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Individual Project

Telemedicine in India – Current opportunities and barriers

A report submitted to

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Abstract

Telemedicine has seen successful implementation in the developed world. In the developing countries, it has become the buzzword in providing improved healthcare with enhanced access. In rural areas especially, where a huge gap exists between demand and supply of healthcare facilities, telemedicine is being seen as a major solution. There are factors such as growing network infrastructure and the technological adoption by the health fraternity which provide support to these claims.

Telemedicine has opportunities in healthcare by providing opportunities to diagnose patients, provide intra-operative assistance and consultation from a remote site. Telemedicine services are majorly used in radiology, cardiology, ophthalmology, pathology and tele-education. It can be used either as a real-time service which enables interaction or as a 'store and forward' service for certain non-critical systems such as health records. Telemedicine also has certain barriers in the awareness, adaptation, network infrastructure, funding and policy related areas. There are certain medico-legal aspects involving all the stakeholders which need to be standardised to enable a working system.

The aim of this project is to analyse the current state of telemedicine services in India. The Department of IT in India has played a very important role of encouraging telemedicine facilities in the country by initiating several pilot schemes, funding the development of telemedicine software and sponsoring major telemedicine projects. This project aims to evaluate the opportunities in telemedicine by critically analysing the following -

- Telemedicine project undertaken by the medical institutions like AIIMS (New Delhi)
- Telemedicine projects undertaken by corporate houses such as Apollo Hospitals

Inputs have also been taken from the vendors of the equipment providers for various telemedicine initiatives to get an understanding of the evolution of standards. Finally, inputs have been taken from the patients availing these telemedicine facilities and the benefits they have got.

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Introduction

As defined by the U.S Food and Drug Administration telemedicine is "*the delivery and provision of healthcare and consultative services to individual patients and the transmission of information related to care, over distance, using telecommunications technologies. Telemedicine incorporates direct clinical, preventive, diagnostic, and therapeutic services and treatment; consultative and follow-up services; remote monitoring of patients; rehabilitative services; and patient education."*[1]

The Department of Information and Technology defines telemedicine as '*The use of electronic information and communications technologies to provide and support health care when distance separates participants*'[6]

Along similar lines the world health organization defines telemedicine as '*The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities*'[6]

As derived from these definitions, telemedicine helps patients who are unable to access specialised healthcare facilities such as in rural areas or from distant areas to avail timely consultation without having to travel long distances. The telemedicine facility provides facilities to transmit patients' medical records, images, output from medical devices and sound files, as well as audio which is two-way.

As shown in Figure 1, telemedicine can be used for a variety of medical applications

Disease Surveillance

This methodology is taken up by the governments and medical committees at times of epidemics where specialists get a chance to predict, observe and minimise the ill effects of the epidemic. Direct case reports are created using the telemedicine applications.

Disaster and Disease management

The telemedicine facilities come extremely in use in the cases of natural disasters such as earthquakes, floods etc. where medical facilities cannot be quickly set-up. In such cases a simple telemedicine facility will help specialists and not require them to reach the disaster struck areas for diagnosis. This also helps in reducing the cost of transportations of medical facilities and doctors.

Remote Consultation

This application of telemedicine is required in providing consultation in remote areas where full-blown facilities have not been set-up. This is extremely critical for rural areas where medical institutions do not believe it is profitable enough to set-up units which provide all medical facilities. Only consultation is provided and recommendations for specialists are made.

Second opinion

Telemedicine applications come to use here when the patients are already diagnosed with a particular disease and the primary doctor wants to confirm the same by seeking the opinion from a specialist in another region. The patient can him/herself take a second opinion from the specialist if he/she is unsure about the diagnosis provided by the primary doctor without having to go to the secondary specialists facility.

Telementored procedures

This telemedicine facility is used in cases where the specialist doctor is unable to perform medical procedures due to his/her inability to be at the concerned location. The specialist can guide his/her sub-ordinate doctors in performing the procedure as well as in diagnosis.

