeries at INR 3,000 (US$57.26) and are a profitable company," said Rajat Goel, co-founding CEO and managing director at Eye-Q Super-specialty Eye Hospitals. In the city, a cataract surgery can cost anywhere between INR 20,000 and INR 30,000 (US$381.75 and US$572.62). His company sees between 500,000 to 600,000 patients a year.

1.15 Cheaper Medical Equipment

Several medical equipment manufacturers are also working at more affordable price points for smaller towns and villages. According to Rekha Ranganathan, senior director and head of strategy at Philips Healthcare, affordability means different things to different consumers."It has one meaning for the premium consumer, and another for rural customers. So we have to constantly

evaluate the price point which our consumers are able to [pay]," she said. There is also a market opportunity for products like One Breath, which was designed for emergency situations and for patient care in resource-poor countries. It is particularly useful for India, where regular power supply is a challenge, the company said. However, India needs the right regulations to encourage large-scale adoption of telemedicine. In fact, India does not even have a medical device safety bill.

"In India, regulations do not exist. Doctors get arrested for incubators that catch fire," Simha noted. The country also needs a regulatory authority for medical devices, while there is no regulation pertaining to telemedicine consultation. "Lack of regulation in this area is getting in the way of large-scale adoption of telemedicine," Bakshi said.

1.16 Different Models

There is no one standard business or operational model in the world of telemedicine. At Hrudayalaya, teleconsultations happen side-by-side with the routine Out Patient Department (OPD) work for specialists at the main hospital in Bengaluru. NH has installed telemedicine equipment in every OPD so that the specialist takes turns in seeing his virtual and physical patients every day, without any difficulty, says Abhay Singhvi CEO, Preventive Health and Telemedicine at Narayan Hrudayalaya. NH offers a slightly different model from Apollo's. Of its 800 centres, none have been set up by Hrudayalaya. "We offer our expertise to centres who want to link up with us and take our name, says Singhvi. "We don't spend anything as Government is providing everything free of cost to us," he says. Fortis Hospital, which is setting up a new facility in Gurgaon in the outskirts of Delhi, has a similar franchise model to Hrudayalaya's. The hospital chain plans to offer telemedicine from there to centres across the country and its centre in Noida is already running a telemedicine service to 60 franchise units in 10 states. These centres keep the hospital's flag-flying in new terrain without having to physically go there or invest a single paisa. Apollo's business model is a little different as it chooses to set up its own centres at the cost of Rs 5 lakh per centre. Recurring cost is about two and a half lakh per year per centre. It charges Rs 20 per patient for three visits to the centre. Of the patients who came to the centres, only 10 per cent were required to go to the hospital for further treatment. Aravind recovers it through fees and sale of glasses.Perhaps the most unexpected role model for the success of telemedicine lies in the success of the Tripura government's efforts in replicating the Aravind model—a public-private partnership with Infrastructure Leasing & Financial Services Limited (IL & FS), with the eye hospital lending them necessary expertise. Under the unique PPP, the State Government has set up about 40 vision centres and plans to expand further. IL & FS invested Rs 10 lakh in a pilot project on telemedicine 75 kilometres away from Agartala and nudged the reluctant Communist government into holding hands with a private partner for scaling up the eye care model. With just 18 ophthalmologists catering to a population of 37 lakh, the government had no option but to agree.IL & FS identifies patients and lines up doctors from Tripura's Indira Gandhi memorial eye hospital, and in times of need, from Aravind and other willing hospitals in Bengal, and connects them. Under this model, the cost of consultation per patient comes to Rs 280 and salaries of IL & FS teams as well as IT costs and of service providers comes to Rs 1.40 crore per year which is paid by the government. IL & FS hopes for an extension of the partnership for another three years. The model has proved successful enough for the Bihar government to rope in IL & FS for running Ayush centres, while Gujarat plans 40 centres linked to tertiary and secondary hospitals.

