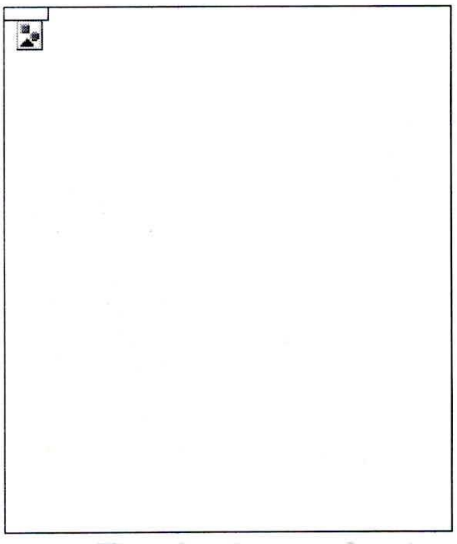
DR 36.



Delving into the Digital Divide

By Kumar Venkat, Surya Technologies Inc.

The power of technology and market forces to solve the central social problem of our times--the extreme poverty and deprivation of sections of the population in every part of the world--has become almost an article of faith. In fact, the idea of closing the digital divide is now at the core of major poverty reduction efforts.

The information technology industry, having nearly sated demand in the developed countries, is naturally eager to create new markets elsewhere. Political leaders in many developing nations, having failed to address poverty in their countries, are grasping at new technologies and global trade as their last, best hope to raise their large populations' standards of living. Consequently, business executives and government officials are often on the same side of this issue, backed by powerful international agencies such as the World Bank and the World Trade Organization (WTO).

Frequently missing from policy statements, business initiatives, and other poverty reduction proposals, however, is an accurate understanding of what technology can do. A critical question is whether the digital divide is a *cause* of poverty or an *effect* of the underlying social and economic divides.

The United Nations Development Program (UNDP) is the premier international agency dedicated to fighting poverty. In its *Human Development Report for 2001,* it asserted that the technology divide does not have to follow the income divide. But the evidence to date shows that the current technology divide has consistently followed the income divide all over the world.

More than 96 percent of computers connected to the Internet are in the wealthiest nations, home to 15 percent of the world's population. Nearly 60 percent of the U.S. population has some access to the Internet, a distribution that is highly correlated with household income. In India, less than 0.5 percent of the population has Internet access--which translates to about five million people with high enough income levels, education, and computer skills in a country of one billion people.

It is also instructive to look beyond access to technology and focus on outcomes. The latest U.S. economic boom was fueled in large part by new technologies. But in spite of all the prosperity and proliferation of technology, the national poverty rate remains above 11 percent--essentially where it was before the computer revolution in the mid-1970s. Nearly 40 million Americans lack health insurance and over 15 percent of children are growing up in poverty. Technology and market forces have clearly stopped short of addressing poverty in the United

States, and not surprisingly, they have stopped at the point where there is no profit to be made.

Moreover, the income gap between the rich and the poor in the United States has expanded by almost 50 percent over the last quarter century. The implication is that, as market forces propagate new technologies, people who are already doing relatively well are likely to benefit the most, reinforcing long-standing economic disparities. The digital divide is thus an effect and manifestation of these disparities in wealth.

The United States, of course, is a "best case" example. Poverty in developing countries is far broader and deeper. Most of the 1.3 billion people surviving on less than a dollar a day live in developing countries. Given the United States' failure under the best of economic conditions to eliminate poverty within its own borders, is it reasonable to expect that developing countries could use the same tools--technology and markets--to root out the same problem on a much larger scale?

The UNDP Report, to its credit, acknowledges that technology is created in response to market pressures, and not the needs of the poor. Markets, in turn, are driven by the investments and consumption patterns of the affluent sections of society. In many cases, technologies have been developed to make life comfortable and convenient for those who are not worrying about their next meal or wondering how to get medical care. Much of the recent focus on poverty reduction has been on applying these technologies of convenience to situations where fundamental human needs have yet to be met.

This is not to say that people in poor countries have no use for modern technologies or that market-based approaches cannot play a role in a broad attack on poverty. In Bangladesh, one of the poorest countries in the world, Grameen Bank has successfully used micro-credit to encourage entrepreneurship in several thousand villages. In each village, an entrepreneur purchases cell phone service from a subsidiary of the bank, and operates a pay-per-call service that in effect connects the whole village to the telephone network. These small-scale enterprises have turned a profit in most cases, and loan repayment rates are very high.

The digital divide seems quite meaningless for the multitudes everywhere who lack essentials like adequate nutrition, primary health care, basic education, safe water, and sanitary living conditions

While the program is quite small, Grameen Bank's experience suggests that micro-credit could work in poor countries, often at the level of just a few hundred dollars. The challenge is in applying innovative approaches like this on a broader scale without getting caught up in the hoopla surrounding new technologies and globalization.

Alvin Toffler, the futurist, has urged combining the idea of micro-credit with "micro-trade." He envisions poor people in small villages using the Internet to "identify markets 10 thousand miles away" for small amounts of agricultural products or crafts.

The obvious problem with this argument is that it requires people who might not even be literate, let alone computer savvy, to make sophisticated use of the Internet for marketing and sales over long distances. Moreover, while it is easy to send information around the world through the Internet, it is inefficient and complicated to ship large numbers of small packages everywhere, especially from hundreds of thousands of small villages often deficient in transportation infrastructure.

Gurcharan Das, a former business executive and now a venture capitalist in India, proposes in his recent book *India Unbound* (Alfred Knopf, New York, 2000) that, in the "globalized open economy governed by the WTO," developing countries like India should make only what they are good at and import the rest. As an example, he suggests that a little software could buy a great deal of a generic commodity like steel.

But what about the hundreds of millions of Indians who are producing other things and have no chance of participating in this trade regime? Global trade is no substitute for building diversified and healthy local economies.

Are the poor a business opportunity?

The digital divide is a major concern to technology companies, because it bars billions of people from buying their products. But it is difficult for industry to tap this market potential

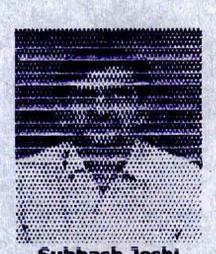
without addressing poverty as an issue. Microsoft chairman Bill Gates has publicly stated that he does not see the rural poor in developing countries as a significant business opportunity. Hewlett-Packard, believing it can "do good while doing well," has responded more positively. Its World e-Inclusion program is a plan for working with local partners on applications that are "appropriate and relevant" in areas like telecommuting, e-commerce, and financial services. It remains to be seen how bottom-line pressures will influence the choice of applications. Moreover, some of the applications the company is interested in, such as "e-jobs" based on global telecommuting, seem appropriate only for those with fairly high levels of education and skills.

The technology divide is real for those who have moved beyond obtaining the basic necessities of life and are held back by lack of access to technology. Bridging the divide might well make a big difference to this section of the population, while bringing new revenues to technology companies.

On the other hand, the digital divide seems quite meaningless for the multitudes everywhere who lack essentials like adequate nutrition, primary health care, basic education, safe water, and sanitary living conditions. Access to information technology cannot be useful unless such needs are also met at the same time. Even if a primary school in a village is equipped with computers, a child will not benefit if she is malnourished, if her parents are struggling to make a living, or if her family cannot get medical care.

Any serious solution to such deep poverty will necessarily have to reach beneath the digital divide and confront the underlying disparities in society. Ultimately, the nature of the problem should dictate the solution. An age-old human problem like poverty suggests a people-centric approach that is built around meeting the needs and aspirations of human beings, using whatever technologies are appropriate and sustainable. Society must find ways for the poor--the landless laborers and subsistence farmers in rural areas, the low-wage workers living in urban slums--to earn a living wage and supply their own needs with a measure of dignity. This would take nothing less than a paradigm shift in how we view and tackle poverty in this age of information and globalization.

DR 36.2



TELEMEDICINE: WHAT, WHY AND FOR WHOM

Subhash Joshi
sureg@icenet.net

INTRODUCTION

Telemedicine is very much in vogue these days. There are 'n' number of popular articles in newspapers and magazines, just as there are several technical articles on the subject. There are many meetings, conferences and workshops on telemedicine. The number of websites —both Indian and foreign- has to be seen to be believed. But in spite of all these, the concept is somewhat diffused and vague. There are apparently different levels at which telemedicine is understood and practised. This article attempts to discuss telemedicine in the overall context of India. Telemedicine is basically an application of communication technologies for medical purposes and hence it is necessary to examine both these contexts of communication and health/medicine.

The present communication revolution has two major aspects: (1) Its very rapid expansion alongside its user-friendly nature and (2) merger or convergence of several different communication technologies. The way radio and television has spread in the last couple of decades makes the point of widespread use very apparent. The spread may not be uniform. The developed countries have a far greater access than the developing countries. But even in the latter countries, the spread has been no less phenomenal. For example, a country like India has as many as 75 Million television households. The case of personal computers (PCs) illustrates the user-friendly nature of technology. The PCs have become so user-friendly that even small children can operate it with ease. These different media, however, do not any more operate in isolation.

There has been a remarkable convergence of different media of communication. The Internet is a classic example of this. It combines the features of mass media, telecommunications and computers. It is no longer just a sum of different technologies. It is a new communication technology with unique features of its own. All this has opened the doors for a variety of applications. Telemedicine is one such application.

WHAT IS TELEMEDICINE

The term "telemedicine" is derived from the Greek '*telly*' meaning '*at a distance*' and from the Latin '*mederi*' meaning '*healing*'. In its simplest form telemedicine means enabling people in one geographical area to have access to a trained medical specialist in another geographical location. Understood in this mode telemedicine can be of a very simple nature or can assume a very complex form depending upon the purposes and the types of technologies used.

Telemedicine understood in this simple form is really nothing new. Medical advice through correspondence, letter, etc. has been in practice for several years. Doctors providing tips on diagnosis or treatment of ailments through newspaper columns or through radio and TV broadcasts also hardly need a reminder because they are so widespread. Telemedicine through correspondence involved considerable time lapse between the patient's query and the advice of the doctor, but protected the privacy of the patient. Telemedical advice through the print media made it more widespread, but ceased to be one to one. The response to the queries through radio and TV broadcasts accelerated the spread of information and like the newspapers had the 'advantage' of being both specific to the query as well as it being shared by other members of the audience.

A more basic change occurred when the phone-in programmes on radio and TV became popular. The patient can directly call on to a doctor in the studio and the advice could be given live and in an interactive mode. Since it is in the broadcast mode, other members of the audience can hear both the query as well as the advice. Here was a combination of the medium of telecommunication and mass media, which saved time and extended the reach. Radio and television broadcasts can also be categorised as a form of telemedicine.

Telemedicine these days, however, is not understood in its simpler form. It would mean something significantly more than a mere dialogue between the patient and the medical specialist. The complexity has become possible because of the new communication technologies. They have become faster, more widespread and more independent of geographic locations.

Telemedicine is a system of health care delivery in which the physicians examine distant patients through the use of telecommunication technology. This communication bridge can take several different forms. It can be live or it can be offline. It can be delivered via a two way interactive audio and video mode or two way time delayed, stored and forward multi-media electronic mail. Basically it means that the patients' data ranging from description of the symptoms in a text form or medical data in the form of simple X-rays and electroencephalograms to more advanced angiograms, magnetic resonance images, and histopathology slides can be transmitted from a distant location to the medical specialist located practically anywhere in the world. The specialist studies all these medical data and conveys his diagnosis and the treatment to the patient through the doctor at the patient-end. This also may happen through live interaction or on the off-line mode.

WHY TELEMEDICINE

Telemedicine is used for a variety of purposes. Some of the more common purposes include: (1) Remote consultation; (2) Second opinion; (3) Interpretation services; (4) Continuing education and exchange of clinical information; (5) Home care and (6) Online surgery in some very rare cases. Of all these, the first three are the more common uses of telemedicine the world over. Telemedicine is open to a variety of medical specialities such as cardiology, pathology, neurology, psychiatry, dermatology, opthalmology, oncology and practically every other branch. It is also useful for emergency care, home health care and distance education.

One of the advantages of tele-education is that it can reduce excessive demands on the health care system by focusing on prevention. If the people are empowered through tele-education, it helps in creating a physically and mentally healthy society. Tele-education can take three major forms: (1) Continuing distance education, (2) Community health education, and (3) Access to remote information. The medical specialities to which telemedicine will be applied and for which specific purposes it will be applied should depend upon the needs of the community, availability of infrastructure and availability of medical professionals.

Since India's independence from the British rule in 1947, the country has made significant progress in several areas including health. For example,

Smallpox has been completely eradicated, the infant mortality rate has been brought down, life expectancy has gone up, pre and post natal care facility has improved and there is overall progress in disease control and establishment of modern health infrastructure. There is extensive network

of dispensaries, hospitals and institutions providing specialist curative care. There are a large number of well-qualified medical and paramedical staff available and a very significant indigenous capacity has been established for production of drugs, vaccines, hospital equipment, etc. Yet a lot remains to be done. There is scope for improvement in practically every area of health care. India's rank is still above 100 in terms of the overall health system performance. The peri-natal mortality rate is about 46 which compares very poorly with some of the other Asian countries like Sri Lanka (25), Thailand (20) and not to speak of developed countries like Japan and Singapore (5 each). The ratio of doctors to population is also very poor. In developed countries there is one doctor for every 500 persons. In India this ratio is one to 15,500.

What is even more significant in India is the stark contrast that one sees in the health status and the availability of infrastructure. Advanced medical services, highly trained medical doctors, modern medical equipment, etc. are available in some or the other part of the country. There is a sizeable section of population enjoying very high level of health status and medical care. The overall health indicators have also gone up significantly in some sections of the society. If one were to look at the urban areas and the rural areas, the stark contrast becomes very obvious. The big metros and towns will have the most advanced facilities available while the villages do not have even rudimentary services available. It is in a situation of such stark contrast one has to see the applicability and usefulness of the telemedicine programme.

TELEMEDICINE FOR WHOM

Telemedicine to be really useful in India would mean to reach the unrelated rather than merely enhancing the facilities of those who already have better means of obtaining medical services. If telemedicine is merely going to serve the needs of a few rich patients in cities like New Delhi and Mumbai, it will have little relevance. This is not to say that these segments should not have these facilities, but only to underline that they already have such facilities available and they could afford to have telemedicine not only within the country, but even with the best of super specialists in any other part of the world. Telemedicine, therefore, for this purpose will be discussed only from the perspective of the unreached who are in need of specific interventions.

It can be clearly seen from the discussion so far that certain amount of infrastructure/facilities is pre-requisites of telemedicine programme. These include: minimal availability of medical/para-medical staff, availability of electricity, availability of communication lines like telephone, availability of elementary hospitals and clinical investigation facilities are a must. This contrast creates a dilemma. Looking at the Indian conditions, if you look for a place with this minimal infrastructure, one also sees that there are doctors available. In other places you have neither doctor nor the infrastructure and facilities available. This creates a peculiar condition. Efforts, however, have to be made to overcome this contrasting situation. It is true that there is shortage of facilities, but it is not as if nothing is available. It is true that a village or a group of villages may be such where no facilities are available. But many of them will be available somewhere in the district place usually not very far from the villages. Some hospitals, either government, private or charitable trust owned, is available in any district town. A reasonable number of medical staff and associated medical facilities are also available in these towns. So telemedicine facilities (patient end) will have to be created in some such district towns. Patients from the nearby villages any way visit these hospitals and may have to come for tele-medical purposes also. These patients end can be linked to super specialist end in any other part of the country/world (where the best of doctors would be available) and interaction can be established between these two ends. Telemedicine can be expensive in the initial stages, but over a period of time as the technologies develop, the human power gets used to using these facilities, the cost will gradually decrease.

Telemedicine is able to overcome some of the identified barriers of delivery of specialist health care. Some of these barriers are lack of proper public transportation, large distances, travel time and cost, waiting time after having reached the hospitals, lack of economic means and non-availability of trained medical doctors especially specialists and super specialists.

There have been quite a few efforts to use telemedicine but these are usually restricted to bigger metro and towns cities. These have taken place at the initiative of the private parties. There are stray examples of charitable institutes using this technology; there are a large number of health web sites in India. But in all this, there is very little of planned, goal-directed telemedicine intervention programme to meet the requirements of the needy. For the telemedicine programme to be effective and 'successful' in India, the following criteria will have to be met:

1. It should benefit the unreached
2. It should benefit a larger community
3. Medical data transfer be error-free and reliable
4. Medial technology should be user-friendly
5. There should be a complete system — properly equipped patient-end, super specialists, links, etc.
6. There should be proper storage and retrieval system for the medical data
7. The medico-legal provisions should be thoroughly thought through
8. Its economic sustainability should be looked into from the beginning
9. Maintenance aspects are important but often neglected at the planning stage. This can lead early death of the project after birth
10. It should be able to meet the felt and observed needs of the community

DECU's EFFORT

Telemedicine clearly has enormous utility for a country like India. Care has to be taken that it does not remain confined to a few well-to-do patients in big metros. Given the scarcity of medical facilities in rural areas, efforts will have to be made to take this technology to these areas as the majority of Indians reside in the villages. Market forces alone will not meet their needs. There will have to be a planned intervention programme dedicated to this end. Development and Educational Communication Unit (DECU) of Indian Space Research Organisation (ISRO) is now trying to set up a needs based telemedicine project in different parts of the country. ISRO has recently initiated a GRAMSAT ('satellite for villages') programme. It is aimed at reaching out to the villages for development and educational purposes. A variety of satellite based technologies/applications will be used for this purpose.

One of the major applications programme under consideration is that of telemedicine. DECU proposes to initiate it in three or four states wherein links will be established between remote rural areas to specialist ends. Detailed monitoring, feedback and evaluation studies have been planned. The progress and achievements of telemedicine should be of interest to all, especially in the developing world.

DR 363

Challenges in Development of an Integrated Telemedicine System in a Developing Country – The Indian Experience

Sanjay P. Sood [1] **& R.S. Khandpur** [2]
Centre for Electronics Design & Technology of India
A-34, Phase 8, Industrial Area, SAS Nagar, INDIA.
1 System Engineer (Project Telemedicine)
2 Director

Centre for Electronics Design & Technology of India, SAS Nagar, India was awarded a project "Development of Telemedicine Technology" by Ministry of Information Technology, Government of India. The primary Objective of the project was to link three premier medical institutes of North India for practicing Telemedicine, initially for the three specialties of radiology, pathology and cardiology.

The development of the integrated telemedicine system - ***Sanjeevani*** in a developing country like India was a challenging task. All the components of telemedicine namely Telecommunications, Medical Technology and Health services infrastructure posed rather unexpected challenge. The objectives had to be disintegrated into smaller modules in order to keep the deliverables within sight. This strategy met the targets both timely and precisely. Some of the challenges those were addressed during the development process were :

- The design and the approach towards the development had to be such that would not dislocate the existing pattern of working regarding patient records.
- Initial development and modular testing and trials had to be limited to LAN as the communication service provider needed their time to install the lines.
- The communication services (mainly ISDN) provided by the service provider were not in tune with the technology that was being offered, primarily because of the lack of experience.
- The development had to be done keeping in mind cost vis-à-vis ultimate objective i.e. this pilot study had to be planned for a tertiary level institute whereas eventually the technology was to be adopted for the peripheral institutes with limited resources (both professionally and financially).
- Medical peripheral devices being used were PC based as against the stand alone devices which the medical professionals had been using ever since. This was to be ensured so the adaptation by the medical fraternity easy.
- The design of the system had to be cost effective and this lead to the selection of a conventional relational database management system for image storage and retrieval as against the necessity of having a PACS based system.
- Since the prevalent infrastructure does not support inclusion of Telemedicine facility at the medical institutes at the developmental level, concept of a centralized Telemedicine facility was preferred for all the applications of Telemedicine.