Home care

This facility is used by patients by logging in directly to the hospital/institute teleconsultation unit and getting feedback and diagnosed.

Medical education and public awareness

Telemedicine applications can be used for spreading general awareness to the public especially in times epidemic without the need for the specialist doctor to be present in the concerned location. This facility helps a lot in reaching out to large masses and early information dispersal.

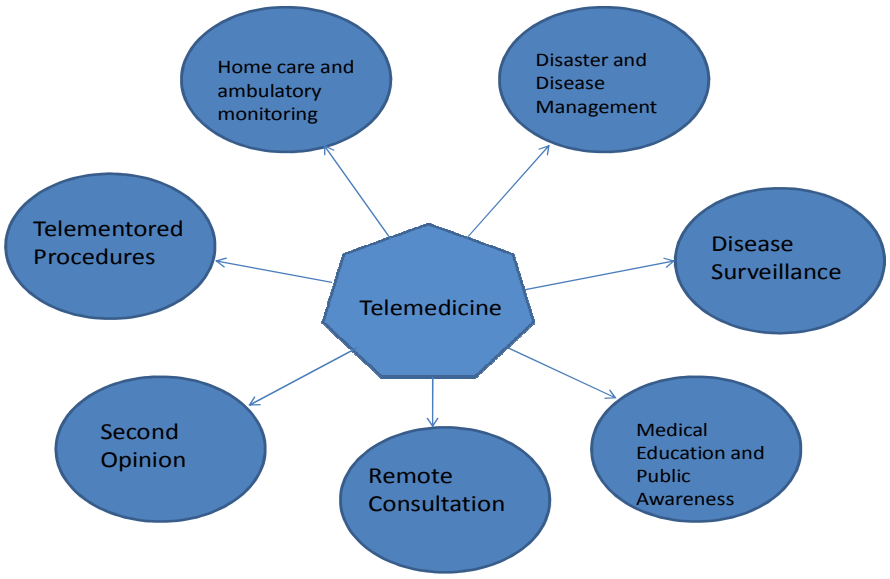

Figure 1: Applications of Telemedicine

Source: Telemedicine in India: Initiatives and Perspectives – B.S Bedi

Evolution of Telemedicine

Generation 1 (Pre 1970)

During this phase, in the 1920s primarily audio and cable based television technologies were used for consultation. This was followed by ship-to-shore radio transmission of medical information. The transmission of ECG began as early as in the 1930s and as early as 1960s interactive TV was used for educating medical students. The first professional telemedicine network came up in 1967 when a telemedicine link was established between Boston Airport at Logan and the Massachusetts General Hospital.

Generation 2

Telemedicine initiatives were accelerated in the West particularly in the US and Canada. There were large government sponsored projects for telemedicine using satellite and microwave communications. As early as 1978, around 30 veteran administration and 8 non-veteran hospitals were linked via satellites.

Generation 3

By the 1980s, technology such as T1, ISDN and ATM were well developed. These were used as backbones for comparatively faster transmission of data for video-conferencing, X-Ray scanner output, and camera outputs for documents. These served in helping reach hospitals in the interior regions as well. This was the time when IP was also being developed, providing the impetus for phasing out of ATM technology and thus helping provide greater flexibility.

Generation 4

This is the current phase that telemedicine is right now in. The store-and-forward methodology is gaining popularity, where the relevant data of the patient is stored for the

specialist in the other hospital to use on a later date for diagnosis. There are standards evolving for the kind of equipment being used as also for the images being used.