1.17 The Future of Telemedicine[12,13,15,18]

Many anticipate an infinitely more advanced version of telemedicine in the coming years. Hrudayalaya's Singhvi expects to soon employ futuristic applications like health phones and robotic surgery. "Remember the James Bond movies and the video phones in them? We plan to do something like that soon. Health would be

home delivered as on Flipkart,'' he says."Health phones are being developed and people can choose any health provider and get a pre paid or post paid service,'' he says, adding that robotic surgery would be the next stop for Hrudayalaya in a decade or so.A prototype mobile phone monitoring system developed by a team of engineers in Loughbourough University of UK and Indian experts was unveiled in 2005. It transmits a patient's vital signs such as blood pressure, blood glucose, oxygen saturation, and even electrocardiogram (ECG) heart signals to a hospital or clinic anywhere in the world. The team has tied up with London's Kingston University, the Institute of Technology Delhi , Aligarh Muslim University, and the All India Institute of Medical Science to develop a more portable device.Still, the promise of telemedicine is in its fundamentally basic enablers which is essentially cable connectivity and a screen. Singhvi is looking forward to the 12th Plan which is expected to make broad band available to the common man as a sort of entitlement. "That will change the way telemedicine works. Even now all you need to get connected is a broad band and a computer. You can just skype and NH telemedicine runs 24 x7 for anyone who wants it,'' he says.

1.18 Challenges

Despite the promising activity in the field, observers say that there is a long way to go before it stands a chance at becoming a pervasive way of healthcare delivery. "A good business model is needed too to make it attractive and viable. You also urgently need a policy and law to address licence issues ,'' says SK Mishra who heads the telemedicine project in Sanjay Gandhi Postgraduate Institute of Medical Sciences, in Lucknow. "How can a patient be prescribed medicines through long distance calls unless there is a law which regulates this , he asks.The mad rush for telemedicine amidst claims of poor earnings may look like a contradiction. But in the long term, the hospitals are laying the foundation for future partnerships with state governments for rural markets, which is why they will be more than content to shoulder the costs for penetrating rural India for now.

1.19 Telemedicine in India: The Next Big Wave[12,15,19,20]

The semiconductor industry has a critical role to play in the development of innovative medical electronic products and devices and can bring about a paradigm shift particularly in areas such as portables and telemedicine.

1.20 Omnipresent Technology

Expertise across digital and analog technologies, and ability to address the wireless connectivity, digital imaging and power management requirements of applications, is required among service providers to help customers put innovative medical electronic systems into the hands of more people. The market for companies dealing with high technology medical equipment is expected to grow rapidly. This is especially true in developing countries like India where there is a gap between demand and supply of quality healthcare facilities.The medical industry is changing and as more and more medical practices move out of the doctor's chamber into other spaces (eg, the Internet and home), companies are embracing the associated developing technologies in order to be more competitive in the market. The traditional arrangement of the patient visiting the doctor for diagnosis and then getting cured from the problem is slowly changing. People are reaching out to the Internet more frequently to learn about symptoms and the possibility of finding cure remotely. New applications in medical electronics are ushering in a completely new market that provides healthcare solutions in areas where traditional medical infrastructure does not exist, similar to the mobile phone, which enabled communications where no telephone lines were in place.

1.21 Helping Patients at Every Corner

Technology will also enable easier access to consultation. Home monitoring in combination with good connectivity can help ensure proper treatment of the aged at home. It can help patients

reduce the duration of hospital stay. Telemedicine technology will also bring medical care closer to remote areas. A long journey to meet an expert will soon be replaced by an appointment at the nearest telemedicine kiosk where one can have a consultation session using video conference technology and review of all medical data enabled by patient records. Follow-up care during recovery will happen within the comfort of homes or by visit to the nearest telemedicine centre.In case of emergency, it is critical to have the ability for quick diagnosis and quick access to an expert. Distributed medical technology will be a change agent here. The semiconductor companies are working towards lower power, smaller form factor solutions that will enable this. Reliable wired or wireless connectivity is the second major technology that is needed for this to be a reality.