The challenges faced, no doubt typically reflect the developing world's culture. The paper will address the challenging issues faced during the development and implementation phase and the strategy adopted to overcome the problematic issues.

Telemedicine: Hype Vs reality

Dr Saji Salam

Many hundreds of consultations have taken place since HealthNet began operating in June 1990. The second of these consultations — and one of the most dramatic to date — involved a baby named Aida Porras. Less than an hour after she was born in Alpine, Texas, she began to have what doctors call "severe respiratory distress" — in other words, she could barely breathe. Her doctor, James Luecke, immediately contacted HealthNet in Lubbock, more than 500 kilometers away. In minutes, he and Dr Marian Myers, a neonatologist, were reviewing the baby's X-rays and lab work. Dr Myers decided that Aida had aspiration pneumonia and told Dr Luecke how to counteract it. Within two hours, Aida was breathing comfortably.

TeleDoc designed and manufactured by Texas Tech's Health Sciences Center, is a self-contained, portable unit about 1.5 meters tall and one meter wide. Setting it up at the place where the patient is being examined is simple: just plug in a power cord and a telephone cable. On top is a small camera with a remote control that makes it pan,

ult, and 200th. This video transmission device also incorporates endoscopic attachments for examining ears, throats, joints, and internal organs. A large high-resolution monitor shows the patient at both locations — and a smaller one shows the consulting specialist. A microphone picks up all conversations. Inside TeleDoc is also a lightbox that allows transmission of X-ray images and a video cassette recorder for documenting the consultation. Designers are working on a TeleDoc Junior, a unit designed to be the size of a briefcase that could be carried in ambulances or a doctor's car.

This is the kind of technology which is written about nowadays when it comes to telemedicine. This article explores some of the myths and realities associated with telemedicine and examines where our healthcare providers stand with regard to some of the developments in this space.

The Indian healthcare industry has been exposed to various flavours of "telemedicine," from the healthcare portal suggesting that healthcare info provided on the website uses telecommunications to provide healthcare information to patients, thus delivering 'tele health,' to video conferencing vendors who claim to be "telemedicine" providers. At the other end there are a few genuine healthcare providers who really use telemedicine effective to provide care, minus the hype, and organizations such as ISRO which are taking an innovative approach to facilitate healthcare delivery by way of launching an exclusive health satellite. To the mind of many healthcare stakeholders there is still confusion on what really comprises telemedicine.

What is telemedicine?

According to a Japanese definition in 1996, "it the use of any electrical signal to transmit medical information". In a JAMA paper in 1995 telemedicine has been defined "as the use of telecommunications to provide medical information and services. It may be as simple as two health professionals discussing a case over the telephone, or as sophisticated as using satellite technology to broadcast a consultation between providers at facilities in two countries, using videoconferencing equipment".

A broader definition from University of Virginia is "the use of telecommunication technology to deliver healthcare services and health education to sites that are distant to the host site or educator." The American College of Radiology has however defined the detailed ACR standard for teleradiology, which includes definition of teleradiology, besides goals, qualifications, qualification of personnel, equipment guidelines, licensing, communication, quality control.

Applications

Clinical applications could be utilized in the following areas effectively, though one could argue that telemedicine could be used for any specialty, like cardiology, radiology, homecare, pathology, endoscopy, nephrology, ophthalmology, surgery and emergency care. Many of these have specific applications and interfaces built around these specialties, which differentiate them from generic telemedicine applications.

International Scenario

The history of telemedicine dates back to 1971, when the Alaska Biomedical Demonstration Project linked 26 sites using NASA satellite technologies. The Nebraska Psychiatric Institute is mentioned as the pioneer in some papers citing the use of closed circuit television in 1955 as "telemedicine". In 1967, Mass Gen linked up to Logan airport using 2 way audiovisual microwave circuit. The developed world has made major strides in utilizing telemedicine for healthcare delivery.

Telemedicine in India: The drivers

The drivers for adoption of telemedicine could vary from country to country based on various factors. Some of the factors that would expedite the telemedicine revolution in India are:

Topography: Think of a patient in Tinsukiya, Assam or Aragonda, Andhra Pradesh who requires a consultation with a specialist at Bangalore or Mumbai. The cost of travel and the travel it self could be a deterrent to the poor patient in these rural settings. Even if a specialist is available at the nearest town, reaching the interiors of such a far flung village would be a challenge. This is where telemedicine could be utilized as an effective medium for healthcare delivery. India with a diverse collection of landscapes with mountains and valleys and high altitudes, telemedicine could well be a boon for the patients.

Travel time/ cost: There is a shortage of specialist/ super-specialist professionals in India, especially in rural areas. It might not be good time management on the part of the specialist to travel all the way to the rural areas without having enough patients to be attended to there. Travel time can be cut down dramatically while the expertise is made available in real time via technology. The specialist's physical presence becomes necessary only when a surgical procedure is planned. In reality even surgical procedures are being conducted with guidance from the specialist who is at a remote location. For a patient cost of travel is a major worry especially if she has to fly in to a specialist care center in a city.

Pressure to reduce costs: Cost of healthcare and questions on who will bear the burden of care are issues across

the world, developed countries included. The incidental expenses related to patient care, i.e. the cost associated with factors other than the actual medial care such as travel, accommodation for relatives, food etc also contribute substantially to the cost of treatment. In a country where health insurance is yet to catch up, cost of acre is borne by patients, in many cases by selling property and livestock. If hospitals can reduce these costs associated with treatment it would go a long way in reducing the burden of care on the patient. Telemedicine seems to be the answer.

Availability of healthcare facility/ transportation

It is no understatement if I say that healthcare delivery in rural India is not adequate. The government has limitations and so does private enterprise. Setting up a full fledged care facility at a remote location might not always be economically or operationally viable. Even if there is a healthcare facility with bare minimum resources, transportation might be a challenge. Various studies have documented the inverse relationship between distance and outcomes particularly in acute MI and ventricular arrhythmias. Training telemedicine is an effective medium to impart knowledge to professionals within a healthcare organization. This becomes relevant in corporate hospitals chains spread across the country wherein they could share and institutionalize best practices across the group. Telemedicine could also be utilized to provide public health education to the remote corners of India.

Telemedicine for competitive advantage

Telemedicine is a technology-enabled marketing tool as well. It makes it possible for hospitals to address the needs of patients who might not have otherwise used their services. Slowly and steadily telemedicine is being utilized as a tool for competitive advantage, which would over a period of time, lead to a divide in the healthcare industry along the lines of "telemedicine haves and have nots".

The players: The two major players in the telemedicine space in India are Apollo Hospitals and Asia Heart Foundation. Between the two, several remote villages have realized the benefits of technology-enabled care. The organizations are now in a position to share the expertise available in-house with neighbouring countries too. The missionary zeal with which these hospitals operate will ensure that distance does not deter patient care. The public sector too is taking steps in this direction. According to Dr Alok Roy, Asia Heart Foundation, several lives were saved by telemedicine intervention in far flung villages, which might not have been otherwise possible.

Issues: Beneath the glossy reports of telemedicine successes, there are many stories of hard work, dedication which happen behind the scenes to make this all happen. Making Telemedicine work is not as sweet as the reports. Some of the issues involved are outlined below:

Connectivity: Connectivity for telemedicine is a major concern as many of the remote villages do not have basic telephony. Thus an exclusive satellite from ISRO to service healthcare needs is revolutionary and will change the dynamics of telemedicine in India very soon. Satellites provide almost 100 per cent uptime, making it the best medium for countries such as India with diversity in terrain. The bandwidth available with various connectivity options are provided below.

POTS	- 20 kbps
ISDN	- 128 Kbps
T1	- 1.54 Mbps
Cable modem	- 1- 27 Mbps
T3	- 44 Mbps
ATM	- 155 Mbps
Small Foot print Satellite Dish:	400 kbps
Low orbiting Satellite	
Asynchronous:	6 mbps
Synchronous:	14 kbps - 2 Mbps
Wireless Terrestrial:	1- 26 Mbps

Standards

As telemedicine becomes ubiquitous, a challenge to be addressed is adherence to standards. A few years down the line, when corporate mergers and acquisitions become commonplace in the healthcare sector integrating to leverage investments made be a major roadblock to integrating services. Integrating disparate systems could be expensive in the long term, unless standards are followed from day one. HL7 and DICOM are two standards that are critical for the success of Telemedicine in India.

Security & Privacy

Security and Privacy are no serious concern in India at the moment as consumerism in healthcare is yet to take the proportions in the developed world. However this is set to change soon. As patients become more aware, thanks to the Net, these concerns will have to be addressed. European and US standards for Privacy and Security are being incorporated by vendors in those countries.

Integrating the Healthcare Enterprise initiative is a US initiative by leading trade organizations in the US. The role of IHE is the integration of healthcare information, promotion of existing standards (eg HL7, DICOM, CORBA, XML) and implementation profiles for transactions used to communicate images and patient data within Hospital Information systems Radiology Information systems (RIS) and Picture Archiving and communication systems (PACS). These initiatives will make the move towards a Telemedicine enabled Electronic Health Record.

Legal & regulatory

Who is liable is a telemedicine assisted remote surgery ends in a disaster due to loss of connectivity? The surgeon? The Satellite provider? The software/hardware provider? What is the legal status of a telemedicine based diagnosis in a medico legal framework? Many of thee questions have not been raised in India as we are still in the honeymoon phase of telemedicine, when all news is good news.

Management issues

Strange as it may sound the major areas of concern in telemedicine implementation is not technology perse, but the organization's preparedness to handle the management and human resources issues related to the same. Telemedicine is a labour intensive process which involves co-ordination with sending and receiving stations and the staff technical, clinical and support staff at the centers. Management buy in is slow in most organizations. Training the doctors, nurses and technicians on a continuous basis is critical, more so as employee turn over is increasing in the healthcare setting. The success definitely depends on the management's commitment to a long term strategy to achieve competitive advantage utilizing telemedicine.

GoK to set up task force for telemedicine project implementation

EHM News Bureau - Bangalore

The Government of Karnataka is in the process of setting up a task force for implementation of telemedicine projects in co-ordination with all hospitals and government machinery, Dr G Parameshwar, state minister for Higher Education and Medical Education, Government of Karnataka, has said. He was speaking at the inauguration of California-based company Televital Inc's unique technology which empowers medical service providers to monitor, diagnose, treat and manage their patients from any remote location, anytime, thus overcoming the barriers of time and distance.

Healthcare being one of the priorities of the state government, it is determined to provide better specialised facilities in healthcare system to rural masses at cheaper cost, the minister said. "Televital will play an important role in the delivery of technology in healthcare. We are planning to provide this facility by networking all the district and taluk hospitals and all other pubic health centres in the panchayat levels. Initially we are looking at Hubli and Dharwad," he said.

Director of Medical Education, Government of Karnataka, Dr Seethalaxmi said, "Telemedicine is already present in a small way in the eight government hospitals in Karnataka and with Televital, we see scope for implementing telemedicine on a larger scale."

Televital Inc was founded with the vision of empowering medical service providers with the potential life saving, time saving and cost saving tools and services to monitor, diagnose, treat and manage patients without the barriers of time and distance. It specializes in providing a browser based integrated electronic patient care system. Real time streaming can take place over broadband networks or DSL lines, dial-up modems or 2.4K Iridium based satellite phones. The acquired vital data can be securely viewed using a PC or handheld device by medical experts who can be anywhere in the world. Multiple doctors in a conference mode can view the same data.

Speaking on the occasion, Rajan K Pillay, CEO and director, Indian operations of Televital said, "The technology is very useful in a situation where it is not practical for everyone to build speciality hospitals."

Televital has built a working relationship with NASA for their applications. It can regulate hospital application anywhere in the world and provide medical connectivity like pulmonary functional testing, anesthesiological monitoring and so on. The company is also looking at providing remote training and supervision in medical schools.

"We are initially looking at healthcare organisations in the South for our technology. Telemedicine can carry total medical specialities like emergency healthcare, home healthcare and distance education. The technology is viable for a country like India which has 23,000 PHCs, district hospitals, multi speciality and super speciality hospitals with one doctor for every 15,500 persons as against one doctor for every 500 persons in the developed countries. However we need to provide error free and reliable information with user friendly medical technology to increase diagnostic medical efficiency," said Prof M N Shivaram, vice president, India operations.

"What we need is proactive support from the centre and state governments. We are planning to go for a contract with ISRO to provide medical education link for teaching hospitals," he added.

In India, Televital recently established a link between Amrita Institute of Medical Sciences, a 800-bed multi-

speciality hospital at Kochi with the Amrita Kripa Charitable Hosptal at a remote village called Vallikavu, a distance of about 150 kms to provide medical speciality consultation to the rural area in real time. Televital plans to expand its network to Andhra Pradesh, Tamilnadu and Lakshadweep. In future Televital is looking at foraying into some of the future segments like home healthcare, clinical trials, remote care for travel industry and correctional facilities.

Telemedicine service in Pune primary health centers

by V.Radhika, India Abroad News Service

Pune, May 3 - Those living in interior Pune villages will now be able to avail expert medical council well within their means, thanks to a unique telemedicine program.

The Pune district administration has teamed up with www.doctoranywhere.com and Tata Council for Community Initiatives (TCCI) to launch a telemedicine service from a government primary healthcare center (PHC).

The service, says the Chief Executive Officer of Pune district administration V. Radha, will reduce the traveling time and expenditure of the poor villagers.

The villagers rush to big cities to meet specialist doctors. Since their relatives often accompany the patients, the cost mounts up. The service launched at three primary health centers is targeted at the rural masses, Radha told IANS.

There are 88 PHC's in Pune district, each manning five to six sub-centers. The PHC's are manned by two doctors each and equipped with basic medical facilities, including operation theatres, laboratory and a pharmacy. The staff consists of 15 personnel who travel to the sub-centers to implement government programs on primary health, vaccinations, leprosy and AIDS.

The telemedicine project, she said, will ultimately connect all the PHC's in the district. In the first phase, three PHC's in Wagholi, Chakan and Paud regions would be linked with the district administration of Pune and the specialists.

"If we have the headquarters connected with these PHC's, we can respond immediately. If there is an emergency, we can at least rush medicines. There are at least five to six doctors always present at the headquarters who can respond even if there are no specialists."

As part of the project, a two-day training program was conducted recently for 12 doctors. According to Chetan Shetty of doctoranywhere.com, "These doctors along with the doctoranywhere team will train the key users of the computer and impart training about the software provided for telemedicine at each heal

Internet is an emerging key component of telemedicine infrastructure in developing nations

20th July 1999
Madanmohan Rao,
World Telemedicine Summit
Buenos Aires

The certified elimination of smallpox from the face of the earth in 1986 was the greatest public health success story in the world. The second - but less well known - success story was the use of IT and telecommunications in the control of river blindness in West Africa earlier this decade

It involved sensors, telephone lines, satellite links and computers for the surveillance and tracking of the deadly black fly larvae living along 50,000 kilometers of the Volta river, which runs through 11 West African countries.

"Today, new forms of communications and information technology like the Internet are becoming an important part of the national infrastructure for health care around the world," according to Dr. Salah Mandil, health informatics director at the World Health Organisation (WHO).

Participants from around the world gathered recently in Buenos Aires, Argentina, for the International Telecommunications Union's Second World Telemedicine Symposium for Developing Countries.

A Multidisciplinary Approach

Around the world, costs of health care are going up -- but IT and telecom costs are dropping. Governments are also under coming under increasing pressure to cut costs, make their services more economically affordable, and privatise sectors like telecommunications and health care.

"The challenge in telemedicine systems is to harness new technologies and operating models while also improving equity in access to high-quality health care," said Mandil.

Telemedicine requires a multidisciplinary approach involving varied sectors like telecommunications, IT, medical experts, general practitioners, hospitals, equipment suppliers, logistics companies, government agencies, social workers and universities. It also brings to the table a wide range of technologies like radio, analog land lines, e-mail, Internet, ISDN, satellites, and tele-sensors.

Telemedicine systems harness information and communications technologies in several ways: for administration and management of health care systems, transferring and storing of clinical data, surveillance during epidemics, publication and search of medical literature, and education and training for healthcare workers, students and individual citizens.

Benefits

Theoretically, telemedicine can provide crucial benefits and savings by reducing the time to travel for doctors, providing faster access to medical expertise (especially during emergencies), using health care resources more effectively, and upgrading skills and knowledge for medical professionals.

For instance, satellite links between hospitals in Mexico City and ten rural hospitals in the Mexican province of Chiapas reportedly reduced unnecessary referrals by 60 per cent. Cancerology resources in France were tapped from Tunisia via satellite connections. E-mail is used heavily by health care researchers at the University of Lusaka in Zambia.

A conference on Alzheimer's disease in Argentina greatly benefited from participation via the Internet. Many cases have been documented on the use of the Net to save lives of patients in countries ranging from China to Turkey.

Medical Literature and Data

Though the Web is not yet well suited for the kind of broadband realtime communications that videoconferencing for remote diagnosis sometimes calls for, it is superbly geared towards the publishing and search of health care literature as well as transmission and acrchival of image data.

"The function of information sharing, now expanding in developing countries via Internet access, may be the most valauable of all telemedicine applications," said Heather Hudson, author of "Global Connections: International Telecommunications Infrastructure and Policy" and a coordinator at the International Develpment Research Centre (IDRC) of Canada.

In early 1998 the Caduceus Project was launched in Peru for the establishing a biomedical information system in Spanish on the Internet.

Computer networks are now used to coordinate health monitoring of 700,000 victims of the Chernobyl disaster in Ukraine. Web-based telemedicine projects have been launched by the Ukrainian Association of Computer Medicine (http://www.ucm.cit.ua.net), which

by the Ukrainian Association of Computer Medicine (http://www.uacm.cit-ua.net), which provides access to online medical information in three languages: Ukrainian, Russian and English.

There are also gateways to online medical resources of Europe such as EuroTransplant, to coordinate services for organ, tissue and cell transplants. Medical universities and research institutes are linked via a three-tier network called "UkrMedNet."

"The Net has helped accelerate the intergation of our medical system into the world informational space," said Dr. Oleg Mayorov, chief medical informatics advisor at the Ukrainian minsitry of health care.

Online academic literature and tele-education systems are becoming an important component of the medical education system and national health infostructure. The growing muscle of the Net can also be evinced from the vast array of resources available from sites like the Telemedicine Information Exchange and Telemedicine.com

E-Mail

Though full connectivity to Web-based databases may be a long way off for the medical sector in many developing countries, email messaging lists and email-based database gateways can come to the rescue here.

"For example, reliable email services via the Internet have been introduced and used in parts of the health sector of at least 38 of Africa's 49 countries," according to Dr. Mandil of WHO. Over 80 per cent of telemedicine traffic in the world is over store-and-forward messaging networks, he said.

One of the best success stories of email-based medical support comes from SatelLife. This Massachusetts-based non-commercial organisation provides free store-and-forward messaging services for developing countries via a low earth orbiting (LEO) satellite called HealthSat-2.

The HealthNet email service (www.healthnet.org) provides literature summaries, expert commentary, event information, and community discussion facilities in numerous fora like the cardiovascular health forum ProCOR, which has participation from health professionals in 51 countries.

The HealthNet network has also been used by burn surgeons in Mozambique, Tanzania and Uganda to consult with one another on surgery techniques.