Current State of Healthcare in India

India's healthcare infrastructure is currently unable to meet the needs of the rising demands. Although India has several state of the art centres for healthcare delivery, these centres are small in number. Except certain institutions such as the All India Institute of Medical Sciences (AIIMS), most public health facilities have shortage of resources, be it doctors, staff or equipment. In 2002, there were around 15400 hospitals of which two-thirds were public[7]. Also, these hospitals were able to provide only basic care. The number of such public health care facilities is inadequate in India, which has less than half the 74150 community healthcare centres per million population[7]. Around 11 states in India do not have laboratories for testing drugs or have inadequate testing facilities. 80% of the public funding for healthcare is provided by the state governments, while the central government provides around 15% of it[7].

However, when it comes to spending for healthcare, 82% of $30.5 bn of spend on healthcare came from the private sector in 2003[7]. Also, the number of beds in the urban region when compared to those in the rural areas provides a wide healthcare divide.

Per Lakh (100K) population	Beds	Hospitals	Dispensaries
Urban	178.78	3.6	3.6
Rural	9.85	0.36	1.49

Source: Review of Healthcare in India, 2005

90% of the country's secondary and tertiary healthcare facilities are in the urban areas. Nearly 68% of the population is in the rural areas[2]. The third NFHS Survey (2005 -06) reports that sixty-eight percent of households (56% of rural households and 93% of urban households) have electricity. Fifty- five percent of households have no toilet facilities. Three-fourths of rural households have no toilet facilities. Eighty-eight percent of households use an improved source of drinking water (95% of urban households and 85% of rural households), but only 25 percent have water piped into their dwelling, yard, or plot. One-third of households treat their drinking water to make it potable; half of those that treat their water strain the water through a cloth, and almost one-third boil the water[5].

Healthcare facilities are largely absent in rural areas. The unavailability of doctors, nurses, trained paramedics and equipment and even basic health facilities have made the rural population rely on local quacks and semi-skilled professionals. The number of doctors in India is currently 70 lakh which implies that for there is a doctor for every 180 citizens in India[5]. Although this is not a very small number for a developing country, the fact that only 28% of this population resides in rural areas is a cause of concern. Also, around 80% of the total healthcare expenditure comes in the private sector. This emphasizes that private sector plays a very dominant role, and with a major intention of maximizing profits would further rely on high cost diagnostics and equipment making it more difficult for the poorer rural masses to afford.

Telemedicine thus becomes a very effective tool in reaching out to the rural masses. Telemedicine's major objectives lie in making healthcare facilities available to the rural population and remote areas. There are no legislations which ensure that the specialists in the private sector are to be available on the rural areas. Telemedicine is aimed at providing quick,

effective and precise opinions to both the patients as well as the doctors in the rural/remote areas who might not be specialists in that field.

Current State of Telemedicine in India

In India, a number of initiatives are either deployed or are nearing completion. Major support has been provided by the DIT through ISRO and other medical institutions such as SPGPI, PGIMER, AIIMS. There are private players also in play such as the Asia Heart Foundation, Apollo Hospitals, SGRH, Fortis, Max etc.

The Department of Information Technology under MCIT has implemented projects at multiple levels. Some of them are pilot projects such as the funding of software such as Sanjeevani and Mercury which have been developed by C-DAC. In addition, there is a project connecting premier institutions like SGPGI, AIIMS, PGIMER. Here, the technology in use is ISDN. State level connectivity is achieved in turn by these 3 medical institutions.

DIT also had implemented a telemedicine network for diagnosing and mentoring of tropical diseases using low speed WAN. This was deployed in the state of West Bengal, with help from IIT Kharagpur, Webel (developed the WAN network) and the School for Tropical Medicine at Kolkata. Two district level hospitals connect to the School of Tropical Medicine at Kolkata for consultation purposes.

In the north-eastern states too, super-speciality hospitals at Kohima (Nagaland), Sikkim and Mizoram have been connected for telemedicine consultation. This involves the Indraprastha Apollo Hospital and is a public-private partnership.

Reliability of the telecommunication link is of significant importance for early adoption of telemedicine. The Indian Space Research Organization (ISRO) has committed to provide free bandwidth for telemedicine as well as tele-education. Satellite based telemedicine nodes have

been deployed with the help of state governments. Around 250 nodes have been deployed across the country.

