Telemedicine Network Implementation: Challenges and Issues

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Introduction

The objective of a Telemedicine system is "Consultation". Therefore it needs a network of a minimum of two terminals. One that seeks consultation and the other that provides consultation. Call these the "**patient**" end that seeks consultation and the "**specialist**" end that provides consultation. Telemedicine system prepares an electronic file of the patient records at the patient end and transfers it through a communication link to the specialist end, where a specialist opens the file, examines the records and gives his diagnosis and recommended line of treatment.

The network, of course can be much larger where several patient ends could seek consultations from several specialists' ends. The first and foremost condition in setting up the network is that the two ends have-to-have an agreement to seek and provide consultations.

This article briefly touches upon the different systems & elements in the Telemedicine network and considerations in their selection touches the issues involved in the Telemedicine implementation.

Elements of the Network

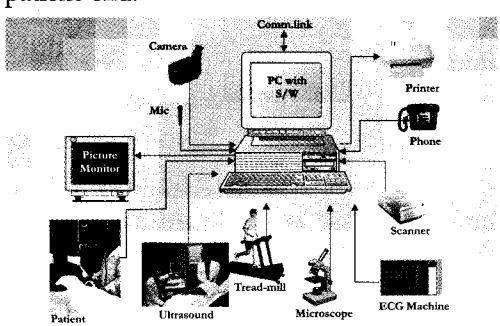
The elements of the network are:

1. The Patient End
2. The Speciality End
3. The Communication Link

The Patient End

The patient end has to prepare an electronic file of the patient's history and his radiological and pathological reports and forward to specialists. The hardware requirement at the patient end includes various medical equipment like ECG, X-Ray/ MRI, Scanner, Ultrasound etc., interfaced with a computer which has the Telemedicine software for preparing and transferring the patient file.

The diagram shows the equipment at the patient end.



A Typical Patient End Terminal

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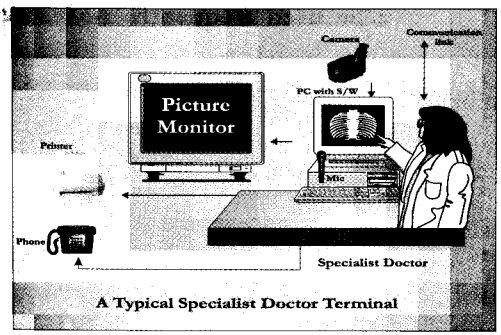
The Specialist end

The specialist end has to receive the patient file and display the patient records properly on the monitor in order to enable the specialist doctor make a diagnosis. The specialist doctor should be able to provide diagnosis & line of treatment.

This process can be done in an **"offline"** mode, i.e. without the patient and specialist simultaneously being present and talking to each other or in **"online"** mode where simultaneous data transfer & video conferencing take place.



A Typical Specialist Doctor Terminal

The Communication Link

The Communication link is like a pipeline connecting two sources of information. The speed and quality of flow will depend upon the **"bandwidth"** available. The link could be a simple *telephone line* (providing 64 Kbps) *Internet or ISDN line* (provides 128 or 384 Kbps) or *fibre optic* or *satellite link*, depending upon requirement, availability, operational acceptability and affordability. From experience, it is seen that generally a 384 Kbps connectivity is found acceptable. This is the norm in many Telemedicine networks.

Links like the **telephone line** provide narrow bandwidth and therefore sending of patient record takes longer time. Of course, satisfactory video conferencing is also very difficult with a telephone line.

The **ISDN lines** (which are like combination of two or three telephone lines) can provide better bandwidth, but the reliability and continuous availability can be limitations. However, the capital costs for such communication links are low.

Optical Fibre connectivity if available can be of high quality, can provide bandwidth as required, and can have better reliability. However, the operational cost could be high depending upon the bandwidth used and the duration of usage. Availability of fibre optic connectivity can be a limitation especially in remote areas.

It may be added that efforts are on to use cellular phone connectivity for Telemedicine. Both **GSM and CDMA** connectivity can be technically utilised. Broadband connectivity has been introduced in India and could be used for Telemedicine connectivity.

Satellite based connectivity has the advantage of being available in the remotest part of the country. Normally, a Very Small Aperture Terminal network

(VSAT Network) would be used to provide this connectivity. The bandwidth can be selected as per requirement. These networks have the disadvantage of higher costs but have much higher reliability and availability especially in rural areas and small towns. Of course, there are situations like islands, or remote, hilly terrain, border areas, where no other communications link is available and satellite link is the only answer.

Satellite terminals can also be mounted on vans and be made **"Mobile Unit"**. Such vans can visit rural areas, establish connectivity, and provide consultation from a speciality end and then move on to another location.

Cost and Operability Considerations– Patient end

Besides the medical equipment for collecting patient data like ECG, X-RAY, etc., the most important element at the patient end is the Telemedicine software. The cost of this software can be an important consideration in setting up a Telemedicine system. The total Telemedicine software consists of several packages, with several features and uses certain standards. A full software including all the packages may not be required at the patient end. The software requirement can therefore be reduced by procuring only those packages and features that are essential. The cost also depends upon the standards used and licences paid for. It may not be necessary to follow all the prescribed international standards. For this purpose, the Ministry of Information Technology in India has defined Indian standards for Telemedicine packages and these should suffice.