The Latin American Healthcare Link programme provides email-based discussion and document access services to health care professionals in Peru, Nicaragua and Spain.

Moving Forces

The growing importance of telemedicine was formally recognised during summits like the First World Telemedicine Symposium for Developing Countries, held in Portugal in 1997 by the ITU. The ITU and WHO have formed study groups around the issue, and also conduct pilot projects in partnership with private sector players. The ITU published the "Report on Telemedicine and Developing Countries" last year.

The Midjan Group, part of the European Health Telematics Observatory (www.ehto.be), provides European telemedicine services to developing countries like South Africa and Senegal. The Observatory has five national language affiliated sites in France, Portugal, Spain, Greece and Finland.

Satellite consortia like Intelsat and Inmarsat have been involved in numerous telemedicine projects. Other telecom and datacom projects to watch for include AT&T's Africa ONE project and Project Oxygen. WorldSpace has three three geo-staitonary satellites AsiaStar,

AfriStar and CaribStar for digital audio broadcasting in developing countries.

International NGOs like the Association for Progressive Communciations (www.apc.org) also provide low cost Internet solutions for non-commercial use in dozens of developing countries. IDRC's Acacia project (www.idrc.ca/acacia) specialises on providing such Internet resources to African countries.

Till 1995, most telemedicine projects involved cooperation between developed and developing countries, but the Net has helped more South-South collaboration between developing countries in recent years.

Project Challenges

Many telemedicine pilot projects have been launched around the world, but several have faced challenges in areas like measuring the clinical and cost efficacy of telemedince, and in devising norms and standards for the tools, languages and quality control mechanisms used.

Formats for the reportage and documentation of telemedicine experiments and mechanisms for guaranteeing security of patient data are other key concerns. In addition to infrastructure shortages in developing countries, there have been several project assessment challenges as well.

An ambitious teleradiology experiment using imaging equipment and special "telecursors" for interactive diagram discussion was launched by Mauritius Telecom.

But there were was no clearly defined mechanism for evaluating the project, and the equipment was not adequately used by the intended audience, said R. Seenundun, technical head for terminal services at Mauritius Telecom.

"For effective telemedicine, IT use in hospitals should be increased to improve computer literacy. Telemedicine systems should be integrated into the traiditonal working environment. Adequate training should be provided, and key personnel should be trained," he said.

South Korea launched major telemedicine projects for local medical care centres in farming and fishing villages with satellite and Internet links to the Seoul National University Hospital and Korea University Hospital.

"But such services were not covered by the medical insurance system. There was also lack of clarity on how doctors and hospitals were to charge for such services," said Sung-Ok Lee, informatics director at the Korean ministry of communication.

A mix of Internet and Intranet delivery is used by Argentina's ARGONAUTA service (http://tm.tm.conae.gov.ar) for tele-radiology from hospitals in the city of Cordoba. According to designers of the project, challenges arise in standardisation of medical care protocols, especially with regard to integration with inter-regional or global systems.

Legal, Cultural and Political Issues

Though Web-based access to medical literature has skyrocketed, many experts warn that literature published on the Web needs to be carefully checked for authenticity, credibility and copyright conformity.

Telemedicine is meant to augment - and not replace - traditional practices and channels of medicine, but several doctors tend to feel threatened by such new technology-based approaches. Legal liability issues, especially for trans-border communications, are not easily resolved.

Affordable access to quality health care is a fundamental human right, but care needs to be taken to bridge the growing "digital divide" between urban and rural areas, developed and developing countries, and English and non-English speaking nations.

Sustainability of telemedicine projects - many of which do not go beyond a pilot project stage - is a key concern, and care needs to be taken to ensure private sector participation in such issues.

A growth industry is booming around telemedicine technologies and services. For instance, the Vision Technology Group in Bogota, Colombia, uses the Internet, satellite and proprietary software for tele-radiology services; it plans to extend its offerings to other Latin American countries.

Many countries are thus in a position to convert their telemedicine expertise into an export earning, but challenges also arise in regulating and monitoring cross-border trade in such practices.

Telemedicine in Asia

The Interactive Medical Curriculum Project (www.hol.com.au/curriculum/index.html) is a major APEC (Asia Pacific Economic Cooperation) project for online tele-education cooperation in medicine.

Medical schools in Indonesia, Malaysia, Papua New Guinea, China, Japan, Philippines, Thailand, South Korea and the U.S. are collaborating in this initiative for electronic delivery of interactive medical curricula, according to project manager Anne McLennan.

The HealthNet email service has been available in Nepal since 1995. For a country with scarce medical expertise and uneven distribution of population like Nepal, it is more appropriate to concentrate on simple telemedicine solutions involving low-cost PCs and basic text-based email, said Dileep Agrawal, CEO of the ISP Worldlink Communications in Kathmandu.

His company is working on providing PCs to hospitals, training health professionals on the use of Internet email, and create email discussion lists for consultations.

Multipurpose community telecentres are being launched in Bhutan by an initiative of the International Medical Centre of Boston, with funding from international donors.

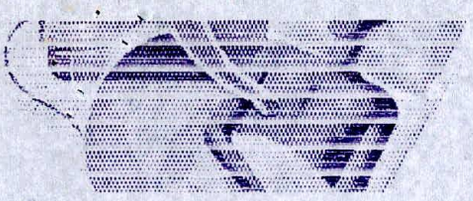
In India, telemedicine projects will be implemented next year by the Department of Telecommunications, according to P.K. Agarwal of the Telecom Engineering Centre in New Delhi.

Numerous first-generation Web sites focusing on ayurveda and homeopathy have been launched by Indian entrepreneurs, but Internet-based telemedicine is still at the embryonic stage in India.

One of the best examples of telemedicine in Asia comes from Jordan. In 1997, telecom engineers, heart specialists and two major hospitals founded the teleradiology service HeartBeat Jordan to help reduce the "symptom to needle time" for treating partients of heart problems, which accounted for 45 per cent of the country's mortality rate.

Heart specialists in Amman receive and diagnose ECG data via satellite, land lines and the Internet from medical centres, corporations, hotels, holiday resorts and even the Royal Jordanian Airlines.

Pilot tests have shown that the service can cut down unnecessary referrals and provide better service in many situations, and the company is even becoming profitable this year, according to Dr. Khalil Zayadin of Heartbeat Jordan.



The service is being extended via the Net to other Gulf countries: inquiries are also coming from European countries like Germany. Unfortunately, there is not enough support and recognition coming for the project from health ministry officials.

"The public health sectors in many developing countries have limited resources and even more limited vision. Information and communications technologies tend to be dismisssed as expensive -- but a well-developed solution using these technologies is sometimes the only economically viable solution," said Zayadin.

.....

India: Telemedicine's Great New Frontier

An indigenous technology effort is wiring up its healthcare system

By Guy Harris, Secretary, International Society for Telemedicine

Champions of telemedicine, the systematic application of information and telecommunications technology to the practice of healthcare, have been very patient. By the 1980s, pilot projects begun amid great hopes in the 1950s and 1960s had fizzled out for the most part. More recently, however, telemedicine has undergone something of a resurgence, as technology has begun catching up with aspirations. Perhaps nowhere is this renaissance so vitally needed as in India.

With their dependence on high-bandwidth real-time technologies, most telemedicine projects of the past decade have been ill suited to India. Now, though, new hopes are being engendered there by the confluence of low-bandwidth telemedicine with a growing middle class, an improving telecommunications infrastructure, a world-class software industry, and a medical community open to new ideas.

The facts on India's healthcare situation are sobering. With a ratio of one hospital bed for every 1333 citizens, the huge country is far behind even the Philippines, at 1:600, let alone the United States' 1:212. To get to a more reasonable 1:500 ratio would require the annual construction of 700 new 250-bed hospitals for years to come.

India has one doctor for every 15 500 people. But most doctors live in cities, whereas 70 percent of the subcontinent's population of just over 1 billion lives in rural areas.

Figures on the percentage covered by health insurance vary from 3 to 9 percent. For the hundreds of millions of poor Indians, healthcare is nominally a government responsibility. But spending on healthcare represents only 0.9 percent of gross domestic product, as against around 14 percent in the United States.

The basic unit of the public system is the Public Health Center, which is typically staffed by one or two general practitioners and 10 or so nurses. Each of the centers has a few beds for simple in-patient procedures and perhaps X-ray and lab facilities. There are only about 23 000 of these for some 600 000 villages. Above them in the healthcare hierarchy are district hospitals and, in a few cities, multispecialist hospitals. To get care, those who can afford it typically spend days traveling.

Another complicating factor is that India's government-run healthcare system must coexist with hospitals run bypublic and private trusts and with an active private sector, which caters to middle- and upper-class Indians and can pay salaries around 10 times the public rate. Even the most prominent private group, Apollo Hospitals, manages only about 4000 beds throughout the country. There is no doubt that countless men, women, and children could all benefit enormously from telemedicine.

Technical ministries take the lead

Two government institutions are leading the way. One is the Indian Space Research Organisation (ISRO). The other is the Ministry of Information Technology, which already has 200 sites used for telemedicine and other purposes. The sites are linked by 128-kb/s integrated-services digital networks (ISDNs) or by satellite and offer occasional videoconferencing for medical teleconsultation and education.

The Ministry of Information Technology's National Informatics Center plans this month to bring on-line a 384-kb/s ISDN linking three teaching institutions, the Sanjay Gandhi Post Graduate Institute of Medical Sciences in

Lucknow, the All-India Institute of Medical Sciences in New Delhi, and the Postgraduate Institute of Medical Sciences and Research in Chandigarh. The purpose of the network is collaborative medical education and research.

In a monthlong hookup after an earthquake, telemedics transmitted data on 750 patients to specialists 300 km away

In addition, ISRO plans to launch the statewide Orissa Telemedicine Network to provide physicians in this impoverished state with teleconsultation and education programs. The agency is also launching telemedicine projects in several other areas that have been particularly underserved by healthcare professionals: the Andaman & Nicobar Islands, far to the east of India in the Bay of Bengal; Lakhsndeep Island, off the southwest coast; and the Leh Mountain areas in the Himalaya range in the state of Jammu and Kashmir.

ISRO has also provided access to its V-SAT (very small-aperture antenna) communications infrastructure. Apollo Hospitals' new, small hospital, based in the village of Aragonda, is one V-SAT user. The 40-bed hospital was newly built and equipped with modern computer tomography, ultrasound, echocardiography, automated laboratory equipment, incubators, and electrocardiogram equipment. A pediatrician and a general surgeon were made available in addition to generalists. Using both store-and-forward and real-time technologies such as videoconferencing, some 200 teleconsults have been provided to this village alone from specialists in Chennai, formerly Madras. Data is managed through a locally developed software package, Mediscope.

This last indicates a characteristic of Indian telemedicine—it is a largely indigenous affair. India's prodigious gift for information technology has produced world-leading software and systems, obviating the need for expensive imports. The range of systems developed is already wide, among them assorted mobile vans equipped with basic patient monitoring (like electrocardiographs) and short-range wireless communications equipment. It might even serve as the basis for an export industry, particularly to other countries with limited IT infrastructures.

Successes on a large scale

Can telemedicine really make a difference in India? Two recent events suggest it can. The Gujurat earthquake on 27 January 2001 devastated the western city of Bhuj and left thousands dead and many more homeless. Within 24 hours the Online Telemedicine Research Institute (OTRI) in Ahmedabad, about 300 km from Bhuj, had established satellite telephone links between an emergency command center in neighboring Ghandhinagar and various facilities around Bhuj, including one housed in a tent.

In one month, the hookup transmitted to specialists in Ahmedabad approximately 750 sessions involving primarily X-rays and electrocardiographs of patients in the disaster area. After two days, the satellite phones gave way to the more economical V-SAT (which requires a 2-meter dish), with phone lines and ISDN being added as infrastructure was repaired. Much of the imaging and data transfer was mediated by Pentium 3-based PCs. Eventually, engineers established a full-fledged telemedicine system supplying teleconsultation in pathology, radiology, and cardiology over ISDN lines between district hospitals near Bhuj and others in Ahmedabad.

The second encouraging project was carried out during the Kumbh Mela, a Hindu festival held every 12 years that last year drew 25 million pilgrims to the banks of the Ganges River. Here, the OTRI and the Sanjay Gandhi Post Graduate Institute established a station under the sponsorship of the Ministry of Information Technology to monitor levels of cholera-causing bacteria in the river water. Microscope images of samples of microorganisms from the river were transmitted to the institute's experts in pathology and microbiology for identification and analysis. In addition, radiology and cardiology data was transferred to specialists for the total of 202 pilgrims who fell ill. The project ran for 45 days.

Interestingly, it is the engineers and technologists, not physicians, who have pushed hardest for telemedicine. "The Ministry of Health has not started any activity, not even R&D," noted professor Saroj Mishra, head of Endocrine Surgery at the Sanjay Gandhi Post Graduate Institute.

Pathologists have been something of an exception. Just this past December, the Indian Association of Pathologists and Microbiologists organized a symposium on telepathology at their annual conference in Mumbai (formerly Bombay). Among other topics, the more than 500 participants heard a formal announcement of the establishment of a free consultancy, at telepathologyindia.com, providing second opinions on diagnoses from a range of Indian and international experts.

A number of other dot-coms are in the game, including DoctorAnywhere.com, a Web-based service through which more than 1000 physicians in private practice now consult with specialists. In April of last year the service was offered to the public health system at no cost, beginning with a pilot program at a Public Health Center in Wagholi, near Pune, in collaboration with the Tata Council for Community Initiatives, the humanitarian arm of the country's largest industrial group.

Perhaps the greatest lesson of India's recent telemedicine experiences, and one applicable to any developing country, is that a lack of physical infrastructure no longer precludes the development of an effective healthcare system. The West's resource-intensive specialty-care institutions, the cornerstone of industrial Age medicine, are to a large extent obviated in the Information Age by telemedicine. India can be the template for a new kind of healthcare.

Acknowledgments: The author wishes to thank Milind Purandare, Zakiuddin Ahmed, Srikrishna Sharma, Ragesh Shah, Leonid Androuchko, Sanjay P. Sood, Sunil Kumar, M.K. Baruah, and Saroj Mishra for their advice and support.

K'taka CM launches telemedicine project

Monday, April 8 2002 20:55 Hrs (IST)

Bangalore: Karnataka Chief Minister, S M Krishna on April 8 inaugurated the telemedicine project in the state marking the beginning of a process to gradually network all 27 main district hospitals and Bangalore-based Narayana Hrudayalaya as the hub to deal with coronary heart problems.

The Rs 17.5 lakh telemedicine project links Chamarajnagar district hospital and Vivkananda Memorial Hospital, a non-government organisation run health unit, in H D Kote taluk.

The project inaugurated on April 8 is the fourth such telemedicine project linking remote or distant areas with specialised doctors at well-equipped hospitals located in cities.

The first project was undertaken with two villages in Andhra Pradesh, which were linked a large hospital in Chennai.

The second linked Andaman and Nicobar Islands with a specialty heart centre, while another heart centre at Udayapur near Agartala in Tripura is connected with Ravindranath Tagore Heart Speciality Centre in Kolkata and Narayana Hrudayalaya in Bangalore.

The Karnataka telemedicine project is a shot in the arm reinforcing heart specialties to treat patients in remote areas and is considered a major step forward in the fight against heart disease, which a large part of the Indian population is prone to suffer from.

TELEMEDICINE IN INDIA– THE APOLLO EXPERIENCE:

DR - 36.5

Dr. K Ganapathy.

Neurosurgeon, & Medical Director, Apollo Telemedicine, Apollo Hospitals, Chennai, India.

For more on the links recommended below refer to:

" Watson, come here I want you" said Alexander Graham Bell on March 20, 1876, when he inadvertently spilled batter acid on himself, while making the world's first telephone call. Little did Bell realize that this was indeed the world's first telemedical consultation. We have come a long way since then. Today even tele surgery is a reality. This article will br review some aspects of Telemedicine particularly its relevance in a developing country like India and the experience of Apollo Hospitals in setting up telemedicine centers.

Introduction:

Secondary and tertiary medical expertise is not available in several areas of the world. Quite often, many patients are elsewhere at considerable expense. In a number of these cases the treatment could have been carried out by the loca doctor with advice from a specialist. Even within a country there is a tendency for specialists to concentrate in the big making medical care in suburban and rural areas sub optimal Using a PC, a scanner, a digital camera networking, appropriate software and telecommunications it will be possible to transfer clinical data from any part of the world to a other part.

Offering medical advice remotely, using state of the art telecommunication tools is now a regular feature in several pa the world. Several studies have shown **telemedicine** to be practical, safe and cost effective.. Telemedicine hinges on transfer of text, reports, voice, images and video, between geographically separated locations Success relates to the efficiency and effectiveness of the transfer of information

What is Telemedicine?

Telemedicine is a method, by which patients can be examined, investigated, monitored and treated, with the patient a the doctor located in different places. Tele is a Greek word meaning "distance "and Mederi is a Latin word meaning, "t heal". Time magazine called Telemedicine "healing by wire". Though initially considered "futuristic" and "experimental' Telemedicine is today a reality and has come to stay. In Telemedicine one transfers the expertise, not the patient. Hospitals of the future will drain patients from all over the world without geographical limitations. In Cyberia after all c a netizen! High quality medical services can be brought to the patient, rather than transporting the patient to distant a expensive tertiary care centres. A major goal of telemedicine is to eliminate unnecessary travelling of patients and thei escorts. Image acquisition, image storage, image display and processing, and image transfer represent the basis of telemedicine. Telemedicine is becoming an integral part of health care services in several countries including the UK, U Canada, Italy, Germany, Japan, Greece, and Norway and now in India.

What is the relevance of telemedicine in a developing country like India and particularly in the specialiti

The following table indicates the ground realities of the present state of health care in India.

620 million live in rural India (NCAER)

Bed-Population ratio 1.1333 (1991) Vs. ideal of 1:500

2 million beds are required as against0.7 million available.

700 hospitals of 250 beds each are required every year.

only 9% of 1 billion people are covered health schemes.

only 0.9% of GDP for health (WHO recommends 5%)

5% of annual family income spent towards curative health care.

Specialists relocating to sub urban or rural areas

Approximate Distribution of Tertiary Care Hospitals in India (1998)

In Utopia, every citizen has immediate access to the appropriate specialist for medical consultation. In the real world t cannot even be a dream. It is a fact of life that " All Men are equal, but some are more equal than others ". We are at present, unable to provide even total primary medical care in the rural areas. Secondary and tertiary medical care is n uniformly available even in suburban and urban areas. Incentives to entice specialists to practice in suburban areas ha failed. After all professional isolation would lead to mediocrity, which is one step away from entering the Jurassic Park. 'Health for All' may be a slogan even in 2020.

It is generally considered that communities most likely to benefit from telemedicine are those least likely to afford it o have the requisite communication infrastructure.

This may no longer be true. In contrast to the bleak scenario in health care, computer literacy is fast developing. Pric are falling. Health care providers are now looking at Telemedicine as their newly found Avathar. Theoretically, it is far easier to set up an excellent telecommunication infrastructure in suburban and rural India than to place hundreds of medical specialists in these places. We have realised that the future of telecommunications lies in satellite-based technology and fiber optic cables. Providing health care in remote areas using hi tech is not as absurd as it may initia

appear. Could even the greatest optimist, have anticipated the phenomenal explosion in the use of computers, in Indi

What does telemedicine encompass?