There are efforts being made elsewhere as well with the Ministry of Health and Family Welfare launching a major country-wide network called the Integrated Disease Surveillance Project. Here, district hospitals and medical colleges are connected, with the National Cancer Care network also to be connected in the future.

However, these efforts have largely been disparate and sporadic. An overarching architecture would be definitely required for the telemedicine network to grow and for any kind of standards to be adopted. There have been questions as to how the hospitals and healthcare facilities at the various levels need to be connected. Confusions about the hardware and software requirements, bandwidth and connectivity also exist. An integrated telemedicine network has become possible due to the fact that a fiber optic network backbone has been created by contributions from both the public and private sectors.

The telecommunications infrastructure in India is largely government owned. This, however, is changing with a lot of private players doing particularly well of late.

A typical telemedicine set-up in India would be as shown in Figure 2

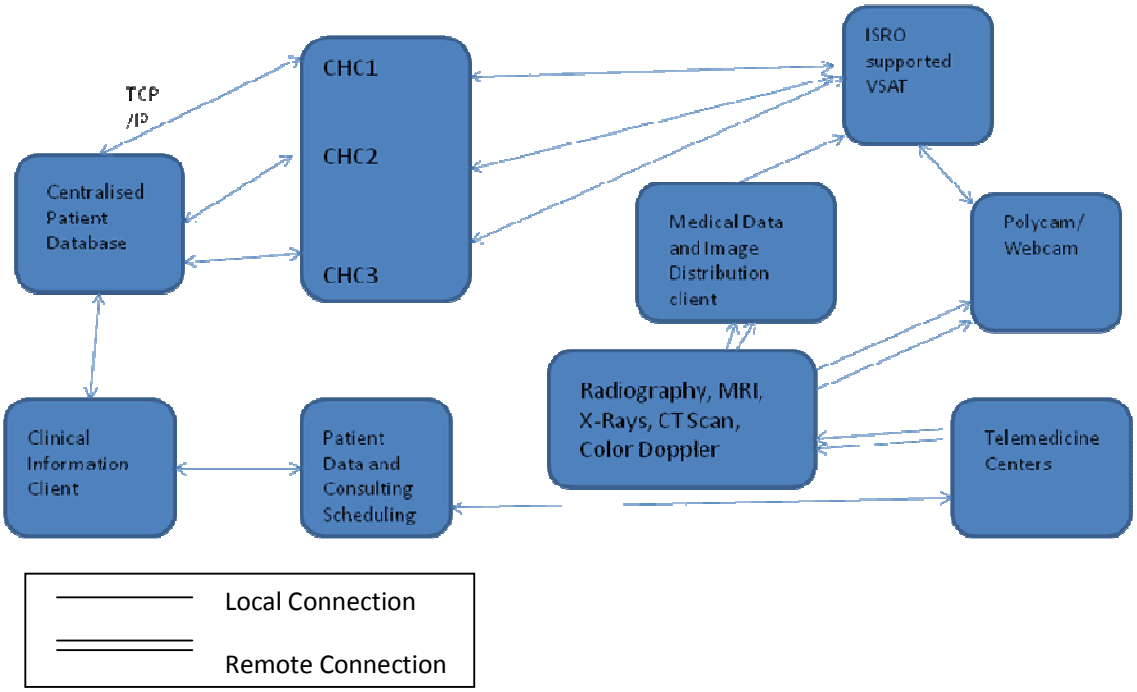

Figure 2: Standard Telemedicine set-up in India

Telemedicine at Apollo – a critical analysis

Apollo Hospitals has been the prime proponents of telemedicine facilities in the country. It has its telemedicine centres at various cities such as Delhi, Gandhinagar, Bengaluru, Chennai etc. The telemedicine centre at Gandhinagar caters to around 8 districts in the state of Gujarat. The telemedicine centre caters to providing expert opinions and report interpretations of[3]

i) Tele-radiology

ii) Tele- dermatology

iii) Tele-cardiology

iv) Tele-pathology

v) Remote ICU monitoring

vi) Ambulance monitoring

vii) Mobile Telemedicine Unit

viii) Electronic health record

The Apollo telemedicine facility caters to a number of Primary health centres, Community health centres and Village health centres. It is called as the Apollo Telemedicine Networking Foundation and works as a not-for-profit organization. It has around 150 telemedicine centres around the world[4]