There have been developments around patient monitoring devices that can be with patient at their homes, in an ambulance and in hospitals. During an emergency, these devices will collect all required data and send to the hospital while the patient is being transported to the hospital. When the patient arrives at the hospital all the required tests are completed and he can get immediate care. This will help in saving time. The semiconductor and healthcare industry is focussed on innovations that will impact human life with patient care being at the centre of all the innovations.

1.22 The Impact of Telemedicine

If we are looking at the possible impact, it is probably best to relate to a few other industries. For instance, the computing industry with the ability to move from these very large mainframe systems from the 1980s and take them to today's laptop format. The semiconductor industry provides interesting solutions in key areas like data acquisition, processing and connectivity. Today, the penetration level of technology is often completely driven by one factor — the amount of power needed to run the equipment, which ultimately determines the amount of time the equipment will run with no recharging. It is also interesting to note that in many types of equipment today, batteries are much larger than the electronics they power, thereby expanding the size and cost as well. The need is to design equipment that run on low levels of power and semiconductor companies are devising many energy harvesting techniques to achieve this goal.Pursuing this objective, Texas Instruments (TI) has introduced key products that consume very little power while driving major applications. TI's IC innovations and long-standing history in the market help customers make advanced medical devices more flexible, affordable and accessible.An interesting, but less known fact is that there are a large number of innovative, home-grown medical electronics companies in India, designing and manufacturing medical equipment in tier II and III cities. These companies require application support, and TI with its large portfolio of products – nearly 40,000 in number – plays an effective role as their partner in innovation. Within telemedicine, there is a requirement of high definition video for which TI has chip solutions.

1.23 Healthcare Cost Reduction[11,13,15,17]

Telemedicine Can Cut Health Care Costs By 90%.

If you've not yet heard of telemedicine or think that it's not a great way to deliver quality health care, you may want to read this. Telemedicine, made possible by the availability of mobile networks, is revolutionizing health care. But not in the U.S.You have to look to India, where telemedicine is already widely used in the delivery of health care — and is saving lives even in the most rural corners of the country. It is especially used in peritoneal dialysis (PD), a key treatment option for patients with severe and chronic kidney disease, so-called end-stage renal disease (ESRD). Under this procedure, fluid is introduced through a permanent tube in the abdomen, and flushed out either every night while the patient sleeps, or via regular exchanges throughout the day. It is home-based care. The alternative treatment is hemodialysis (HD). Compared to HD, the primary advantage of PD is the ability to deliver treatment without visiting a hospital; it is thus more cost-effective. The