The cost of patient end can also vary depending upon the type of equipment. For example the scanner used for scanning the X-Rays, MRI, etc., can have a varying degree of resolutions. The resolution could vary from 400 dpi to 1200 dpi. Obviously, the resolution of 1200 dpi would be of better quality but it would be much more expensive.

Similarly, a pathology microscope could be quite expensive and should be procured only if it is to be used frequently. In many situations it is found that this is not used much. The cost of the teleconferencing camera too can vary very substantially. The system therefore needs to be configured with care and keeping in mind the budget available.

Specialist end

The major element at the specialist end is the Telemedicine software that opens and displays the file sent by the patient end. This software needs to be inter-operable with the patient end software.

Communication Links

As indicated, communication links can be of multiple variety and costs. A combination of communication links can very easily be employed in a single network. This means that a network could use ISDN, fibre optic

or satellite links, and all these could operate with each other. However, there can be a problem of one type of VSAT network operating with another type of VSAT network. The VSAT networks too are generally proprietary in nature, and therefore if a network utilises one type of VSAT configuration it can be expanded using the same VSAT only, using VSATs of different vendors within a network would not be possible. However, two networks having different technologies could be made inter-operable at the hub level by suitable arrangements and agreements with the vendors.

Challenges and Issues of Implementation

The technology of Telemedicine to meet the minimal requirements of tele-consultation is fairly well established. There are ofcourse developments going on the world over, for providing better diagnostic tools for tele-diagnosis. There is also a great interest in the field tele-surgery. But these are not the challenges and issues of immediate concern in India. If better health services are to be provided to smaller towns and villages, a serious thought is needed for the establishment of Telemedicine networks on a wide scale.

The health services in India can be divided into three sectors e.g. The Government sector, the private sector, and the NGO sector.

The **Government sector** has major hospitals (Civil Hospitals) in the state capitals, district hospitals at the district level, community health centres, primary health centres and sub-centres.

The **private sector** has corporate hospitals in metros and major state capitals. There are private practitioners with nursing homes at the district level. Very few qualified private practitioners would be available below district level.

The **NGO sector** has charitable hospitals in major cities and towns. These do exist up to district level in most cases.

To improve the availability of better health services, it is essential that all the three sectors adopt Telemedicine in a big way. Given the type of load that exists at the hospitals up to district level, it would be economically viable, and operationally desirable to establish fixed Telemedicine Centres at the district level connected to the Civil hospital or other major super speciality government hospitals. This could very substantially reduce the number of patients physically moving from the district to the major cities.

Below the district level, it would be advisable to try Mobile Telemedicine terminal that could move to CHC or below on a fixed route basis. However, the concept of these general-purpose Telemedicine vans has not been adequately tried and developed. There

is a need to develop these vans. It has been noticed that the present Mobile Vans provided at PHC level are not maintained in an operational condition. It is therefore considered desirable to have the vans attached to the district level, where these could be maintained and moved. With experience these could be attached to the CHC's where found appropriate.

The private sector, can establish franchisee consultants at district level provided with Telemedicine connectivity. The patient would be able to pay for the Tele-consultation services, and would find it less expensive than travelling to the city for consultation.

The NGO sector that is strong in some parts of the country can have a network of its own or can join the private sector in providing Telemedicine services to its patients.

Can there be a Telemedicine service, quite independent like a courier service? This is also an option that needs consideration. In this option, a Telemedicine service provider could transfer the patient data from district level to his own centre at the state where the opinion of the doctor of the patient's choice could be sought and given back to the patient. This too could be made independently economically viable.

Some issues and challenges in the adaptation of Telemedicine systems are discussed below.

Awareness

The medical community is not fully aware of the possibilities of Telemedicine. There is need for a wide spread effort to create awareness amongst doctors and Health administrators and the public about the various possibilities of adopting Telemedicine technology & reaping its benefits.

Training

There is need to train the doctors in the use of Telemedicine systems. Just as doctors learn how to use computers, the use of Telemedicine should become an integral part of the education and training of doctors. Telemedicine should be introduced as a topic at the undergraduate level. Training programmes should be organised to familiarise the practitioners with the features.

Acceptance

It has been found that the patients have no difficulty in accepting Telemedicine. In fact, in almost all cases the patients are more than happy and satisfied when their cases are referred to specialist on the Telemedicine system. They are happy that some senior doctor has seen their case.

However, some resistance is seen amongst doctors. Doctors in the government sector tend to look upon Telemedicine as an additional burden or workload. Therefore, there is need to weave Telemedicine into the routine duties of the doctors. It is also seen

that the government doctors would like to have technical staff to operate the system rather than operating themselves. The government doctors need to realise that over a long period of time the unnecessary rush of patients to civil hospitals could reduce, as the patient would be treated at the district level. This would result in reduction of unnecessary workload.