Telemedicine covers a wide range of activities. In the past it was primarily teleradiology – the transferring of resolution medical images, X ray pictures, ultrasound, CT, MRI pictures, live transmission of ECGs and echocardiog Today even a detailed clinical examination can be conducted remotely.

What are the advantages of telemedicine?

Worldwide there is difficulty in retaining specialists in non-urban areas. The distribution of specialists in India is ir lopsided. There are more neurologists and neurosurgeons in Chennai, than in all the states of North eastern Indi together. Similarly tertiary care hospitals are also concentrated in pockets with large segments of the population havi access. The increasing availability of excellent telecommunications, infrastructure and video conferencing equipmer help provide a physician where there was none before.

65% of 1100 million will be literate by 2005

60% of rural India has access to TV coverage.

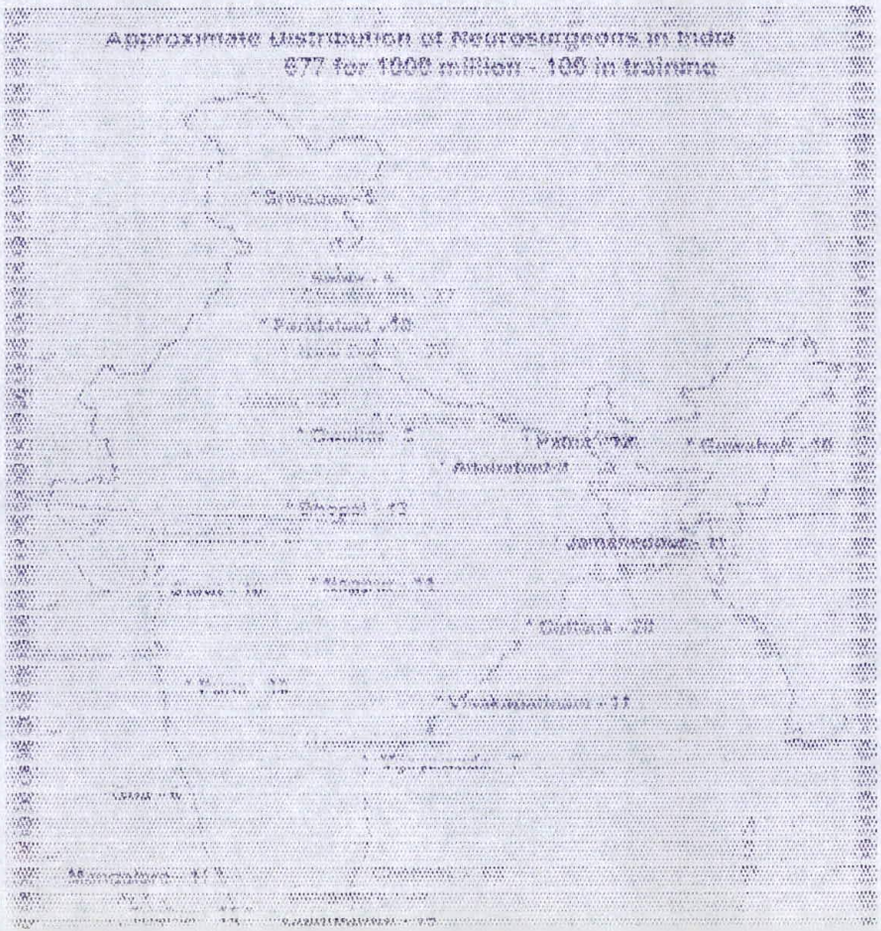
50% of rural India has access to TV coverage

650,000 existing PCOs ® internet kiosks,.

400,000 villages already have telephone connections.

Internet users in India 2m Dec 2001, 8.5m 2003.

Hardware, software and brain ware all available.



Telemedicine can thus avoid unnecessary travel and expense for the patient and the family improve outcomes and save lives. Once the "virtual presence" of the specialist is acknowledged, a patient can access resources in a te referral centre without the constraints of distance. Telemedicine allows patients to stay at home ensuring much ne family support. In a large Telemedicine project in the USA 83% of patients who would have been transferred to an hospital remained in their community reducing the cost by at least 40 to 50%. This also ensures maximal utilisati suburban hospitals. The general practitioner in the rural/suburban area often feels that he would loose his patient t city consultant. With Telemedicine the community doctor continues to primarily treat the patient under a speci umbrella. With modern software/ hardware at either end 90% of the normal interaction can be accomplished thi Telemedicine.

The following tables give some important facts which have to be considered when introducing Telemedicine in India.

Doctors licensed to practice all over India,

Maximum utilisation of limited resourcesSaves travel, time and money,

Makes Geography History!!

Enormous CME potential for GP, urban trainee and Teleconsultant,

International grand rounds, Web casting conferences,

Motivation for computer literacy among doctors

- *In unnecessary referrals to specialists,*

Useful in designing credits for re certification of doctors.

Will faster transmission or better image quality alter diagnosis or treatment ?

Medical Coordinators for each specialty to lay ground rules,

Technical coordinators to identify the most effective mode of data acquisition, compression, transfer and manipulat
TCS console,

Execution of pilot project within 6 months,

Collecting data over 1 year and analyzing data over next 3 months.

With software, hardware, brain ware and a large number of doctors

licensed to practice abroad, India could offer global Teleconsultation

at reduced international rates.

Sophisticated extension of medical transcription.

Marginal profits for Teleconsultation in the metros.

TM for suburban and rural India heavily subsidised from agencies like WHO, World Bank, Asian Development Bank, G of India etc.

Successful implementation in India = Successful Implementation anywhere in the world

---

To evaluate acceptance– patient, GP, Teleconsultant, public, Govt.

Identification of disciplines / diseases for teleconsultation.

Designing appropriate need based cost effective modules.

Training technical personnel, GP, Teleconsultant.

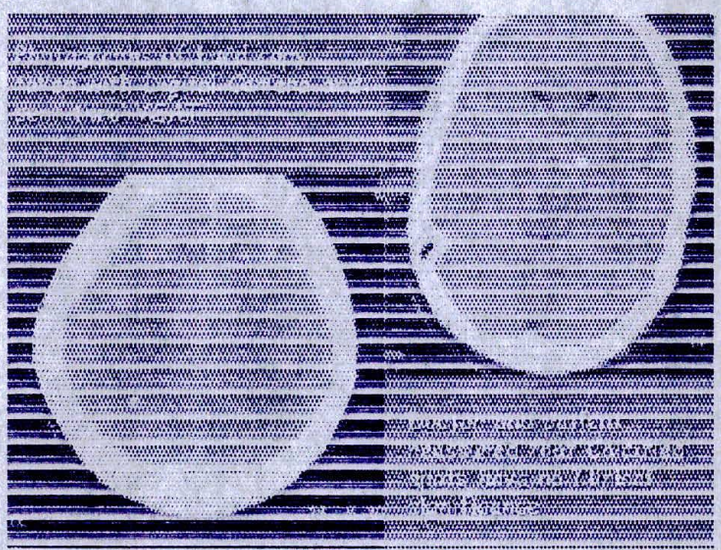
Techno economic feasibility, optimum pricing.

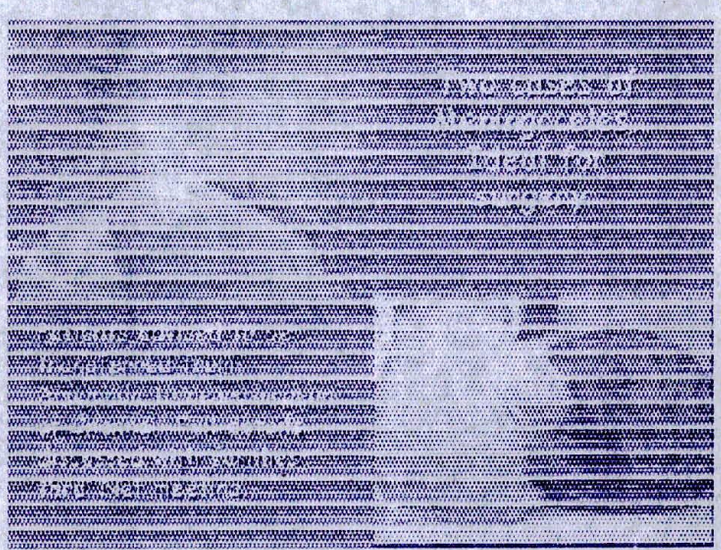
Limitations of Teleconsultation.

The Aragonda (Andhra) Story:

As in several disciplines, the Apollo Hospitals have been the pioneers in putting up the first modern secondary care hospital using Telemedicine to provide expert care. As a pilot project a secondary level hospital was set up in a v called Aragonda 16km from Chitoor (population 5000). This 40 bedded hospital was equipped with a CT scan, a m ultrasound, ECHO, automated laboratory equipment, an incubator, automated ECG etc. A paediatrician, a general phy and a general surgeon were available in addition to general duty doctors.

Starting from simple web cameras and ISDN telephone lines today the village hospital has a state of the art conferencing system and a VSAT (Very Small Aperture Terminal) satellite installed by ISRO (Indian Space Res Organisation). About 200 tele consultations have been given to this village alone from specialists and super specialists Chennai. A specially designed software (Mediscope) was used and the clinical history and physical findings transf from Aragonda. . Images of x rays and ultrasound were scanned, compressed and sent thro ISDN lines (64 x6 384k CT images being DICOM compatible were directly electronically transferred to the telemedicine computer for or transmission to Chennai. Most of the teleconsultations were initially off line – store and forward. The tele consul opinion was sent back to the primary physician. There are no fixed hours for tele consultation – a medical officer available at the telemedicine unit at Chennai from 9am to 5pm. Arrangements are now being made to provide emer tele consultation as well. When the tele consultant wanted to directly interact with the primary physician and the pati "net meeting" was initially arranged. Later on with availability of better infrastructure a formal video conference was using state of the art video conferencing equipment. . All such on line interactions were recorded and stored. De clinical "examination" or pseudo seizures, involuntary movements, Parkinsonism, myopathy etc. was possible. Soc electronic digital stethoscope will be made available so that auscultation of the heart and lungs can also be done rem In almost all cases the tele consultant was able to give a definite opinion and guide the local physician. Several s head injuries not requiring surgery were successfully managed in the village hospital.





Some cases required management in a tertiary care hospital. Details of the treatment were discussed in detail wit patient and the family so that they were well informed and fully prepared. These tele discussions were of conside help. Tele consultation was particularly useful in the follow up of already treated patients. Interestingly the acceptar tele consultation by the rural patient, the sub urban doctor and the suburban community was much better than expe None of them were really averse to a tele consultation. The tele consultants have also accepted this new meth interacting with a patient. Detailed evaluation of the socio economic benefits needs to be done.

The Sriharikota Story:

Sriharikota Space Center is an important launch pad of the Indian Space Research Organisation located 130 kms Chennai. It is actually an island. About families live in the campus. The Health Center also provides medical assistar

the neighbouring villages Unlike Aragonda here a virtual OP is operational every Saturday from 10am to 1pm. 25 diff specialities are covered some every week, others once a fortnight and others once a month. Emergency consultatio other days are also available.

Expansion Plans:

It is proposed to establish a VSAT telemedicine link up with Port Blair in the Andaman and Nicobar Islands

Connectivity has already been established with Information Centres at Gauhathi and Calcutta. The tertiary care hospit Hyderabad, Delhi and Madurai are interconnected. Tele consultation is also available to doctors in the Middle Eas other countries. Connectivity with the Apollo Hospitals at Colombo, Dhaka, Bilaspur, Erode and others are on the anvil

Other uses of Video Conferencing:

The Telemedicine department of the Apollo hospitals was the only unit from Asia which took part in the Ist International conference on Telemedicine in January 2001. Subsequently a paper was presented from Chennai, International conference on telemedicine at Upsaala Sweden in June 2001. This was an ***Intercontinental*** Live mult Symposium between Europe, Africa, Asia, Australia and Americas on the topic

"Telemedicine as a tool for a more equitable distribution Of health care delivery around the world"

Video conferencing is an inexpensive way of projecting the state of the art facilities available in India to a global audi In August 2001 the Dept of Neurosurgery Apollo Hospitals Chennai had a two hour teleconference with the Dept of Neurosurgery Fujitha Health University, Nagoya Japan. This international grand round went of without a hitch. Regular conferences such as this are planned to be conducted periodically.

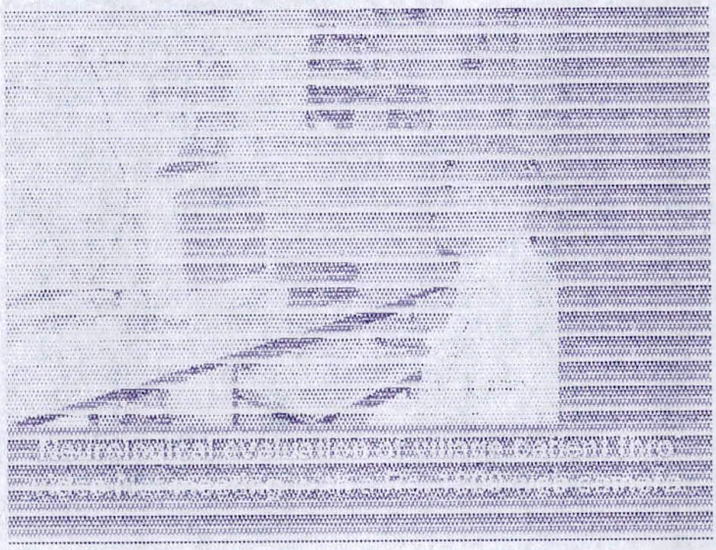
Tele conference between Apollo, Chennai & Fujitha university, Japan

This will considerably augment the skills of all those who take part and more important change our perspectives and us think globally.

Conclusion:

It is our dream that within the next few years there will be telemedicine kiosks throughout the length and breac suburban and rural India. No Indian should be deprived of a specialist consultation wherever he/she is. This i impossible. What is required is not implementing better technology and getting funds but changing the mind set o people involved.

The first generation of telemedicine enthusiasts should not forget that technology should be used as a support to treat patients and not viewed as a goal in itself. The challenge today is not confined to overcoming technological



barriers, insurmountable though they may appear.

It is true that available technology still has considerable scope for improvement. Rather the challenge is why, when now, to implement which technology and at what cost. **A needs assessment is critical.** Due to pressure from pov vendors the perceived needs for Telemedicine may not conform to the actual needs. The take off problems, f telemedicine is legion. Telemedicine today sounds hep and cool, but the reality may be quite different. The future hol promises to be exciting. So ladies and gentlemen hang on for the ride! Telemedicine will be more than a roller coaste The journey will well be worth the wait.

Time alone will tell whether Telemedicine is a "forward step in a backward direction" or to paraphrase Neil Armstrong small step for IT but one giant leap for Healthcare".

Feedback

http://www.naavi.com/cl_editorial/edit_06oct00_1.html
http://tic.telemed.org/
http://www.telemedtoday.com/articlearchive/articles/telemedicine_articles.htm

http://www.neurosurgery.org/aans/bulletin/summer97/articles.html
http://www.hs.org.hk/it/mic97/telemed3.htm
http://www.cddc.vt.edu/knownet/articles/pune-telemedicine.html
http://www.cddc.vt.edu/knownet/articles/doctor.html

Legal Issues of Tele-Medicine Practice

In the aftermath of the controversy sorrounding the treatment provided by Apollo Hospitals at Delhi to the late former Cabinet Minister, Mr Kumaramangalam, the accountability of the medical professionals has been brought into sharp focus. This debate on the limits upto which the medical professional is responsible for his judgements will further accentuate as the Medical Insurance Industry develops in India. If not the individual, the insurance industries would expect and try to force a higher degree of standards in medical practice.

In the light of this general trend, progressive Medical Practitioners and Hospitals who are trying to use the developments of Information Technology to improve the standards of medical service would also have to watch their backs, lest they may be let down by the technology. Apollo is one institution which is reported to have already instituted a system whereby diagnostic reports and patient records are transmitted over a nwtwork and shared by experts. Internationally there has been reports of critical medical advice being sought by medical practitioners from experts through the internet even while a patient is being operated upon in a surgical unit.

Additionally, several reputed corporate entities are putting their reputation on the block through bold initiatives to run "Health Portals".

While such initiatives are welcome in the larger interest of the community, it is extremely important for the medical community to realise that there are "Security Issues" they should be concerned with and the consequential legal liabilities.

While the liability for "Wrong" or "Inefficient advice" may be attributed to the medical personnel involved, there is a danger of these people being victimised by either a playful or criminally intentioned hackers who can intercept and alter the critical information that may be floating around.

Imagine the possibility of an e-mail interceptor changing the dosage of a drug or the drug itself while the doctors prescription is being transmitted on the net. Or let's say that the patient's records in the hospital database is tampered with to mislead the doctor attending on him. While this may sound to be fiction at this point of time, one cannot rule out the possibilities of well planned murder conspiracies to executed by the misuse of technology.

The medical community should therefore address this issue of ensuring "Security" in communication and storage of information besides the normal risks of technology failures at crucial times.

In India, the legal framework is yet to be established to meet these emering needs. It is however in the interest of the medicl community that they should through appropriate industry fora address this issue and develop norms which may later be

converted to law. If they don't take pro-active steps, the legislators may in their anxiety to "Do some thing", rush into formulating "Tele-Medicine Practice Laws" which may be imperfect and dangerous.

I therefore urge medical practitioners to start thinking on the needs of "Security Issues in Modern Medical Practices". Naavi.com would be happy to provide assistance to the medical community in this regard to the extent feasible.

Naavi

Related article in Business Line

The Health Insurance and Accountability Act of USA

October 6, 2000

Legal Issues of Tele-Medicine Practice

In the aftermath of the controversy sorrounding the treatment provided by Apollo Hospitals at Delhi to the late former Cabinet Minister, Mr Kumaramangalam, the accountability of the medical professionals has been brought into sharp focus. This debate on the limits upto which the medical professional is responsible for his judgements will further accentuate as the Medical Insurance Industry develops in India. If not the individual, the insurance industries would expect and try to force a higher degree of standards in medical practice.

In the light of this general trend, progressive Medical Practitioners and Hospitals who are trying to use the developments of Information Technology to improve the standards of medical service would also have to watch their backs, lest they may be let down by the technology. Apollo is one institution which is reported to have already instituted a system whereby diagnostic reports and patient records are transmitted over a nwtwork and shared by experts. Internationally there has been reports of critical medical advice being sought by medical practitioners from experts through the internet even while a patient is being operated upon in a surgical unit.

Additionally, several reputed corporate entities are putting their reputation on the block through bold initiatives to run "Health Portals".

While such initiatives are welcome in the larger interest of the community, it is extremely important for the medical community to realise that there are "Security Issues" they should be concerned with and the consequential legal liabilities.

While the liability for "Wrong" or "Inefficient advice" may be attributed to the medical personnel involved, there is a danger of these people being victimised by either a playful or criminally intentioned hackers who can intercept and alter the critical information that may be floating around.

Imagine the possibility of an e-mail interceptor changing the dosage of a drug or the drug itself while the doctors prescription is being transmitted on the net. Or let's say that the patient's records in the hospital database is tampered with to mislead the doctor attending on him. While this may sound to be fiction at this point of time, one cannot rule out the possibilities of well planned murder conspiracies to

executed by the misuse of technology.

The medical community should therefore address this issue of ensuring "Security" in communication and storage of information besides the normal risks of technology failures at crucial times.