primary disadvantage is that it can cause complications due to infections, since PD permanently attaches a tube to the abdomen.The major barrier in the acceptance of PD is concern that patients won't have proper access to a doctor — especially in geographically dispersed countries such as the United States. As a result, less than one in twelve ESRD patients are treated with PD. The net result? It costs over $170,000 to treat patients with ESRD in the U.S., using the more expensive HD.Dr. K. S. Nayak, Chief Nephrologist at the Lazarus Hospital in Hyderabad, India, and his team are able to treat ESRD patients using PD with excellent results at a remarkable one-fifteenth of the cost, about $12,000.Lazarus Hospital uses mobile phone short messaging service (SMS), inexpensive digital cameras, and the internet to address patient accessibility issues. Those technologies — coupled with a dedicated PD team (comprising medical and paramedical staff) have enabled the hospital to develop a unique PD remote monitoring system. The innovation is in the software that provides the connectivity. (U.S. patent pending for the PD-SOFTWARE).Patients are constantly in touch with kidney specialists, communicating in real time, around the clock. To monitor complications from infection, patients and their caregivers are trained during their initial PD period to use their own mobile phone cameras or digital cameras to take photographs of the PD effluent bag.After signing into the (secure) hospital website, patients and caregivers are directed to a personalized home page from which they can use the site to enter and share information. Health complaints made by patients receive immediate response. Remote monitoring is augmented by a home visit protocol that ensures that each PD patient's progress is followed up by a well-trained clinical coordinator (CC) on a regular basis. The CCs are trained to follow a set protocol and are equipped with a standardized checklist for a step-by-step assessment of patient well-being during each visit. All this information, together with a brief summary of the patient's most current laboratory results, is conveyed to the nephrologist by SMS from the patient's home. The CC is instructed to wait until the nephrologist responds (usually within 15 minutes), and then to counsel the patient accordingly. CCs also assess and advise patients on nutrition, psycho-social well-being, and physical fitness and rehabilitation levels.The hospital retrospectively analyzed 115 rural patients who had started PD using this remote monitoring technology. Amazingly, rural patients performed well on PD and had significantly better survival rates than did their urban counterparts.But in the U.S. it's a different story. Over 90% of patients in the U.S. with ESRD use HD as their treatment. However, that is a procedure that requires the patient to go to the hospital three times a week. This is more cumbersome, more expensive, and hampers the patient's lifestyle and work/family obligations. What is the primary driver of this system-wide inefficiency and cost? Most health care providers would agree that it is physician "mindset:" higher physician reimbursement for HD than PD, and concerns about accessibility in a geographically vast country contribute to historically low use of PD in the U.S.It doesn't have to be this way. The "distance" between the patient and the PD unit can be overcome, at a dramatically low cost, by efficient use of the internet, mobile phones, and a strong home visit protocol. To quote Dr. Nayak: "Our success can easily be replicated in the U.S. Conservatively, even if 15% of ESRD patients choose PD over HD, cost savings for Medicare and Medicaid will run into many millions of dollars every year."

1.24 Guidelines for the Implementation of A Telemedicine Programme[17,19,20]

1.24.1 Sensitizing

In sensitizing government decision-makers, health and telecommunication professionals, concerned communities and users, the following points should be highlighted:

1. Telemedicine is not meant to replace the physician;
2. The value of telemedicine lies in spreading medical knowledge, through the use of telecommunications, to remote areas where it is not available;
3. No sophisticated communication

infrastructure is required in order to develop telemedicine applications.

1.24.2 Evaluation of the present situation

1. Both sanitary and communication infrastructure should be evaluated.
2. The evaluation of sanitary infrastructure should cover the existing problems, needs and priorities, as well as the geographical distribution of the primary, secondary and tertiary assistance centres. Consideration should be given to communication infrastructure; the links currentlyavailable and future expansion plans.

1.24.3 Creation of Interdisciplinary Groups

1. Working groups should include members from the health and telecommunication sectors, as well as other sectors that may be able to share the structure to be developed (e.g. education, tourism, production).

1.24.4 Integration of Telemedicine

The telemedicine programme should not be isolated, but must be made part of the global health project.

1.24.5 Training of Health Professionals

Health professionals should be aware of:

1. available tools;
2. applications that can be developed;
3. how to develop such applications;
4. how to use the applications developed.

1.24.6 Implementation of Pilot Projects

Aspects to be considered for the implementation of pilot projects:

1. Identification of a project-leading group;
2. Identification of existing problems;
3. Definition of quantifiable and verifiable objectives;
4. Selection of technology (physical links, types of equipment and systems to be used, as

well as possible combinations thereof);

5. Definition of the cost of the infrastructure: cost of initial installation, cost of operating the system and cost of its maintenance; evaluation of the cost/benefit ratio of the different systems.
6. Comparison with reference models of existing projects (benchmarking); when developing a project on distance medical education (tele-education), there is also a need for a roject-leading group to be responsible for providing valid content on a permanent basis; organization of the pilot project into phases, with an individual programme for each phase; monitoring and evaluation of the projects. It is important to verify the number and type of applications developed, the number of users, the level of diagnostic quality, the amount saved by the use of telemedicine (in terms of transportation, unnecessary procedures, etc.); feedback between designers, operators and users of the project in order to allow the necessary adjustments/corrections; assurance that the project is sustainable; identification of funding sources to get the project started and keep it going.
7. Telemedicine and the national health plan. Based on the results of the pilot projects, it should be possible to generate specific application models to be included in the national health plan.
8. Education for telemedicine. It is of crucial importance to introduce telemedicine into formal health education programmes.