The private doctors are some times afraid that telemedicine is likely to reduce their practice. They need to realise that the system enhances their reach and exposure and is only likely to increase their practice further.

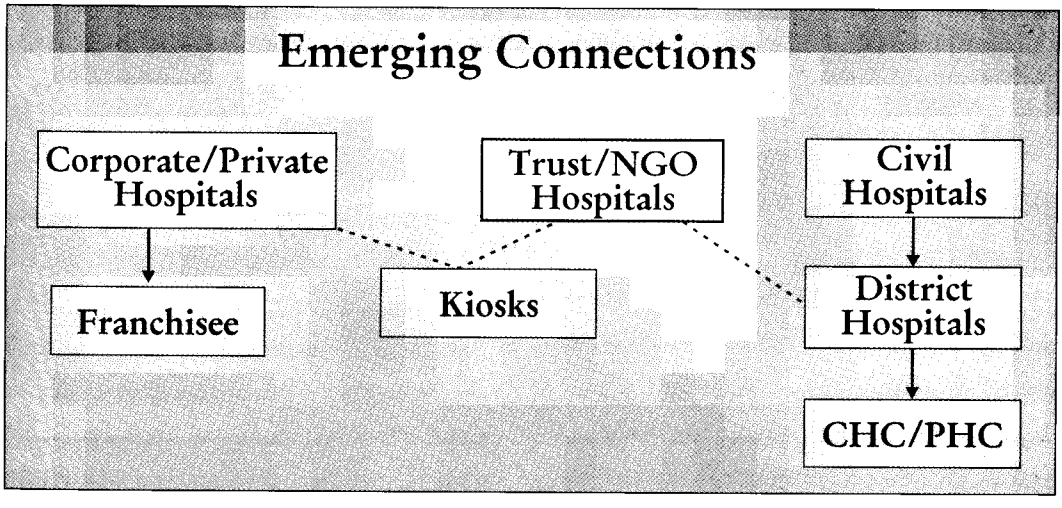
Funding and Self-Sustenance

Telemedicine systems are no more expensive. The basic system consists of computer hardware, software and telecommunication link. In all these areas, there has been a significant reduction in prices over the past few years. A Telemedicine terminal could cost anything from about Rs. 2 lakhs to Rs. 6 lakhs or more. Most of these costs are well within the reach of most hospitals, and can be recovered by a nominal charge to the patient over a time (which would be much less than the patient physically travelling to the specialist). Today, it is found that patients are more than willing to pay for these services.

The operational costs can further be reduced if telecommunications costs can be subsidised. The provision of satellite bandwidth without charge by ISRO has been an important factor that has given a fillip to Telemedicine in India.

Role of Medical Insurance

Medical Insurance can play an important role in making the Telemedicine system viable and spread to rural areas. Group insurance of



members of cooperatives or family group insurances coupled with use of Telemedicine with involvement of speciality hospitals could play an important role in the spread of Telemedicine systems, development of simpler models and mobile Telemedicine system. One such scheme "Yeshaswini" is in place in Karnataka.

There is need to have simpler modules of Telemedicine, and development of transportable and mobile systems. Handheld or laptop based Telemedicine systems combined with mobile/cellular phone technologies can help take Telemedicine to the doorstep of the patient. Developments in these areas need to be supported.

Medico Legal Issues

As yet, there is no framework available in the country regarding any medico legal issues arising out of use of Telemedicine systems. There is need to initiate debate and develop a minimal framework. However, this should not become a bottleneck in the spread of Telemedicine service.

Safety, Security and Confidentiality of patient records

Telemedicine would create electronic databases of patient records. These could be stored in centralised servers, and would therefore be subject to risks like hacking, viruses, etc., that any database is exposed to. Adequate safety measures would have to be ensured for the security and confidentiality of the data.

Flexibility and Freedom of Patient

In the conventional systems, the patient is free to change his doctor at any time and carry his own medical records to any doctor of his choice. Telemedicine system should not limit this freedom of the patient. His record should be available and accessible to him at all times. While the hospital may empower all records in electronic form, the practice of patient carrying his own records either in conventional form or in electronic form on a CD would have to continue for some time.

National Telemedicine Grid

A rural patient normally starts his treatment at the local level and then moves to the district hospital, state capital or a super speciality centre anywhere in the country. The medical records of the patient, which may be created at the district level and stored at the state level, have to be available to any doctor to whom the patient goes for treatment. This will require a unique ID for each patient and accessibility of his records from anywhere in the country. This is possible if all servers holding medical records are linked on a **National Telemedicine Grid.** The development of such a system is going to need a major coordinated effort by

all health service providing agencies, and advance long-term planning and standardisation.

Conclusion

There are different challenges and issues in the implementation of Telemedicine Systems and network and they can be categorised under technical, managerial, ethical, legal and financial aspects and they need to be addressed systematically for establishing a successful Telemedicine network. This requires an integrated effort by all agencies–the government, health care providers, administrators, doctors, technologists and financial institutions with a suitable private-public partnership.