In India, the legal framework is yet to be established to meet these emerging needs. It is however in the interest of the medicl community that they should through appropriate industry fora address this issue and develop norms which may later be converted to law. If they don't take pro-active steps, the legislators may in their anxiety to "Do some thing", rush into formulating "Tele-Medicine Practice Laws" which may be imperfect and dangerous.

I therefore urge medical practitioners to start thinking on the needs of "Security Issues in Modern Medical Practices". Naavi.com would be happy to provide assistance to the medical community in this regard to the extent feasible.

Naavi

Related article in Business Line

The Health Insurance and Accountability Act of USA

October 6, 2000

Telemedicine in India from Apollo

Doctor-on-call
24 hours, worldwide

The distance between the patient and the doctor has just been removed. With the launch of the Telemedicine unit in Aragonda village (chitor - district) Andhra Pradesh, by the Apollo Hospitals Group.

With 80% of India's population living in rural areas and 80% of the medical community living in cities, there is an imbalance in health care reaching people, so much that in the new millennium, 11% of the world's population (residing in our rural areas) remain devoid of quality health care.

The answer? Telemedicine from Apollo

Simply put, Telemedicine is the close interaction between a patient and a doctor, even when both are miles apart from each other. Telemedicine allows medical treatment using electronic communication networks. By using computer-aided transmission of audio visual data, Apollo can now deliver quality health care, instantly and effectively. Allowing easy consulting, diagnosis, treatment and continuing education, too. Ensuring that a heartbeat in a secluded village can be heard clearly, even in a busy city. This cost-effective solution has already attracted the interest of several developing countries. The Aragonda model will soon extend across 5 Indian states, covering 10 districts and 20 village groups in each state. After which Apollo Telemedicine will cover the whole of India. Similar services will be globally powered by Apollo Hospitals overseas, right now

it will directly cater to the people of Aragonda and 6 neighboring villages. Bringing advanced, yet affordable health care to over 50,000 people.

The Aragonda project is well-equipped to support a global -quality Telemedicine centre, comprising:>

- **Telemedicine Technology - CICOM viewer, direct medical equipment interphases, health care messaging systems, scanners, digital camera, video frame grabber, video conferencing facilities, integrated software for electronic medical records, PCs and modems etc..**
- **Telemedicine services - referral services, second opinion, post acute care, interpretation service, health education**
- **Physical infrastructure - clean water supply, sanitation, drainage, solid waste, better roads**
- **Preventive health care programmes - community service in partnership with the primary health care centres**
- **Health insurance - the gram Panchayat propagates a scheme at Re.1 per day for a family of 5. Through an insurance cover extended by NIC and CIC, up to Rs. 15,000 in patient care is covered. the Apollo group will absorb extra costs**

Apollo mission has always been to bring world class health care within the reach of every individual. A step closer towards that mission will be the launch of the telemedicine Unit in Aragonda.

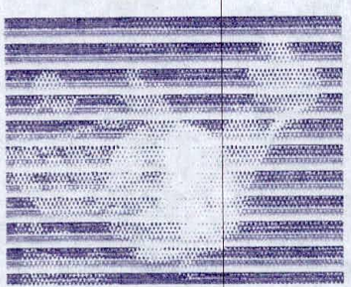
June 13, 1999

Referral online

Health: *Telemedicine catches up in*

Gujarat

Anosh Malekar



A few months ago the doctors at the Rajkot Civil Hospital 'referred' an emergency case to the U.N. Mehta Institute of Cardiology and Research Centre, Ahmedabad. But the patient did not have to go to Ahmedabad since the two hospitals are linked with an Online Telemedicine System.

A High-tech operation: An Event Recorder being used for taking an ECG

The Rajkot doctors recorded the patient's ECG using an Event Recorder, a small electronic equipment resembling a TV remote control. It can record live the ECG data within a minute and transmit it over the telephone. Simultaneously, videos of the patient's condition were taken by a tiny camera and the doctors' comments recorded by a microphone attached to a computer. Then they dialled the telephone number of a transmitting centre which passed on the data to the specialists in Ahmedabad. The specialists analysed the ECG, viewed the patient on video, heard the Rajkot doctors' comments, and jotted down their advice on an electronic pad, which was transmitted back to Rajkot. All this in a matter of minutes. And on

ordinary telephone lines.

ÒThe patient was the winner,Ó said Ragesh Shah, chairman of the Online Telemedicine Research Institute (OTRI), Ahmedabad, which has developed the system. So far these applications had been carried out through satellites, said Shah, a biotechnologist who led the OTRI team's decade-long research and development efforts in telemedicine.

Using indigenous technology, the team developed the system with expert advice from a panel of eminent physicians and surgeons from India and abroad. It can be used to transmit online ECG, CT scans, magnetic resonance imaging, Cathlab reports, pathological reports, doctors' prescriptions, typed and even handwritten notes, and moving images.

Shah said that moving images, which may include X-rays, sonography, angiography, 2-D echo and colour Doppler, are important in finding minor clues for precise diagnosis. They enable the specialists to gather maximum information from the patients and doctors on the periphery, during the very first 'consultation'. The specialists can even get a feel of the patient's heartbeat through an electronic stethoscope which could be attached to the computer at the peripheral health centre.

But the most important innovation, according to Shah, is the Event Recorder (ER). The ER has no cords attached to it. The patient simply has to place it on his chest, push a button and wait for a minute for recording the ECG. This done, he has to dial the telephone number of his doctor and place the equipment on the mouthpiece as per directions given, and press the same button again. The ER converts the electronic signals into audio signals which again get converted into electronic signals on the doctor's personal computer.

The ER was tested on domestic flights, in moving vehicles, offices and parks. It worked to the satisfaction of medical experts.

Having successfully demonstrated the Online Telemedicine system at the civil hospitals in Ahmedabad, Rajkot and Gandhinagar, Shah has now had it installed in 58 cities and towns in Gujarat. Similar systems have been installed for use in homoeopathy and ayurveda.

DR - 36.6

Telemedicine in India

Sanjay P. Sood

sood@spsood.com

Vast area with varied geography (from deserts to frozen mountain ranges), weather (with maximum temp. touching 50 degree Celsius and in some northern regions mercury stays settled at below -20 degree Celsius round the year), population (1.029 billion) [1], high infant mortality rate (63.19 per 1000 births) [1], high population per physician (1916) [2], majority of the population (72.2%) [2] living in isolated villages, total life expectancy is 63.14 years as against China's 69.76 years [3] (keeping in mind that India spends 5.2% of its GDP on health as against China's 2.7% [4]) - that is India, a developing country. All the factors support and justify the need for Telemedicine in the country. India could be said to be one of the countries with a potential to reap the most out of Telemedicine.

The Ministry of Communications and Information Technology, Government of India, has classified "Telemedicine" as one of the thrust areas for development in the country. In sync with the policy, the Government initiated a project called "Development of Telemedicine Technology". Hence, the activities in Telemedicine, at Centre for Electronics Design & Technology of India (an ISO 9002 certified institute under Department of Information Technology, Ministry of C&IT, Government of India) in SAS Nagar. We are working towards linking three tertiary level hospitals of North India namely :

1. All India Institute of Medical Sciences at New Delhi.

2. Post Graduate Institute of Medical Education and Research (Nehru Hospital) at Chandigarh.

3. Sanjay Gandhi Post Graduate Institute of Medical Sciences at Lucknow, Uttar Pradesh.

As regards me, I am working as a Senior Design Engineer and am discharging the duties of a System Engineer-cum-Coordinator for this National Telemedicine project at CEDTI, SAS Nagar, Punjab.

The proposed Telemedicine setup between these medical institutes would primarily be in the three specialties of Radiology, Cardiology and Pathology. Doctors (working in Radiology, Cardiology and

Pathology) in any of these three hospitals would be in a position to (Tele)consult an expert in the other hospital using the technology under development. The cities of New Delhi (capital of the Country), Chandigarh (capital of the states of Punjab and Haryana) and Lucknow (capital of the state of Uttar Pradesh) are among very few Indian cities which enjoy benefits of the State-of-the-art communication technologies like ISDN, leased lines etc. The project is currently in the terminal stages of the development. It would enable the exchange of clinical information among the three hospitals via ISDN lines. Technology for the transfer of data over POTS has also been developed and is currently in the lab testing phase. The three hospitals being linked in the pilot project are referral hospitals and the technology from these referral hospitals would flow down to the secondary and eventually to the primary healthcare delivery level.

At CEDTI, SAS Nagar, we have named the development as "Sanjeevani" - an integrated Telemedicine application software. It incorporates latest software technologies to reap the most offered by Telemedicine. The foremost requirement of any application of IT in Medicine, in a developing country, is that the application should be user friendly, mainly because the medical fraternity is not technology savvy. Sanjeevani is extremely user friendly. Besides being user friendly, it supports a comprehensive patient medical record, DICOM image format, video conferencing, standard TWAIN interfaces for webcams, digital cameras and scanners and offers tools for image enhancement as well. Sanjeevani would form a dedicated Telemedicine network among these three medical institutes.

For Teleradiology - Sanjeevani supports capturing of images in common formats including DICOM from scanners with transparency adapters and specialized medical film scanners.

For Telepathology - Sanjeevani supports the transmission of the following pathological reports:

DR 36.7

What is Telemedicine?

Telemedicine Coming of Age

September 28, 1998; updated May 3, 2002

Doctors are getting 'wired' in novel ways to benefit patients.

Telemedicine has been defined as the use of telecommunications to provide medical information and services. (Perednia and Allen, 1995). It may be as simple as two health professionals discussing a case over the telephone, or as sophisticated as using satellite technology to broadcast a consultation between providers at facilities in two countries, using videoconferencing equipment. The first is used daily by most health professionals, and the latter is used by the military and some large medical centers. It is the practice of telemedicine somewhere in between those two which will be described in this article.

Types of Technology

Two different kinds of technology make up most of the telemedicine applications in use today. The first, called store and forward, is used for transferring digital images from one location to another. A digital image is taken using a digital camera, ('stored') and then sent ('forwarded') to another location. This is typically used for non-emergent situations, when a diagnosis or consultation may be made in the next 24 - 48 hours and sent back.

The image may be transferred within a building, between two buildings in the same city, or from one location to another anywhere in the world. Teleradiology, the sending of x-rays, CT scans, or MRIs (store-and-forward images) is the most common application of telemedicine in use today. There are hundreds of medical centers, clinics, and individual physicians who use some form of teleradiology. Many radiologists are installing appropriate computer technology in their homes, so they can have images sent directly to them for diagnosis, instead of making an off-hours trip to a hospital or clinic.

Telepathology is another common use of this technology. Images of pathology slides may be sent from one location to another for diagnostic consultation. Dermatology is also a natural for store and forward technology (although practitioners are increasingly using interactive technology for dermatological exams). Digital images may be taken of skin conditions, and sent to a dermatologist for diagnosis.

The other widely used technology, two-way interactive television (IATV), is used when a 'face-to-face' consultation is necessary. It is usually between the patient and their provider in one location and a specialist in another location. Videoconferencing equipment at both locations allow a 'real-time' consultation to take place. The technology has decreased in price and complexity over the past five years, and many programs now use desktop videoconferencing systems. There are many configurations of an interactive consultation, but most typically it is from an urban-to-rural location. It means that the patient does not have to travel to an urban area to see a specialist, and in many cases, provides access to specialty care when none has been available [illegible]. Almost all specialties of medicine have been found to be

Telemedicine service in Pune primary health centers

by V.Radhika, India Abroad News Service

Pune, May 3 - Those living in interior Pune villages will now be able to avail expert medical council well within their means, thanks to a unique telemedicine program.

The Pune district administration has teamed up with www.doctoranywhere.com and Tata Council for Community Initiatives (TCCI) to launch a telemedicine service from a government primary healthcare center (PHC).

The service, says the Chief Executive Officer of Pune district administration V. Radha, will reduce the traveling time and expenditure of the poor villagers.

The villagers rush to big cities to meet specialist doctors. Since their relatives often accompany the patients, the cost mounts up. The service launched at three primary health centers is targeted at the rural masses, Radha told IANS.

There are 88 PHC's in Pune district, each manning five to six sub-centers. The PHC's are manned by two doctors each and equipped with basic medical facilities, including operation theatres, laboratory and a pharmacy. The staff consists of 15 personnel who travel to the sub-centers to implement government programs on primary health, vaccinations, leprosy and AIDS.

The telemedicine project, she said, will ultimately connect all the PHC's in the district. In the first phase, three PHC's in Wagholi, Chakan and Paud regions would be linked with the district administration of Pune and the specialists.

"If we have the headquarters connected with these PHC's, we can respond immediately. If there is an emergency, we can at least rush medicines. There are at least five to six doctors always present at the headquarters who can respond even if there are no specialists."

As part of the project, a two-day training program was conducted recently for 12 doctors. According to Chetan Shetty of doctoranywhere.com, "These doctors along with the doctoranywhere team will train the key users of the computer and impart training about the software provided for telemedicine at each heal

The success of the telemedicine projects at Aragonda in Chitoor district and at Mahaboobnagar General Hospital over the last two years has spurred the State Government to push for telemedicine links with all districts. Speaking to *The Hindu*, K. Anji Reddy, Director-General, AP Vaidhya Vidhana Parishad, said before the end of 2003 the Government plans to connect all district hospitals with super-speciality hospitals in Hyderabad through telemedicine.

The APVVP has fixed low, and even free, user charges on various facilities to be provided and superspeciality hospitals of Hyderabad have been allocated different hospitals to link up with.

Dr. Anji Reddy feels that telemedicine is the perfect vehicle for a successful implementation of the private-public partnership in extending health services to the districts.

Apollo (Karimnagar) and CARE (Mahaboobnagar) already have telemedicine links with district hospitals. Nizam's Institute of Medical Sciences is on course to link up at least one district hospital before the end of August. CDR Hospitals too has plans to link up two districts.

It is through the development of software and the spread of communication infrastructure that telemedicine has actually become a public health possibility from being merely a technology demonstrator. Images transmitted over ordinary formats have too many distortions for medical use and there were problems of slow network speeds. Most importantly, integration of images, graphics, texts and voice in real time has often proved an obstacle to spread of this technology.

K. Subbarao, Director, NIMS says that the medico-legal aspects of telemedicine have still not been properly worked out. "Who owns the images and accepts responsibility for diagnosis made on the basis of these images," he asks. Till recently almost all the images transferred were not on the DICOM (Digital Imaging and Communication in Medicine) format which is the only internationally recognised format for medical image transfer. Moreover, most of the machines in use, like CT Scans, Echo colour Doppler and ECG, were analog based and thus not DICOM compatible.

Apart from that there were problems with bandwidth -- either it was too slow and unreliable or expensive and impractical. As recently as November last year the CARE link with Mahaboobnagar had to depend on the VSAT satellite link which cost upward of Rs. 27 lakhs to install and about Rs. 1 lakh to maintain every month.

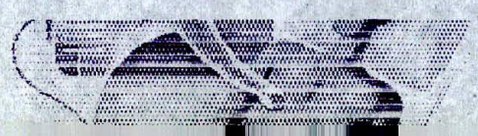
The Mahaboobnagar telemedicine link is now working on a BSNL leased line of 2 mbps on its optical fibre cables network and costs about Rs. 25,000 per month.

Says V. Giridharan, Managing Director, Karishma Software Ltd, the software solution provider for the CARE - Mahaboobnagar link, "We can set up a completely functional telemedicine link, with integration of all high end diagnostic machines, video conferencing and online medical records availability, between any two centres in less than one week." The cost of the computer equipment and software too has come down to less than Rs. 7 lakh per centre.

The software links the high end diagnostic machines at the remote centre with the super speciality centre through real time transfer of images along with a parallel video conference between doctors at these two centres. It is this clarity of images and the possibility of interactive communication between doctors engaged in diagnosis that has set the benchmark in telemedicine.

The possibilities provided by this software solution has emboldened CARE to extend telemedicine links as far as Orissa and even Assam.

The Government of India has plans to spread telemedicine all over the country. R.R. Shah, Secretary, Union Ministry of Information Technology, told *The Hindu* that the Government was even considering



the possibility of a dedicated "Health Satellite" to provide enough bandwidth for this project. Andhra Pradesh can feel proud at having been

in the forefront of this technology driven initiative, whether it was Apollo's technology demonstrator at Aragonda or the Hyderabad based Karishma Software's DICOM based solutions which even got a pat from our President a few weeks ago.

DR - 36.8

India: Telemedicine's Great New Frontier

An indigenous technology effort is wiring up its healthcare system

By Guy Harris, Secretary, International Society for Telemedicine

Champions of telemedicine, the systematic application of information and telecommunications technology to the practice of healthcare, have been very patient. By the 1980s, pilot projects begun amid great hopes in the 1950s and 1960s had fizzled out for the most part. More recently, however, telemedicine has undergone something of a resurgence, as technology has begun catching up with aspirations. Perhaps nowhere is this renaissance so vitally needed as in India.

With their dependence on high-bandwidth real-time technologies, most telemedicine projects of the past decade have been ill suited to India. Now, though, new hopes are being engendered there by the confluence of low-bandwidth telemedicine with a growing middle class, an improving telecommunications infrastructure, a world-class software industry, and a medical community open to new ideas.

The facts on India's healthcare situation are sobering. With a ratio of one hospital bed for every 1333 citizens, the huge country is far behind even the Philippines, at 1:600, let alone the United States' 1:212. To get to a more reasonable 1:500 ratio would require the annual construction of 700 new 250-bed hospitals for years to come.

India has one doctor for every 15 500 people. But most doctors live in cities, whereas 70 percent of the subcontinent's population of just over 1 billion lives in rural areas.

Figures on the percentage covered by health insurance vary from 3 to 9 percent. For the hundreds of millions of poor Indians, healthcare is nominally a government responsibility. But spending on healthcare represents only 0.9 percent of gross domestic product, as against around 14 percent in the United States.

The basic unit of the public system is the Public Health Center, which is typically staffed by one or two general practitioners and 10 or so nurses. Each of the centers has a few beds for simple in-patient procedures and perhaps X-ray and lab facilities. There are only about 23 000 of these for some 600 000 villages. Above them in the healthcare hierarchy are district hospitals and, in a few cities, multispecialist hospitals. To get care, those who can afford it typically spend days traveling.

Another complicating factor is that India's government-run healthcare system must coexist with hospitals run bypublic and private trusts and with an active private sector, which caters to middle- and upper-class Indians and can pay salaries around 10 times the public rate. Even the most prominent private group, Apollo Hospitals, manages only about 4000 beds throughout the country. There is no doubt that countless men, women, and children could all benefit enormously from telemedicine.

Technical ministries take the lead

Two government institutions are leading the way. One is the Indian Space Research Organisation (ISRO). The other is the Ministry of Information Technology, which already has 200 sites used for telemedicine and other purposes. The sites are linked by 128-kb/s integrated-services digital networks (ISDNs) or by satellite and offer occasional videoconferencing for medical teleconsultation and education.

The Ministry of Information Technology's National Informatics Center plans this month to bring on-line a 384-kb/s ISDN linking three teaching institutions, the Sanjay Gandhi Post Graduate Institute of Medical Sciences in Lucknow, the All-India Institute of Medical Sciences in New Delhi, and the Postgraduate Institute of Medical Sciences and Research in Chandigarh. The purpose of the network is collaborative medical education and research.

In a monthlong hookup after an earthquake, telemedics transmitted data on 750 patients to specialists 300 km away

In addition, ISRO plans to launch the statewide Orissa Telemedicine Network to provide physicians in this impoverished state with teleconsultation and education programs. The agency is also launching telemedicine projects in several other areas that have been particularly underserved by healthcare professionals: the Andaman & Nicobar Islands, far to the east of India in the Bay of Bengal; Lakhshdeep Island, off the southwest coast; and the

Leh Mountain areas in the Himalaya range in the state of Jammu and Kashmir.