1.24.7 Need for resource optimization

1. There are multiple applications running on low-cost and high-availability links such as radio, telephony, Internet, etc. Given the shortage of resources and the need to share those that are available with other priority projects, it is essential to carefully explore the possibility of using low-cost links before adopting high-cost solutions.
2. It is important that the systems adopted use configurations that are suitable for future upgrading.

3. The mix of technologies and formats serves to optimize the quality and use of the applications. Resources should be used in a flexible way in order to achieve the maximum benefit at the lowest cost. Examples: Cross-consultation: The Internet could be used for administrative aspects such as identification of specialists, making appointments, sending medical records, etc., with a facility like ISDN being used only for discussion of the case itself.
4. Education: Even though tele-education systems are available, videoconferences, courses, etc. could be recorded, allowing them to be multicopied, made available through the Internet, etc., and distributed to a much wider audience.
5. To optimize the use of resources, the organization of regional or subregional projects should be promoted.
6. The need for setting up demonstration centers in leading hospitals laboratories with terminal equipment that is compatible with technology in the developing countries.
7. The need to enhance participation by health sector delegates, since they are familiar with needs.

1.25 Challenges For Telemedicine In India[23,24,26]

It has always been heard that doctors are the biggest impediments for use of technology; on the contrary it is the doctors' community that is fast becoming tech savvy and forward looking when it comes to technology. Perhaps what is worrying them is the transmission of reports securely and without error or loss. Once the industry is able to give clinical evidence, eHealth and mHealth market will explode!For healthcare to reach masses and to support the growing demand of healthcare services in India, India's mHealth infrastructure needs to undergo drastic changes. Government has taken up some initiatives aimed at providing affordable and quality healthcare services through setting up of primary health centres (PHC) all over the country. However, the communications at these PHCs are not reliable and the internet speed, 33.6 kbps, at which these PHCs get connected to the district or state level hospitals, is inadequate. Thus, PHCs are unable to provide instant healthcare solutions to patients in remote villages through basic online information exchange or more advanced video transmission for telemedicine. There is a need to build sustainable, cost effective infrastructure and ecosystem for implementing mHealth throughout the country. mHealth will transform the lives of common people if there are adequate initiatives from both the private and the public sector for development of ICT technologies in healthcare.The cost of this infrastructure is a big concern as there are not enough funds available for providing healthcare services to the masses. One solution is to pool resources from different government schemes and to create a fast and robust technology infrastructure fund that serves multiple verticals such as healthcare, education, finance, etc. This will not only help in overcoming high infrastructure costs but also create a synergy between different verticals while ensuring maximum utilization of existing infrastructure. More than 44 percent of rural India faces power cuts of 12 to 15 hours a day, where even a battery backup system does not work-out. Thus, while most modern technologies designed for developed countries assume continuous availability of power and telecom connectivity, it takes time and cost to customise them to address such gaps. Another barrier to rapid delivery of equitable care is linguistic diversity. For example in India with over 22 officially recognised languages and over 1600 'mother tongues', linguistic diversity seems a major barrier in the way of a patient in one region being able to talk to a doctor in another region.Incentivising all the stakeholders involved is a major challenge and raises the question of who will pay the bill, as the cost of infrastructure, medical drugs, fees of doctors, and other operating cost could go very high. Hence there is a need to divide these costs among different entities which include third party financing solution. There is a chance that people may deceive system by duplicity of the same

procedure over and over again, which would lead to unnecessary cost overrun. A physician must be motivated and incentivized in order to share medical records of his/her patient with other practitioners, as they might jeopardise bond of faith between a patient and a doctor. Initial investment which usually is fairly large must be borne by government, and this may raise return required by those parties who are going to get there returns on a longer time horizon.

1.25.1 Cost Containment:

Cost of providing healthcare to population of India is a huge task and introducing ICT would require extra upfront investment. Hence, there is a need to manage the cost in such a way that overall cost of healthcare goes down. If a bigger share is given to ICT spending in overall healthcare budget, this could be achieved. It is also required to look at generating volume beneficiaries for costs to be justified.

1.25.2 Information Exchange:

Health information exchange needs to be demanded and driven with proper access and control mechanism in place. Challenge is to motivate and encourage key stakeholders like patient, medical service provider, insurance companies and government to pull as well as push right kind of information from the system.

1.25.3 Adoption and Resistance:

In India and across the globe there is a problem of reluctance on the part of patient as well as doctors in adopting mHealth. There is a need to bring in the right kind of technology in the right way so patients as well doctors feel comfortable in using them. This could work as an ultimate test of technology, as companies not only have to prepare best technological systems but also make sure that they are easy to understand and use. It is also required to run multiple awareness programmes for benefits of mHealth. Staffing at different levels: mHealth is not just about having technology in place, it should also have an identifiable, approachable and well qualified human interface to interact with. Getting the right kind of people to use these technologies in order to provide proper healthcare services is very important. Hence, there is a need to hire right kind of people and train them properly so that they are well equipped to carry out the task of providing healthcare in remote areas.

1.25.4 Evaluation:

Evaluation of the processes needs to be fair and done by an independent third party observer. There is a need to have benchmark so as to compare against them. These could be taken from best practices from local projects or from global examples such as Sweden, Singapore, etc. An independent body could be created for this purpose which provides rating as well as guidance on how to lay down dependable framework for mHealth.
Power Sharing: The entire system of healthcare should be such that it can be driven from both central and state government. Power, responsibility, accountability, rewards and risks must be well defined in advance so as to avoid any conflict of interest.

1.25.5 Managing Information:

All the information that has been collected should be media rich (containing video, image, text, etc.). This information should be properly archived, accessible, retrievable, secure and readable from remote location using different technology platforms. One patient-one record needs to be implemented, so as to avoid duplication of information. Innovative and cost effective health informatics solutions need to be created for the purpose.

1.25.6 Education:

M-Health is not just about providing healthcare service when someone is unwell, but it should also be used to promote preventive healthcare to improve the standard of living and reduce the cost in the medium to long term. This will also help in improving and enabling higher productivity. But achieving this requires bringing people into the system and educating them about the different preventive measures to avoid disease outbreaks like Swine-flu or other seasonal diseases.