ISRO has also provided access to its V-SAT (very small-aperture antenna) communications infrastructure. Apollo Hospitals' new, small hospital, based in the village of Aragonda, is one V-SAT user. The 40-bed hospital was newly built and equipped with modern computer tomography, ultrasound, echocardiography, automated laboratory equipment, incubators, and electrocardiogram equipment. A pediatrician and a general surgeon were made available in addition to generalists. Using both store-and-forward and real-time technologies such as videoconferencing, some 200 teleconsults have been provided to this village alone from specialists in Chennai, formerly Madras. Data is managed through a locally developed software package, Mediscope.

This last indicates a characteristic of Indian telemedicine—it is a largely indigenous affair. India's prodigious gift for information technology has produced world-leading software and systems, obviating the need for expensive imports. The range of systems developed is already wide, among them assorted mobile vans equipped with basic patient monitoring (like electrocardiographs) and short-range wireless communications equipment. It might even serve as the basis for an export industry, particularly to other countries with limited IT infrastructures.

Successes on a large scale

Can telemedicine really make a difference in India? Two recent events suggest it can. The Gujurat earthquake on 27 January 2001 devastated the western city of Bhuj and left thousands dead and many more homeless. Within 24 hours the Online Telemedicine Research Institute (OTRI) in Ahmedabad, about 300 km from Bhuj, had established satellite telephone links between an emergency command center in neighboring Ghandhinagar and various facilities around Bhuj, including one housed in a tent.

In one month, the hookup transmitted to specialists in Ahmedabad approximately 750 sessions involving primarily X-rays and electrocardiographs of patients in the disaster area. After two days, the satellite phones gave way to the more economical V-SAT (which requires a 2-meter dish), with phone lines and ISDN being added as infrastructure was repaired. Much of the imaging and data transfer was mediated by Pentium 3-based PCs. Eventually, engineers established a full-fledged telemedicine system supplying teleconsultation in pathology, radiology, and cardiology over ISDN lines between district hospitals near Bhuj and others in Ahmedabad.

The second encouraging project was carried out during the Kumbh Mela, a Hindu festival held every 12 years that last year drew 25 million pilgrims to the banks of the Ganges River. Here, the OTRI and the Sanjay Gandhi Post Graduate Institute established a station under the sponsorship of the Ministry of Information Technology to monitor levels of cholera-causing bacteria in the river water. Microscope images of samples of microorganisms from the river were transmitted to the Institute's experts in pathology and microbiology for identification and analysis. In addition, radiology and cardiology data was transferred to specialists for the total of 202 pilgrims who fell ill. The project ran for 45 days.

Interestingly, it is the engineers and technologists, not physicians, who have pushed hardest for telemedicine. "The Ministry of Health has not started any activity, not even R&D," noted professor Saroj Mishra, head of Endocrine Surgery at the Sanjay Gandhi Post Graduate Institute.

Pathologists have been something of an exception. Just this past December, the Indian Association of Pathologists and Microbiologists organized a symposium on telepathology at their annual conference in Mumbai (formerly Bombay). Among other topics, the more than 500 participants heard a formal announcement of the establishment of a free consultancy, at telepathologyindia.com, providing second opinions on diagnoses from a range of Indian and international experts.

A number of other dot-coms are in the game, including DoctorAnywhere.com, a Web-based service through which more than 1000 physicians in private practice now consult with specialists. In April of last year the service was offered to the public health system at no cost, beginning with a pilot program at a Public Health Center in Wagholi, near Pune, in collaboration with the Tata Council for Community Initiatives, the humanitarian arm of the country's largest industrial group.

Perhaps the greatest lesson of India's recent telemedicine experiences, and one applicable to any developing country, is that a lack of physical infrastructure no longer precludes the development of an effective healthcare system. The West's resource-intensive specialty-care institutions, the cornerstone of industrial Age medicine, are to a large extent obviated in the Information Age by telemedicine. India can be the template for a new kind of healthcare.

Acknowledgments: The author wishes to thank Milind Purandare, Zakiuddin Ahmed, Srikrishna Sharma, Ragesh Shah, Leonid Androuchko, Sanjay P. Sood, Sunil Kumar, M.K. Baruah, and Saroj Mishra for their advice and supp

Our Vision is to provide a model of Telemedicine, which self propagates throughout India and into the developing world. It will provide a channel for continuous access to the most sophisticated medical support systems, at all times. Further, Telemedicine shall improve patient care, enhance medical training, standardize clinical practice, stabilize costs and unite clinicians worldwide.

Apollo Telemedicine believes that this will only happen with the usage of user-friendly technology that is cost effective and scalable.

Offering medical advice via remote communication networks has grown to become an established service in the developed world and Telemedicine has been recognized by the World Health Organization as a cost effective, practical method to deliver healthcare to all.

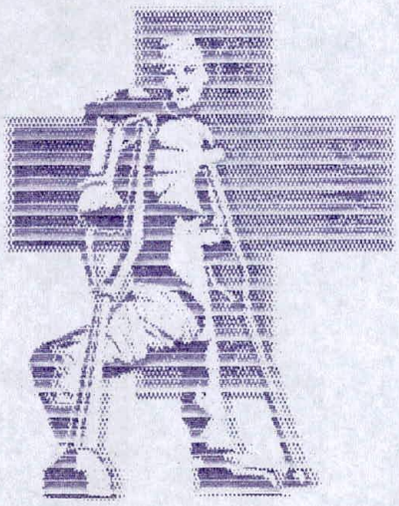
India, owing to its vast expanse of land, has its population scattered. Of this, the availability of healthcare facilities is not evenly spaced but is region specific and very often the majority of the population does not get the benefit of specialized medical treatment.

Telemedicine allows us to present a time based, but value-added, model that efficiently utilizes the scarce resources allocated for healthcare services.

In India, Telemedicine will in addition to health related referrals:

- Allow for it to be used as a channel for communication.
- Allow "community-reach" programs in getting th message across (potable water, village sanitatio family nutrition, etc)
- Allow for successful implementation of population control programs.
- Create a channel for AIDS awareness.
- Bring the private insurance sector initiative to the rural population.
- Allow the state to monitor distress and epidemics & epidemiology.

ort.



Now that tele-medicine has made its debut in India, patients are counting the benefits, rather than the costs.

Illness is no longer a nightmare for those living in the remote villages surrounding a non-descript town in the Chittoor district of Andhra Pradesh. Gone are the days when they had to rush a sick villager in the middle of the night to a city hospital hundreds of kilometers away so that his or her life could be saved. Now, the new hospital in the town has access to the best medical treatment and expertise available anywhere in India. Actually, what the hospital offers is the ability for in-house physicians to consult with experts and specialists from top hospitals in Chennai and Hyderabad without traveling to those cities. Welcome to telemedicine in India!

And telemedicine under Indian conditions won't be limited to remote consultation and referral services — it can also be an important tool for public health administrators. Telemedicine has a variety of applications in patient care, education, research, administration and public health. Plus, home monitoring of patients is attracting much attention. "With this technology, we may be able to realize the goal of 'Health for All' faster than with traditional means," commented an IT Ministry official. In fact, the World Health Organisation (WHO) has recognized telemedicine as the means to deliver healthcare to all.

Apollo Group Launches Tele-Med Project

India's first telemedicine project in the commercial arena was launched on April 13 at Aragonda village (Andhra Pradesh, South India) using satellite and computer links. But that was just the beginning. A series of such projects will soon become operational at several other locations, bringing top-class medical treatment to the doorsten of the rural masses.

Until now, the villages around Aragonda were being served by local practitioners and a government-run Primary Health Center (PHC), manned by a single registered doctor. Under the telemedicine project, the private sector hospital chain, Apollo Hospitals Group, has set up a 50-bed telemedicine center equipped with facilities like operation theater, CT-scan, X-ray and an integrated laboratory. The center has been connected via satellite to Apollo's specialized hospitals at Hyderabad and Chennai, both of which located several hundred kilometers away.

Using special hospital information software and hardware, doctors at the telemedicine center can scan, convert and send data images to teleconsultant stations at hospitals in Chennai and Hyderabad. The facility will be used for seeking referral services, second opinion, post-acute care, interpretation services and health education. For these services, villages earlier used to go to a teaching hospital located more than 100 kilometers away. "The idea is to take modern healthcare even to the remotest village, using advances in information technology," says Dr. Prathap Reddy, chairman of the Apollo Hospitals Group.

The group has plans to extend the facility to cover 125 PHCs, 25 district hospitals and three tertiary centers in five states. "We need to connect all the three levels of the healthcare system in order to reap full benefits of telemedicine. In this endeavor, private and public sector should work together," says Reddy. Telemedicine, he says, will improve patient care, enhance medical training, standardize clinical practices and stabilize costs.

The project has drawn attention of the President Clinton. When he briefly stopped at Hyderabad this March, he checked out the details of the telemedicine initiative. "I think it is a very wonderful contribution to the healthcare of people who live in rural areas and I hope that people all over the world will follow your lead — because if we do so, then the benefits of high-tech medicine can go to everyone, and not just to people who live in big cities," Clinton commented while at the Apollo kiosk setup at Hyderabad's Mahavir Hospital, where he delivered an address on fighting AIDS and tuberculosis.

Other Initiatives

Apollo is not alone in the telemedicine endeavor. Vijayawada, another city in Andhra Pradesh, is the site of yet another telemedicine initiative in the private sector. The project at Tadepalle is being executed by the Soumya Medical International, floated by NRI entrepreneur-doctor G. Suresh. The company is setting up a remote medical diagnostic system for the rural population. The project will call for a core center at Vijayawada, and the creation of five regional diagnostic centers in surrounding districts, which will be linked to 100 general practitioners. If successful, this project would address the need of approximately one million people. The core center, a 250-bed hospital, is nearing completion and likely to be inaugurated soon. The Technology Development Board (TDB), an arm of the Ministry of Science and Technology, has extended financial support to the Rs. 100 million project by shouldering 50 percent of the cost.

The Ministry of Information Technology has already initiated a Technology Development

Program for telemedicine using both ISDN and dial-up telephone lines. Since the basic technology has been developed, soon a pilot project will be launched to study the feasibility of introducing telemedicine. CDAC and CEDT, scientific societies of the Ministry, are the implementing agencies. Initially, three premier medical institutions at New Delhi, Lucknow and Chandigarh will be connected for realizing tele-diagnosis, tele-consultancy and tele-education. Later, each of these institutes will be connected to one hospital at nearby town. "We are looking for cost-effective solutions. Our main concern now is to find ways to make telemedicine affordable," says Sarada Ranjan Das, senior director, IT Ministry. The institutions to be networked are the All India Institute of Medical Sciences, New Delhi; the Post Graduate Institute (PGI), Chandigarh; and the Sanjay Gandhi Medical Institute at Lucknow.

Dr. Reddy commented that telemedicine could radically decrease healthcare costs. First, the cost of traveling to major cities for care would be almost eliminated. Says Reddy, "[Indians living in rural areas] tend to spend much more on travel and stay of the family than the patient's medical bills." Also, hospitals will have a location cost advantage; it is much cheaper, after all, to set up telemedicine centers in smaller towns than to open hospitals in large cities. Government statistics show that up to 80 percent of the healthcare facilities, in both urban and rural areas, are in the private sector.

Getting Wired for the New Age

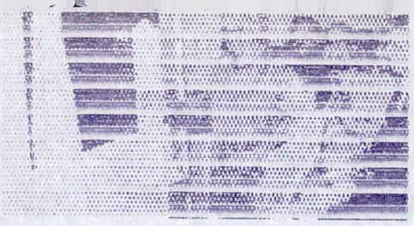
A country like India, there needs to be more than just one technology option. While the IT Ministry is trying to set up dial-up ISDN lines, Apollo has gone in for a satellite link provided by the Indian Space Research Organization (ISRO) on its INSAT series of satellites. In fact, on the latest Insat-3B satellite, ISRO has allocated transponders for specifically for telemedicine, for the first time.

A couple of years ago, the National Informatics Center (NIC) piloted a telemedicine project using its nation-wide VSAT network. "ISRO has given the satellite link for two years. We also have other options like landlines. A lot of bandwidth is going to be available very soon — and we have been promised a free float on that," says Reddy.

For the Indian software companies, which have been delivering packages and services for the healthcare sector in North America, arrival of telemedicine presents new opportunities as well as challenge. Indian requirements are different and far more challenging than the United States. If telemedicine succeeds, it would perhaps the most visible face of application of IT for the masses.

Do you have comments about this article? Please give us your FEEDBACK!

TELEMEDICINE IN ANDAMAN & NICOBAR ISLANDS



The Prime Minister, Shri Atal Bihari Vajpayee launched the much awaited telemedicine project on 3rd July, 2002 for the people of the A & N Islands by being in Delhi where he dedicated to the nation the INSAT-3C at Delhi Earth Station of Department of Space, which has linked the G.B. Pant Hospital, Port Blair with Sri Ramachandra Medical College & research Institute, Chennai, a Deemed University with super specialty hospital. Simultaneously, at Port Blair, the Telemedicine Centre was inaugurated by the Lt. Governor, Shri N.N.Jha same day at a function organised in this connection at the G.B.Pant Hospital Complex.

The Indian Space Research Organisation has the main objective of using space science and technology for grassroots level applications. Today, INSAT and IRS (Indian remote Sensing) satellites launched by ISRO, are being used for various applications – communications, including those to remote and inaccessible areas; television broadcasting, including developmental education; meteorological services;disaster warning and natural resources survey and management. New areas of space applications continue to be explored by ISRO.

One of the recent applications of space technology initiated by ISRO is in the field of telemedicine to provide expert medical services to the rural and remote areas. Under the Telemedicine project, Hospitals/health centers in remote locations are linked via INSAT satellites with super specialty Hospitals at major towns/cities, bringing in connectivity between patients at remote end with the Specialist Doctors for medical consultations and treatment. Telemedicine pilot projects are undertaken by ISRO with the involvement of selected super specialty hospitals located in major cities and smaller health centers in distant and rural areas.

About Telemedicine

Telemedicine system consists of customized medical software integrated with computer hardware, along with medical diagnostic instruments connected to the commercial VSAT (Very Small Aperture Terminal) at each location. Generally, the medical record/history of the patient is sent to

the Specialist Doctors, who will in turn study and provide diagnosis and treatment during videoconference with the patient's end.

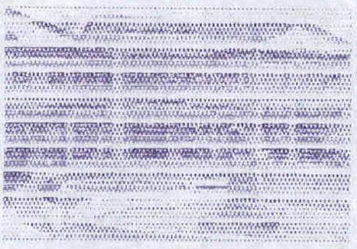
Advantages of Telemedicine

Telemedicine helps patients in distant and rural areas to avail timely consultations of Specialist Doctors without going through the ordeal of traveling long distances at large expense. The facility caters normally for transmission of patient's medical images, records, output from medical devices and sound files, besides live two-way audio. With the help of theses, a Specialist Doctor could advise a Doctor or a paramedic at the patient's end, online, on medical care or even guide the Doctor during a surgery. In the context of distant and rural areas, the telemedicine-based medical care is also highly cost effective.

Sri Ramachandra Medical College & Research Institute, Chennai

Sri Ramachandra Medical College & Research Institute (SRMC & RI), Chennai was established by Shri N P V Ramasamy Udaya in 1985 as a 'not for profit' Trust for medical education, health care and research. The institute, spread over an area of 175 acers, has been recognized as Deemed University since 1994. The College wing of SRMC & RI, with about 5500 students, offers Graduate and Post-graduate courses in various Medical and Para-medical Sciences, and super-specialty courses in Cardiology, Neurology, Neurosurgery, Genito-urinary surgery and Cardio-thoracic surgery. The Hospital wing of the SRMC & RI has over 1500 bed and about 250 specialist Doctors.

G B Pant Hospital, Port Blair



Located in the premises of the historic Cellular Jail, the G B Pant Hospital at Port Blair is the only referral hospital for the entire group of Andaman & Nicobar Islands. Set-up initially in 1963, the Hospital everyday. The Hospital now has about 40 Doctors including a few specialists. Super Specialty services in cardiology, cardio-thoracic surgery, neurology, nephrology, gastro-enterology, urology, plastic surgery, etc. are obtained from the mainland. A & N Administration also provides Air Ambulance Services to patients with medical emergencies.

Other Space Technology Application Project/initiatives in Andaman & Nicobar Islands

- Coastal Zone Management Plans
- Biodiversity Characterization at Landscape Level
- Fisheries Potential Forecasts
- Space Museum at Port Blair
- Remote Sensing Cell at Port Blair
- Satellite based Communications Back-bone for the Islands- for administration and technical education
- Natural Resources Information System (NRIS)

Some Telemedicine Projects of ISRO

Project	Specialty Hospital end	Distant/Rural end
Andaman & Nicobar Islands	Sri Ramachandra Medical College & Research Institute, Chennai	GB Pant Hospital, Port Blair
Apollo-SHIR	Apollo Hospital,Chennai	ISRO's SHAR Hospital,Sriharikota Aragonda Appollo Hospital, Chittoor District, Andhra Pradesh
Karnataka	Narayana Hrudayalaya, Bangalore	District Hospital, Chamarajanagar Vivekananda Memorial Hospital, Saragur, HD Kote Taluk,Mysore Dis.
Tripura	Narayana Hrudayalaya, Bangalore and Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata	Tripura Sundari District Hospital, Udaipur, South Tripura
Assam	All India Institute of Medical Sciences(AIIMS),New Delhi	Guwahati Medical College & Hospital
Ladakh	All India Institute of Medical Sciences(AIIMS),New Delhi	District Hospital, Leh
UT of Lakshadweep	Amrita Institute of Medical Sciences(AIMS) Cochin	Indira Gandhi Hospital, Kavaratti
Orissa	Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow	Medical College Hospitals-Cuttack Behrampur & Burla

Introduction to Telemedicine

This introduction to telemedicine is based on a presentation given by Dr. Susan Zollo, Director of the Telemedicine Resource Center at the University of Iowa. Contact susan-zollo@uiowa.edu

The Institute of Medicine defines telemedicine as "...the use of electronic information and communications technologies to provide and support health care when distance separates the participants..."

The most common applications today are in transmission of high-resolution X-rays, cardiology, orthopedics, dermatology and

psychiatry. Often, interactive video and audio are used for patient consultations and guidance on procedures; sometimes video briefings and records of specific operations are kept on a network in digital form. Groups of physicians, teachers and researchers often "meet" across large distances. Telemedicine also embraces the management of electronic patient records, access to libraries and databases on the Web and on private networks, and extensive use of e-mail by many in the medical profession.

Telemedicine arose originally to serve rural populations, or any people who are geographically dispersed -- where time and the cost of travel make access to the best medical care difficult. Now, it is increasingly being used in mainstream medicine, to allow doctors the world over to share expensive resources and valuable experience.

Telemedicine is increasingly global in its reach; in 1997 there were 188 active programs around the world, including Israel, Chile, India, Taiwan, Japan and the USA.

Telemedicine is increasingly global in its reach; in 1997 there were 188 active programs around the world, including Israel, Chile, India, Taiwan, Japan and the USA. The availability of telemedicine is dependent to a large degree on telecommunications, and on high bandwidth, the field is concerned with advanced telecomm equipment and standards, methods of increasing effective bandwidth and network performance, costs of installation and operation, security, confidentiality and reliability, and with government legislation aimed at furthering progress in these areas.