1.26 Telemedicine Set To Boost Health Ervices[15,22,23]

Skype, biometrics, M-health (use of mobile phones) and E-health are all set to make an entry into India's primary health centres (PHCs) and sub-centers as the health ministry steps on the gas to go hi-tech.The steering committee on health has said that in the 12th plan (2012-17), all district hospitals would be linked to leading tertiary care centers through telemedicine, Skype and similar audio visual media. M-health will be used to speed up transmission of data. India will also put in place a Citizen Health Information System (CHIS) - a biometric based health information system which will constantly update health record of every citizen-family. The system will incorporate registration of births, deaths and cause of death. Maternal and infant death reviews, nutrition surveillance, particularly among under-six children and women, service delivery in the public health system, hospital information service besides improving access of public to their own health information and medical records would be the primary function of the CHIS.The committee said in its report to the Planning Commission, "The overarching goal is to develop a biometric-based health information system, which constantly updates health record of every citizen-family, which begins with universal vital registration, which is portable and accessible to service providers and to the families themselves. Based on this foundation, a network links all service providers, public and private laboratories and also generates the figures needed at different levels for policy making as well as generates the alerts needed for disease surveillance."According to the committee, CHIS will incorporate information on service delivery in the public health system helping to make evidence-based and guideline compatible clinical decisions and make morbidity and mortality profile available. This will also help estimate burden of disease and facilitate policy decisions at state and national levels."Placed on a GIS platform, it can identify geographic concentration of disease. The system will also provide hospital information service to improve the quality of care to patients through electronic medical records, to lower response time in emergency and improve hospital administration. It will support emergency response systems and referral transport arrangements, the organ retrieval and transplantation programme," it added.The ministry plans to give a big push to support telemedicine services in primary, secondary and tertiary care. Disease surveillance based on reporting by providers and clinical laboratories (public and private) to detect and act on disease outbreaks and epidemics would be an integral component of the system."The system will also support financial management -- from resource allocation, resource transfers, accounting and utilization to financial services like making of payments to facilities, providers and beneficiaries. It will provide a platform for continuing medical education and support regulatory functions of the state by creating a nation-wide registration of clinical establishments, manufacturing units, drug testing laboratories, licensing of drugs, approval of clinical trials," the document added.The ministry said that states which are ready to make the transition to electronic medical records would be encouraged to do so. "The major part of public investment in information technology in health care would go to institutional capacity building for understanding and use of information. Incurring large expenditures on hardware and software without making a matching input in capacity development and institutionalization would be an error. As part of this, every state should have the skilled human resources needed at state and district level. This would require a mix of those with IT skills and public health informatics skills. State centres for health information, either standalone, or embedded in existing institutions would be essential and district teams of three to five persons for managing information flows and interpreting information would also be essential," the ministry document said.

2. Conclusion

Telemedicine is an umbrella term that encompasses any medical activity involving an

element of distance. In its commonly understood sense, in which a doctor-patient interaction involves telecommunication, it goes back at least to the use of ship to shore radio for giving medical advice to sea captains. A few years ago the term telemedicine began to be supplanted by the term Tele health, which was thought to be more "politically correct," but in the past year or so this too has been overtaken by even more fashionable terms such as online health and e-health. The implementation of telemedicine in routine health services is being impeded by the lack of scientific evidence for its clinical and cost effectiveness. The British government has stated that, without such evidence, telemedicine will not be widelyintroduced. Policymakers have been warned against recommending investment in unevaluated technologies.Recent advances in telemedicine can therefore be considered to be shown by studies that have obtained evidence of cost effectiveness.