The importance of bandwidth may be seen in a simple example. With a 28.8 Kbps dial-up connection, transmission of a standard X-ray takes 30 minutes; with a T1 line at 1.5 Mbps it takes 30 seconds; with a high-speed DS3 circuit, it takes 1 second. Clearly, productivity and usability of telemedicine data depends on the availability of high bandwidth.

In the Middle East, Greenstar is demonstrating how high-quality medical care can be brought to virtually any village, powered by solar energy and wireless data communications. This demonstration begins with the visit by the President of the United States to the region in December, 1998, as part of the ongoing peace process.

Dr. Khalid Moidu, an adviser to Greenstar on telemedicine, adds to this narrative:

The earliest example of telemedicine was in the physiological monitoring of astronauts, through pioneering work done by NASA. The Gemini and Apollo astronauts in the 1960's had two-way video connections with space medical experts in Houston, and developed a quite natural mode of interaction from orbit that featured taking care of routine health questions and needs, and early experiments on the effects of weightlessness.

This was followed by trials at Boston's Logan Airport, and participation by native American reservations in the STARPHAC program.

Telemedicine in the developed world is really "virtual transportation." In critical situations, the ability to keep a patient where he is and not have to stage an emergency evacuation, with all its costs and dangers, can be vital to the patient's survival and quality of life. But in the developing world, telemedicine delivers access to a high level of care where it is simply not available, at any cost.

So Greenstar, with its built-in infrastructure of power and telecommunications, delivers the platform on which telemedicine can exist in the developing world, and through which knowledge and experience can be effectively diffused.

See more articles at: http://www.greenstar.org/telemed-intro.htm

TELEMEDICINE TRAINING: Client List

- Dept. of Defense, Bethesda Naval Medical Center
- Dept. of Defense, Joint Imaging Project Office, Ft. Detrick, MD
- Dept. of Defense, Space and Naval Warfare Systems Center, North Charleston SC
- Mountain Area Health Ed Center, Asheville, NC
- DeKalb Medical Center, Philadelphia, PA
- East Carolina Medical Center, Greenville, NC
- Bowman Gray Medical Center, Winston-Salem, NC
- University of Arizona, Tucson, AZ
- Arizona Telemedicine Program, Tucson, AZ
- Emergency Medical Associates, Booten Township, NJ
- Vencor Metabolic Services, Louisville, KY
- St. Joseph's of the Pines Hospital, Southern Pines, NC
- John Hopkins University, Baltimore, MD
- Rochester Hospital, Rochester, NY
- Medihelp, Queensland, Australia

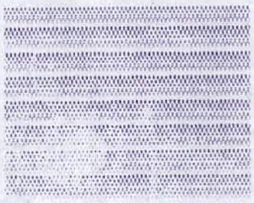
- University of S. Carolina, Columbia, SC

- Richland Memorial Hospital, Columbia, SC
- Johnson City Medical Center, Johnson City, TN
- Collegis, Raleigh, NC
- Mission St. Joseph's Health System, Asheville, NC
- ASHSP, Bethesda, MD
- Alaska Native Health Board, Anchorage, Alaska
- Sprint Healthcare Systems, Wake Forest, NC
- SUNY HSC/Dept. of Emergency Medicine, Syracuse, NY
- Physicians Telehealth Network, Columbus, OH
- Telemedicine Department, Madrid, Spain
- Medistat, Madrid, Spain
- California Emergency Physicians, CA
- University of South Alabama, Mobile, AL
- Catholic University of America, Washington, DC
- Integris Health, Oklahoma City, OK
- King Faisal Specialist Hospital, Riyadh, Saudi Arabia
- Halifax Regional Medical Center, Roanoke Rapids, NC
- Duplin General Hospital, Kenansville, NC
- Concurrent Technologies Corp., Johnstown, PA
- Goshen Medical Center, Faison, NC
- Pungo District Hospital, Bellhaven, NC
- Carteret General Hospital, Roanoke Rapids, NC
- Chowan Hospital, Edenton, NC
- Heritage Hospital, Tarboro, NC
- International Craniofacial Institute, Dallas, TX
- Indiana University Department of Surgery, Indianapolis, IN
- University of California Davis Telemedicine Department, Sacramento, CA
- National Rehabilitation Hospital, Washington, DC
- Radiology Department, US Navy, San Diego, CA
- VTEL Corporation, Austin, TX
- Consortium for Worker Education, Health Care Institute, New York, NY
- Shriner's Hospital for Children, Salt Lake City, UT

- The Hong Kong Polytechnic University, Hunghoun, Kowloon, Hong Kong
- University of Hawaii, Honolulu, HI
- St. Francis Healthcare Systems of Hawaii, Honolulu, HI
- Southern Regional AHEC, Fayetteville, NC
- Denley Technology Center, Washinton, DC
- Rural Health Group, Jackson, NC
- University of Maryland, Baltimore, MD
- The United States Telemedicine Training Institute, Washington, DC
- Medical Research Council of South Africa
- Area L AHEC, Rocky Mount, NC
- University of Transkei, Eastern Cape, South Africa
- University of Tennessee, Memphis, TN
- Cabazon Band of Mission Indians, Indio, CA
- Denver Health Authority, Denver, CO
- AVDA De La Universidad, Caceres, Spain
- Heritage Hospital, Tarboro, NC
- International Craniofacial Institute, Dallas, TX
- Indiana University Department of Surgery, Indianapolis, IN
- University of California Davis Telemedicine Department, Sacramento, CA
- National Rehabilitation Hospital, Washington, DC
- Radiology Department, US Navy, San Diego, CA
- VTEL Corporation, Austin, TX
- Consortium for Worker Education, Health Care Institute, New York, NY
- Shriner's Hospital for Children, Salt Lake City, UT
- Methodist Le Bonnheur Healthcare, Memphis, TN
- East Carolina University (ECU) and ECU Medical School, Greenville, NC
- Pitt County Memorial Hospital, Greenville, NC
- Baptist Hospital/Wake Forest University, Winston-Salem, NC
- Medihelp International, Queensland, Austrailia
- People Republic of China, Malaysia, Indonesia
- FUNEN Project, Pune, India and Walnut Creek, CA

- The Secretary of Communications, Argentina
- SUNY Health Science Center, Brooklyn, NY
- Department of Surgery, Rochester General Hospital
- Endovascular Technologies, Inc.
- Shriner's Hospitals for Children National Telemedicine Project

- Johnson City Medical Center, TN
- Eastern Virginia Medical School, Norfolk, VA
- United Telemedicine Services, Corp., Bethesda, MD.
- Catholic University of America, Washington, DC
- Mission St. Joseph's Health System, Asheville, NC
- Cardiothoracic Research Foundation, Escondido, CA
- Merck Co., Inc, West Point, PA
- NASA and the Global Telemedicine Group, McLean, VA
- United Therapeutics Corporation, Silver Spring, MD
- TMI Engineering, Houston, TX
- IBC Healtcare Limited, Greensboro, NC
- Telemedical Speciality Consultants, Winston-Salem, NC
- National Rehabilitation Hospital, Washington, DC
- Consortium for Worker Education, New York, NY
- Methodist Lexington Hospital, Lexington, TN
- Jackson Hospital, Jackson, TN
- University of Paris, Paris, France
- Sentara Healthcare, Norfolk, VA
- Nemours Children Clinic, Jacksonville, FL
- Organization Mikocheni Health and Education Network, Mission Viejo, CA
- Alaskanative Tribal Health Consortium, Anchorage, AK
- The Hong Kong Polytechnic University, Hunghoun, Kowloon, Hong Kong
- University of Hawaii, Honolulu, HI
- St. Francis Healthcare Systems of Hawaii, Honolulu, HI
- Southern Regional AHEC, Fayetteville, NC
- Denley Technology Center, Washinton, DC
- Rural Health Group, Jackson, NC



- University of Maryland, Baltimore, MD
- The United States Telemedicine Training Institute, Washington, DC
- Medical Research Council of South Africa
- Area L AHEC, Rocky Mount, NC
- University of Transkei, Eastern Cape, South Africa
- University of Tennessee, Memphis, TN
- Cabazon Band of Mission Indians, Indio, CA
- Denver Health Authority, Denver, CO

- Methodist Le Bonnheur Healthcare, Memphis, TN
- East Carolina University (ECU) and ECU Medical School, Greenville, NC
- Pitt County Memorial Hospital, Greenville, NC
- Baptist Hospital/Wake Forest University, Winston-Salem, NC
- Medihelp International, Queensland, Australia
- People Republic of China, Malaysia, Indonesia
- FUNEN Project, Pune, India and Walnut Creek, CA
- The Secretary of Communications, Argentina
- SUNY Health Science Center, Brooklyn, NY
- Department of Surgery, Rochester General Hospital
- Endovascular Technologies, Inc.
- Shriner's Hospitals for Children National Telemedicine Project
- Johnson City Medical Center, TN
- Eastern Virginia Medical School, Norfolk, VA
- United Telemedicine Services, Corp., Bethesda, MD.
- Catholic University of America, Washington, DC
- Mission St. Joseph's Health System, Asheville, NC
- Cardiothoracic Research Foundation, Escondido, CA
- Merck Co., Inc, West Point, PA
- NASA and the Global Telemedicine Group, McLean, VA
- United Therapeutics Corporation, Silver Spring, MD
- TMI Engineering, Houston, TX
- IBC Healtcare Limited, Greensboro, NC
- Telemedical Speciality Consultants, Winston-Salem, NC
- National Rehabilitation Hospital, Washington, DC
- Consortium for Worker Education, New York, NY
- Methodist Lexington Hospital, Lexington, TN
- Jackson Hospital, Jackson, TN
- University of Paris, Paris, France
- Sentara Healthcare, Norfolk, VA
- Nemours Children Clinic, Jacksonville, FL
- Organization Mikocheni Health and Education Network, Mission Viejo, CA

- Alaskanative Tribal Health Consortium, Anchorage, AK

- AVDA De La Universidad, Caceres, Spain
- Organization Mikocheni Health and Education Network, Mission Viejo, CA
- Alaskanative Tribal Health Consortium, Anchorage, AK
- The Hong Kong Polytechnic University, Hunghoun, Kowloon, Hong Kong
- University of Hawaii, Honolulu, HI
- St. Francis Healthcare Systems of Hawaii, Honolulu, HI
- Southern Regional AHEC, Fayetteville, NC
- Denley Technology Center, Washinton, DC
- Rural Health Group, Jackson, NC
- University of Maryland, Baltimore, MD
- The United States Telemedicine Training Institute, Washington, DC
- Medical Research Council of South Africa
- Area L AHEC, Rocky Mount, NC
- University of Transkei, Eastern Cape, South Africa
- University of Tennessee, Memphis, TN
- Cabazon Band of Mission Indians, Indio, CA
- Denver Health Authority, Denver, CO
- AVDA De La Universidad, Caceres, Spain

TOP OF PAGE

Telemedicine - Saving Lives in remote areas

As five-year-old Thejas lay in bed in the consulting room at the Aragonda Apollo hospital in this remote village, about 170 km from Chennai, doctors first diagnosed a murmur in the heart and he was put on colour doppler.

As the colour doppler images were transmitted to its hospital in Chennai using special electronic communication, Pediatric Cardiologist Prem Shekhar diagnosed the case as "Sallot's Tetrology" (Multiple Congenital defect of the heart). After a few hours consultation with surgeons and hospital chairman Dr Pratap C Reddy, the child was transferred to Chennai Apollo hospital for surgery. Dr Reddy told that this facility has heralded telemedicine in India and that as a special case Thejas would be operated free of cost and all the expenses borne by the hospital.

Priyanka (11) was similarly diagnosed as having a hole in the heart and she is being shifted to Apollo's Hyderabad hospital for surgery. A Philanthropist will bear the cost of the consumables while the hospital will provide its services free as a special case.
Dr Reddy born in this village was ferried in a bullock cart to a primary school. In contrast a helipad is now being readied to bring union Information Technology Minister Pramod Mahajan to formally declare open this 50 bed hospital, a pioneering venture that will give access to the best medical facilities in India to Aragona with a population of 4000 as also surrounding villages with a population of 50,000 at a nominal cost.

The public sector oriental insurance corporation has also stepped in to provide medical insurance to the villages at a premium of Rs 1 per day. Dr Reddy, who had built Asia's largest private health care group which is also the seventh largest in the world, had done it again, this time by bringing in modern communication technology using satellites to provide state-of-the-art medical care to

the villages at affordable range.

Telemedicine, which is already in vogue in advanced countries, puts health care specialists in touch with remote clinics, hospitals, primary care physicians and patients and is used for remote consulting, medical diagnosis, treatment and continuing education. Dr Reddy said while advanced medical facilities were available in large cities, rural areas at best had only primary health centers and the Telemedicine initiative made by the hospital was to bridge the geographical distance and take health care from the people who have it to the those who don't.

Prime Minister Atal Bihari Vajpayee in a message congratulated the hospital group for the initiative. US president Bill Clinton during his recent visit to Hyderabad was all praise for the initiative that is expected to revolutionize health care delivery in the rural areas. The hospital is built at a cost of Rs 5 crore and is equipped to provide primary and secondary care.

The Indian Space Research Organisation (ISRO) has provided the satellite facilities and citadel, GE and Wipro have extended their support to the undertaking. It has all the basic equipment to scan, convert and send data images to the teleconsultant stations in Chennai and Hyderabad. The images shall be compatible so as to achieve universal standardization, Dr Reddy explained. Dr Reddy said in the phase two of the telemedicine project, 125 primary, 25 secondary and three tertiary centers in five states of Maharashtra, Gujarat, Madhya Pradesh and Tamil Nadu and Andhra Pradesh would be covered. Phase three will connect 2500 primary centers, 500 secondary and 100
tertiary centers all over the country and attempt to extend the services to the developing world.

It will also extend the services beyond national boundaries to connect international centers of medical excellence with local medical institutions via the telemedicine link. Dr Reddy said the vision of the Aragonda telemedicine endeavor is to provide a successful working model for rural telemedicine and its implementation throughout India and the developing world. Telemedicine initiative here is the blending of two worlds--the traditional and the jet set.

International Telemedicine Markets & Business Opportunities

An Article from *Global Telemedicine Report*

Profile: Taurus Technologies Takes on India

A small company out of Newport News, VA is attempting a huge project: Taurus Technologies -- under the direction of CEO Arvind Patel -- is trying to get the Indian government to buy into a plan to install a fleet of multimedia-based kiosks (with satellite communications) throughout the subcontinent as a cheap way to bring improved health care to rural millions.

Patel, himself born in India, told GTR that the government is certainly interested but that there are various political difficulties, as a government shift may soon take place. Taurus isn't the only company interested in the project, although we cannot identify for certain any other players. (It is entirely possible that a Hughes, say, or a consortium of large hardware vendors, communications suppliers and systems integrators is going after the same project. In this sort of situation one hears frequently the plaint from the small players that the big guys are only after the big buck -- do a large demo, take the money, and get out. Whereas, they, the people with the time invested and the organic connection to the place are more interested in a sustainable solution. We make no judgment here because we haven't the facts -- yet.)

Taurus is a systems integrator trying to leverage a background in systems engineering for nuclear plants into the international health-care arena. The idea of their contact in India, evolved with Patel's help, is to flood the country with kiosks equipped with basic diagnostic support, connected to a communications node that talks to the regional support center, which in turn links back to a national -- and, finally, international -- network.

Taurus' job is to put together the subsystems for accepting diverse data feeds from everything from lab equipment to EKG to radiology sources.

The Time and Money Involved

"If the [political] approvals happen, we'd like to do a pilot project around Delhi in the next 90-120 days," Patel informed GTR. The cost-per-kiosk would run about $150,000 to start with. Part of the vision that drives the kiosk idea is that once a working model is generated, systems integrators will swarm in and drive down the cost.

The Indian telecom infrastructure is basically being developed along European lines, with E-1 lines taking precedence. E-1 lines are, in terms of bandwidth, between T1 and T3. A 1.5 GHz TDMA pump has recently been turned on.

There are a number of different players involved: AT&T and Aditya Birla (a billion-dollar

Indian concern involved with a number of industries besides telecom) have teamed up to win contracts to provide infrastructure in several Indian states.

Back in the U.S., Patel and Taurus now search for component and device manufacturers whose products can be integrated into the kiosk. "It is tough to find cooperative vendors who provide data access at the level we need it," observes Patel. They have spoken with both Corometrics (which does work with Dr. Jason Collins, the developer of an in-home, md/tv-based fetal-monitoring solution) for EKG/ECG, and they also are attempting to deal with Beckmann, which supplies PC-based lab tools. GTR will keep you up to date as things progress in India.

Telemedicine project for more States

By T. Lalith Singh

HYDERABAD July 18. Enthused by the success in Andhra Pradesh, the city-based CARE Hospital has decided to replicate its telemedicine project in other States. The service has recently been introduced in two centres in Orissa and plans are on to set up a similar facility in Assam.

Using satellite communication, the hospital first used the concept of telemedicine to connect specialist doctors in the city with Mahbubnagar Government General Hospital, in October last. So far, over 1,100 patients from the district have availed the facility to seek diagnosis.

The doctors in Mahbubnagar use digital transmission for sending their patients' clinical information and diagnostic reports pertaining to cardiology, radiology and neurology for expert consultation. The project is equipped to handle the transmission of real time data, video, audio and graphic communication, enabling medical practitioners to send ECG, ultrasound and CT-Scan.

``Once the clinical information, along with images, comes here, the patient is assigned a unique identification number. The information is then examined by the experts and diagnosed immediately,'' CARE Foundation director, Arun Tiwari, said.

The project, which has the blessings of the President-elect, A.P.J. Abdul Kalam, and cardiologist, B. Somaraju, has now gone online in two centres in Orissa. ``The District Hospital at Puri and the Utkal Heart Centre, Bhubaneshwar, have been linked,'' said Prof. Tiwari.

The CARE team was recently invited by the Assam Government to develop critical care infrastructure and also for a blueprint for healthcare delivery in the insurgency-hit areas. The team comprising, Dr. Somaraju, chairman, CARE Hospitals, D. Prasada Rao, cardiac surgeon, and Prof. Tiwari, visited the State and held discussions with the Chief Minister, Tarun Gogoi.

NatioTELEHEALTHNEWS

Vol. 3 No.2 -- August, 1999

Welcome to the TelehealthNews, the Internet resource for health professionals. Please feel free to pass this newsletter onto your friends and colleagues. Subscribing/unsubscribing information is below.

See our TelehealthNet website at: http://telehealth.net

SPONSORS:

InnoMedia -- http://www.innomedia.com

Institute for Life Empowerment -- computerized protocols for mental health assessment & treatment at: http://mentalhealthhelp.com/

Williams Conferencing -- http://www.wilcom.com/

TABLE OF CONTENTS

DR - 36.

Trends Clin. Biochem. Lab. Medicine 2003 : 42-48

Telemedicine for Rural Areas

Nerges Mistry and Noshir Antia
The Foundation for Research in Community Health (FRCH),
84-A, R.G.Thadani Marg, Worli, Mumbai-400 018

Abstract : The creation of a community based health care system for rural areas visualizes the development of multiple levels of grass root cadre of health and development workers who eventually link up to existent tertiary care services. Much confidence can be generated on a first line referral for the grass root cadres in the form of a diagnostic software package. Thus SYMPMED-I was developed by FRCH in 1988. An upgraded diagnostic and treatment software (SYMPMED-II-E) has been designed in JAVA with additional features incorporating clinical examination findings, pathology tests, pediatric doses, drug information and side effects as well as ancillary information on national disease programmes. The software is to be supplemented with visual literary material supplied to the village health workers who will be trained in its use. A description on the development and content of this package for the internet and its potential for use in rural areas with the aid of telecommunications is presented here.

Key words : Community health care system, Telemedicine, Software diagnostic package.

Introduction

Both the public and private sector have failed to deliver in the area of health and health care Whilst the former has rampant unaccountability, the private exploits and both posses practices features that are irrelevant to their country's needs. Much of it has roots in the great cultura divide between India and Bharat. The ultimate aim is to build up an alternative form of health care system for rural areas that is equitable, accessible and cost-effective based c the principles of decentralization and possessing a graded structure of functionaries.

Over the last 30 years FRCH, a public trust functioning from Mumbai and Pune ha attempted to conceptualize and demonstrate a people-based form of health care syste particularly for the rural areas based on the principles of the pioneering Report of ICSSI ICMR - 'Health for All - An Alternative Strategy', 1981 (1). Its extended experience among many others has shown that ~ 85% of health care can be undertaken at the community lev by trained workers who are drawn from the community and who can fulfill both the technic and social demands of health care humanely with full accountability to their neighbou Women even with minimal education, with their intrinsic quality of care and nurture ha proved to be admirable health workers as well as trainers performing a wide variety functions both in health and illness care.

A graded form of community based health care described by FRCH is presented Figure 1. Whilst clinical skills have their place as an inverted pyramid, social skills a

e-mail : frchborn@born2.vsnl.net.in

For CHC lib
Telemedicine resource file
8/2/05

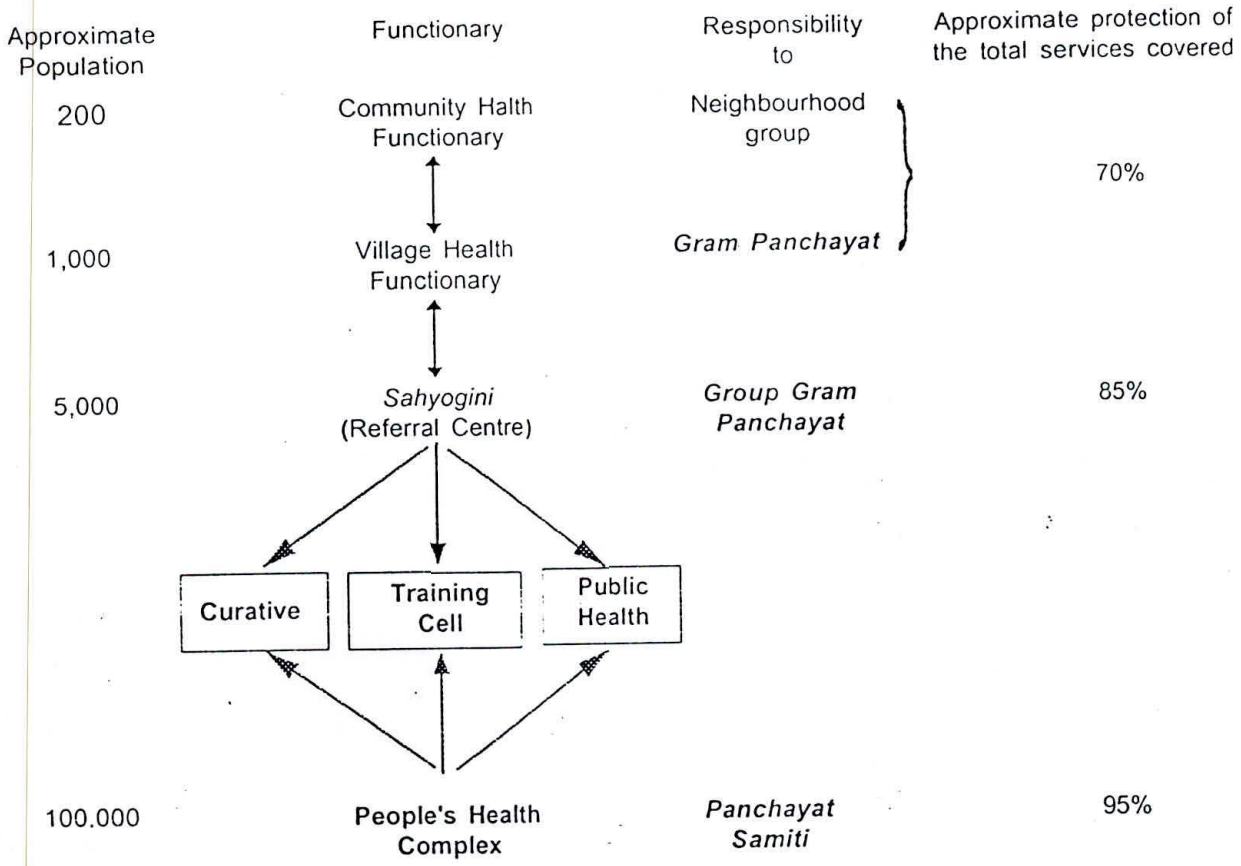


Figure 1. Organization Structure - Community Health Care System (CHCS)

encouraged with the same intensity longitudinally. Training modules striking by their integrated nature are imparted more in the form of experience sharing and discussion. These have been now compacted into courses for distant education accredited to The National Open School. Confidence generating and networking are the keys to the development of health workers at the grass roots notwithstanding either their socio-economic conditions or education levels. One of the most important criteria that sustain confidence is the build-up of a referral chain that supports the first level of workers to handle emergency or diagnosis and referral of difficult problems (as well as facility of transport) to the nearest centre where appropriate medical aid can be provided. If such support is not available, it leads to the eroding of confidence.

The FRCH experience over the past 3 years in the Parinche valley in Purandhar taluka, Maharashtra illustrates that trained semi-literate rural women can handle ~ 55% of illness episodes in their community (Fig.2). Whilst providing humane and accessible quality health care, this has led to considerable reduction in illness expenditure (Fig.3) and generated useful micro-level health information viz. morbidity patterns, (Fig.4) birth and death records etc. which is difficult to generate otherwise.

Health information systems exemplified by these can form a powerful local data base of symptoms that can be transformed to diagnostic algorithms usable in devising IT packages.

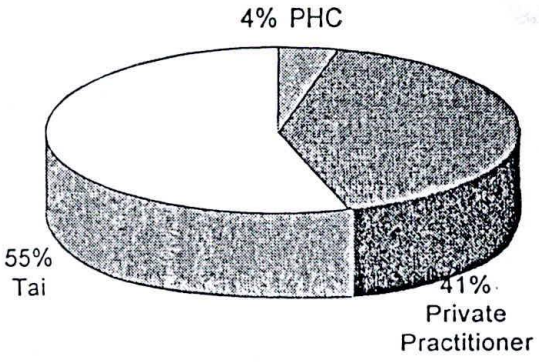


Figure 2. Utilization pattern of grass root workers (tai) by the Community in 2000

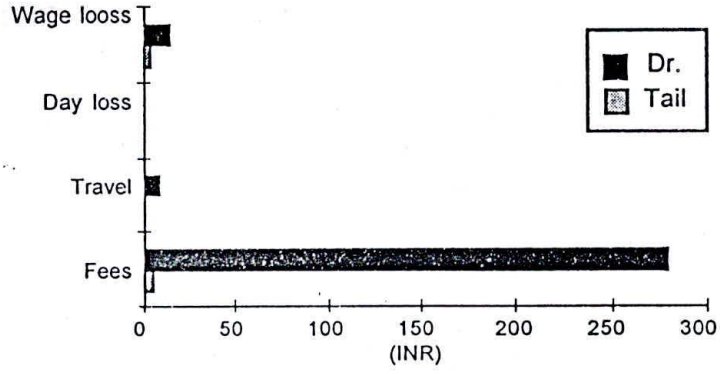


Figure 3. Comparison of illness expenditure for moderately severe illnesses (Year 2000)

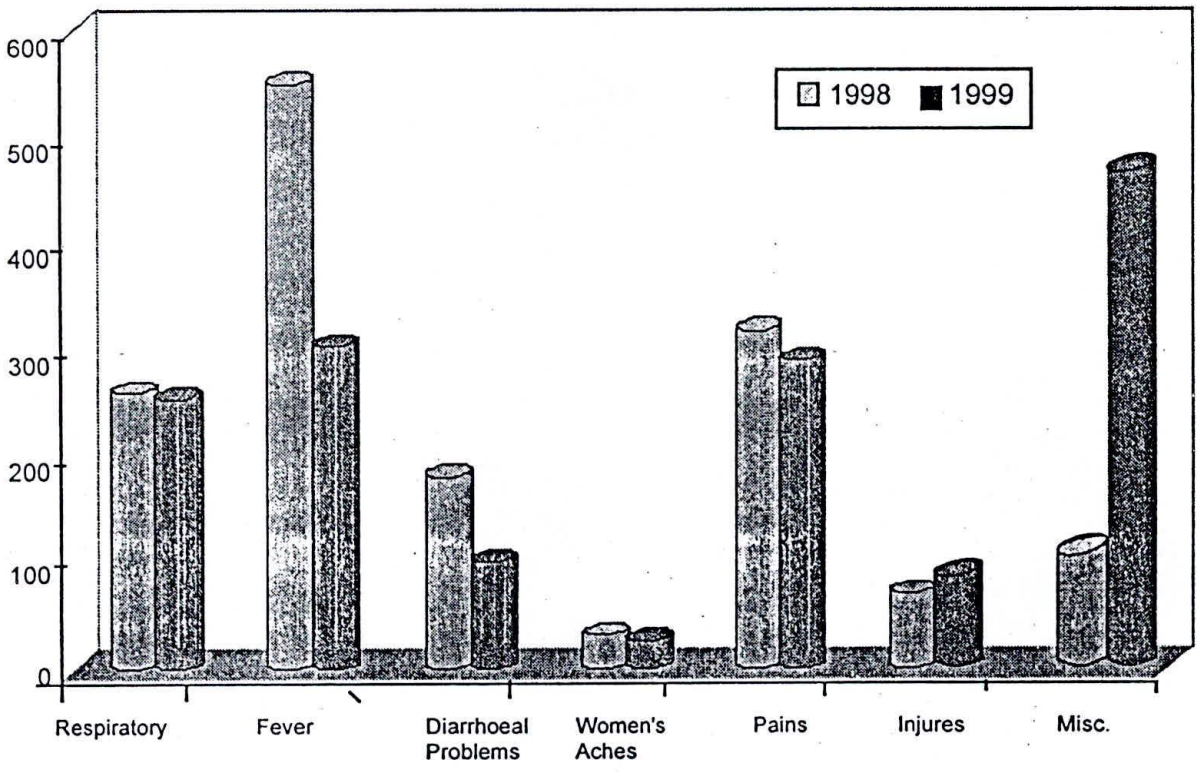


Figure 4. Morbidity observed in a community of 4205

SYMPMED-I was thus developed by FRCH as a pilot software package in the mid 80s from its experience during the Mandwa project (2,3).

The building block for SYMPMED-I is a single symptom. For each symptom entered the first step is to make the user aware of other symptoms or signs which are associated with the presenting symptom and require a doctor's attention or referral to the hospital. The remaining steps included probing deeper into the presenting symptoms for elaboration of the problem. At both testing and conceptualization level, certain shortfalls were noticed :

1. Trained personnel found this programme most simple

2. There was no focus on examination findings - the reason being more weightage given to therapeutic satisfaction.
3. No pediatric doses
4. There were symptoms that could not be handled by SYMPMED-I (Table 1).

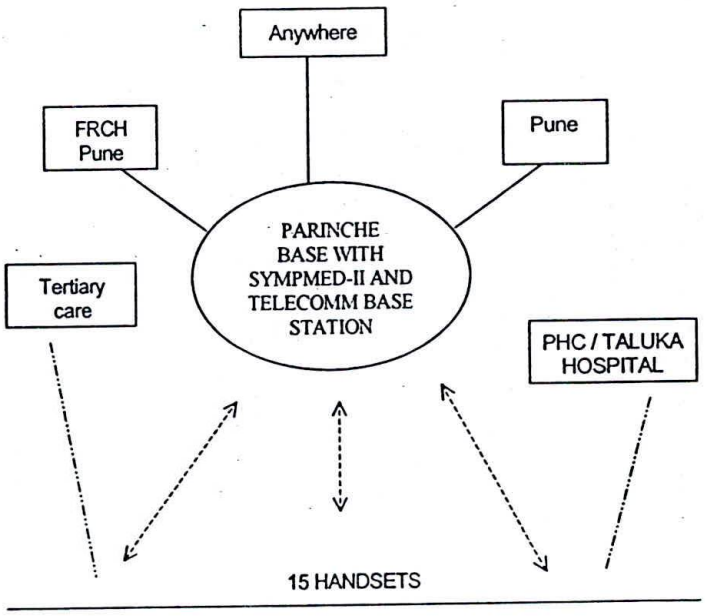
However, the programme confirmed that a majority of problems noticed by first level medical personnel in developing countries are simple, repetitive and treatable at home by a paramedical worker with a few, safe essential drugs. It also demonstrated that flow charts which were anathema to at least our health workers, could be substituted.

Accessibility to such referral information to a grass root level worker in a remote mountainous village on a computer is a tall order especially where the advantages of electrical supply may be snatched intermittently or extended upto four days. The inability to seek prompt medical advice has resulted in several needless deaths in the Western mountainous regions of the Parinche Valley.

The system organization of telemedicine is depicted in Figure 5. The problem of unreliable electrical supplies, wide voltage fluctuations and lack of a repair and maintenance infrastructure exclude the ideal design of maintaining computers with installation of the diagnostic software SYMPMED-II in all the villages in the Parinche valley area. Hence in keeping with the local conditions, a single computer based centrally in Parinche village would receive referrals for the software from selected

Table 1. Symptoms that cannot be handled by SYMPMED-I

• Fever for more than one week
• Convulsion
• Abnormalities of consciousness
• Loss or diminution of power or sensation in any part of the body
• Disorders of eye and vision
• Severe pain anywhere in the body
• Anything more than mild breathlessness
• Bleeding from any organ
• Anything more than minor cuts and wounds
• Appreciable recent weight loss
• Signs presented as symptoms



15 Peripheral locations in community manned by VHFs with hand sets for communication with base

---------- : Telecommunication

———— : E mail : Internet

———— : Patient transport lines

Figure 5. Organization of Telemedicine Set-up

areas in the valley. The telecommunication equipment as well as the computers will eventually be in the charge of senior women health functionaries (Sahyoginis) who will be trained to operate and maintain the same.

A grant from the Department of Electronics in the mid 1990s tested the feasibility of using citizen band (CB) radio in conjunction with SYMPMED-I. The telecommunication hardware had several technical glitches, low communication time, distortion, time and seasonal variations and with lack of preventive maintenance, frequent breakdown and abnormal battery recharging. The equipment recommended to us by the Ministry had a fly-by-night agent who simply disappeared after sale of the sets. However confident utilization of the CB radio by local women has been repeatedly demonstrated. This experience paved the way for defining modified objectives as given below:

1. Development of an expanded upgraded diagnostic and educational software for enhancing diagnostic and treatment skills of health workers at the grass roots in a rural community.
2. Explore use of radiocommunications for establishing a local referral network for medical care.
3. Documentation and analysis of experience with respect of (a) fulfilling the needs of the community (b) accuracy of referrals and (c) cost-effectiveness
4. Build-up of local health information.
5. Use of telecommunications / IT as multipurpose tools for local networking in education and provision of public information.
6. Replication / dissemination of experience in other areas of the country.

The design of an upgraded diagnostic software SYMPMED-II-E has been based on the gleaning of difficulties in diagnosis faced by the village health functionaries over a period of time. Strengthening of the pediatric component, inclusion of differential drug dosages, danger signals at diagnosis and in the post-treatment period are all features in the modified version arising from a needs assessment. Unlike SYMPMED-I, the programming language is platform independent and programme aspects are created for putting on the internet.

A diagnosis is aimed to be arrived at through the recording of clusters of 65 primary and 71 associated symptoms, (each with their own confidence level for an individual disease or condition) examination findings and findings of pathology tests. If pathology tests have not been done then it advises on which ones to do. The programme incorporates footnotes which feature drugs from all symptoms of medicines, home remedies, treatment outcomes, prediagnostic and post-treatment warning signals and national disease programmes. Since ~ 20 drugs are intended for SYMPMED-II-E, a separate folder will provide details on each of their indications, contradictions, side effects and changes. The storage of patient records on a longitudinal basis with easy retrieval will be an advantageous additive for the system. Features for constant evolving of algorithms is intended provided that the system retains its simplicity for operation by local women.

The earlier experience with the CB radio showed the need for significant improvement in communication hardware and training of local users in preventive maintenance. The CB radio has been replaced with an ICOM make Japan Marine Band held transreceiver using the VHF band of 146 MHz. The tests were conducted with one base station set at Parinche

delivering a power output of 25 watts into a fibre omni directional antenna and a hand held set delivering 1 watt output. The sites for reliable communication have also been identified in the valley. The key features of the radiocommunication system include:

1. VHF radio communication
2. Utility for broadcasting with amplification
3. Duplex communication
4. Networking with computers
5. Long-life batteries
6. Attachment to a tape recorder
7. Good voice quality
8. Robust and light weight.

SYMPMED-II-E will be augmented by printed material that will be distributed to each peripheral village. Telecommunication from the peripheral villages to Parinche will be through handsets transmitting to a base station at Parinche. As a back-up for communication problems particularly in the mountainous area, a second base-station will be set up to provide reliability in communications so that village in its vicinity can communicate with it for passing on the message to the base at Parinche.

Training of women functionaries is a key element to the success of SYMPMED-II-E. A selected group of village health workers will be trained in:

1. Eliciting of symptoms from patients
2. Transmission of symptoms and observations to the computer operator handling of emergencies and
3. Transportation arrangements and optimal use of printed material (text and diagrammatic) provided to supplement SYMPMED-II.

Of these a selected group of workers with enhanced diagnostic skills will be taught the operations of SYMPMED-II-E through hands-on training at the computer and during simulations of prevalent difficult conditions.

Several modifications to SYMPMED-II are anticipated before a final version emerges. Unresolved clinical conditions will be referred to doctors manning a clinic at Parinche though onward referrals to doctors in distant locations is technically a possibility. These local clinicians will also be software system administrators with capacity to modify system rules eg. confidence values, symptom clusters as well as information in the software.

A strong research back-up is necessary to test the system. A constant analysis of clinical outcome of the referral is mandatory in the developmental stages to facilitate modifications. At ground level, reliability of communication hardware and communication skills of the health workers will also have to be monitored upon.

The above described approach to telemedicine is tailored specifically to match and aid the skills of health workers at grass roots. Whilst it can never entirely supplement the accessibility to a doctor, its broad information base can be a powerful enhancer of diagnostic confidence as well as a tool for constant education towards Health for All. Recognition of its

niche in rural health care and education will render it a powerful tool and not just another technological gimmick.

References

1. Anonymous (1981). Health for All : An Alternative Surgery. Report of a study group set up jointly by The Indian Council of Social Science Research and Indian Council of Medical Reseach, New Delhi.
2. Uplekar M.W., Antia N.H. and Dhumale P.S. (1988). Sypmed I : computer programme for primary health care. Brit. Med. J. 297, 841-843.
3. Antia N.H. (1986). The Mandwa experiment, an alternative strategy. Brit. Med. J. 292, 1181-1183.