3. References

1. International Telecommunication Union, "The world in 2010: ICT Facts and Figures,"http://www.itu.int/ITU-D/ict/material/FactsFigures2010.pdf.
2. Dr. Ajai Shanker et al. Teletransmission ofECG Waveform: An Ingenious Low PricedTechnique", Indian Heart Journal, 1982,Vol. 34, No. 6.
3. Bowonder, B, et al. (2005) A Telemedicine Platform: A Case Study of Apollo HospitalsTelemedicine Project, International Journal of Services Technology and Management.
4. C. Pop-Eleches, H. Thirumurthy, J. P. Habyarimana et al., "Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders," AIDS, vol. 25, no. 6, pp. 825–834, 2011.
5. N. Mahmud, J. Rodriguez, and J. Nesbit, "A text message-based intervention to bridge the healthcare communication gap in the rural developing world," Technology and Health Care, vol. 18, no. 2, pp. 137–144, 2010.
6. T. Tamrat and S. Kachnowski, "Special delivery: an analysis of mHealth in maternal and newborn health programs and their outcomes around the world," Maternal and Child Health Journal, vol. 16, no. 5, pp. 1092–1101, 2012.
7. M. J. Rotheram-Borus, B. L. Ingram, D. Swendeman, and A. Lee, "Adoption of self-management interventions for prevention and care," Primary Care Clinics. In press.
8. S. Nishtar, F. Khalid, A. Ikram, et al., "Protecting the poor against health impoverishment in Pakistan: Proof of concept of the potential within innovative web and mobile phone technologies," World Health Report, Background Paper 55,2012,http://www.rsis.edu.sg/nts/resources/db/uploadedfiles/WHR_2010_HEARTFILE.pdf.
9. D. Estrin, "Participatory sensing: applications and architecture," IEEE Internet Computing, vol. 14, no. 1, pp. 12–14, 2010. P. Travis, S. Bennett, P. A. Haines et al., "Overcoming health-systems constraints to achieve the Millennium Development Goals," The Lancet, vol. 364, no. 9437, pp. 900–906, 2004. T. Adam, S. S. Lim, S. Mehta et al., "Cost effectiveness analysis of strategies for maternal and neonatal health in developing countries," BMJ, vol. 331, no. 7525, p. 1107, 2005. World Health Organization, World Health Statistics, World Health Organization, Geneva, Switzerland, 2010.
10. "Wanted: 2.4 million nurses, and that's just in India," World Health Organization, 2012,http://www.who.int/bulletin/volumes/88/5/10-020510/en/index.html.
11. "Nursing in crisis," 2011, http://www.china.org.cn/china/2011-05/13/content_22559759_3.htm.
12. S. M. Swider, "Outcome effectiveness of community health workers: an integrative literature review," Public Health Nursing, vol. 19, no. 1, pp. 11–20, 2002.
13. R. Black and H. Perry, "Community health workers: key agents for reducing child mortality,"Global Health, vol. 10, p. 16, 2011.
14. S. Krishna, S. A. Boren, and E. A. Balas, "Healthcare via cell phones: a systematic review,"Telemedicine and e-Health, vol. 15, no. 3, pp. 231–240, 2009.
15. H. Cole-Lewis and T. Kershaw, "Text messaging as a tool for behavior change in disease prevention and management," Epidemiologic Reviews, vol. 32, no. 1, pp. 56–69, 2010. B. S. Fjeldsoe, A. L. Marshall, and Y. D. Miller, "Behavior change interventions delivered by mobile telephone short-message service," American Journal of Preventive Medicine, vol. 36, no. 2, pp. 165–173, 2009. View at Publisher • View at Google Scholar • View at Scopus

16. D. Swendeman and M. J. Rotheram-Borus, "Innovation in sexually transmitted disease and HIV prevention: Internet and mobile phone delivery vehicles for global diffusion," Current Opinion in Psychiatry, vol. 23, no. 2, pp. 139–144, 2010.
17. M. J. Rotheram-Borus, D. Swendeman, and B. F. Chorpita, "Disruptive Innovations for designing and diffusing evidence-based interventions," American Psychologist, vol. 67, no. 6, pp. 463–476, 2012.
18. B. F. Chorpita, M. J. Rotheram-Borus, E. L. Daleiden et al., "The old solutions are the new problem: How do we better use what we already know about reducing the Burden of mental illness?" Perspectives on Psychological Science, vol. 6, no. 5, pp. 493–497, 2011.
19. M. Hebert, "Telehealth success: evaluation framework development," Medinfo, vol. 10, no. 2, pp. 1145–1149, 2001.
20. W. De Neve, C. De Wagter, K. De Jaeger et al., "Planning and delivering high doses to targets surrounding the spinal cord at the lower neck and upper mediastinal levels: static beam-segmentation technique executed with a multileaf collimator," Radiotherapy and Oncology, vol. 40, no. 3, pp. 271–279, 1996.
21. U. Isacsson, H. Hagberg, K.-A. Johansson, A. Montelius, B. Jung, and B. Glimelius, "Potential advantages of protons over conventional radiation beams for paraspinal tumours," Radiotherapy and Oncology, vol. 45, no. 1, pp. 63–70, 1997.
22. A. Pirzkall, F. Lohr, B. Rhein et al., "Conformal radiotherapy of challenging paraspinal tumors using a multiple arc segment technique," International Journal of Radiation Oncology Biology Physics, vol. 48, no. 4, pp. 1197–1204, 2000.
23. A.W. Powell III, "Reengineering health care delivery using telemedicine," in Proceedings of the Medical Technology Symposium, pp. 371–374, Honolulu, Hawaii, USA, 1998.