The Apollo Telemedicine Networking Foundation (ATNF) works along with the Central and State governments in providing health facilities to those who cannot easily avail of it. It also works with other medical bodies, private and public sectors in an attempt to popularise the concept of telemedicine.

The business model of the ATNF involves providing consultation facilities to the patients at the PHCs, CHCs and VHCs either free of cost or at minimal charges (Rs. 50). The ATNF does not cater to the development and maintenance of the PHCs, CHCs and VHCs. The equipment required at these centres is also provided by the government bodies. In certain cases the junior consultants who are present at these centres are appointed by Apollo but in most cases these are government employed. These centres also require technicians who have the ability to maintain and run the equipment at the centres during consultation. More often than not these technicians are employed by the vendors of the equipment. These technicians are jointly trained by Apollo and the vendors for efficient use of the equipment.

The Apollo Telemedicine facility also looks at providing telemedicine consulting to corporate bodies. Basic healthcare facilities are provided to corporate bodies and consultations done are charged.

Apollo majorly intends to earn its revenues from the conversions which occur as a result of these tele-consulting. The patients maybe initially consulted free of cost or at minimal charges. But, normal charges are levied on them when they visit the hospital and take undergo the procedures required for the treatment. Thus, the telemedicine facility is used only

as a remote consulting unit which the patients can use for taking second opinions or in cases of regular check-ups and monitoring. Major sources of revenue come from corporate when high net-worth individuals undergo treatment at the hospital after the initial diagnosis is done remotely at the office premises. Foreign nationals seeking treatment in India are also a good source of income for the ATNF.

The issue that Apollo's telemedicine facility currently faces is that the technicians required to run the equipment often quit due to the monotonous nature of the job. Apollo and the vendors face issues with spending time and money all over again in training the technicians in efficient handling of the equipment. Although the education requirements of the technicians are not high and it is easy to find replacements, training represents a huge chunk of the costs which is unaccounted for.

ATNF adheres to all the legal requirements of patient security and confidentiality. This is done by providing secure login information, encrypted database, secure websites and identification through hardware protocols such as IRIS identification[4]. However, other legal aspects which might arise when the diagnosis can go wrong due to failures arising in improper imaging and transmission faults have not been looked into. The medical records stored are the only proofs that would be used in case of legal action taken. The absence of legal guidelines has not deterred Apollo in promoting the telemedicine initiatives.

Telemedicine at AIIMS – a critical analysis

The telemedicine facility at AIIMS caters majorly to the following specialities – Dermatology, Medicine, Orthopaedics, Nephrology, Cardiology, Cancer Treatment and Neurosciences. Presently, it caters to around 56 centres around India. The telemedicine facility provides consultation to other government hospitals majorly. It also provides consultation facilities to its other centres, for e.g to the Ballabhgarh centre. The consultation provided is on a free-of-cost basis.

On a monthly basis on an average around 6-7 consultations take place. This accounts to around 75-80 consultations yearly. The consultations are provided on a demand basis. This means that the hospitals requiring consultation request the same from the specialist at AIIMS and a separate appointment is given for the same.

Teleconferencing facilities also occur frequently – especially between AIIMS, SGI,PG Chandigarh. These conferences help the doctors update themselves and take opinions of other doctors in other hospitals. These conferences also help keep a check on the number of

The facility is headed by a faculty-in-charge who is assisted by 3-4 staff members (including technicians and other administrative members).

The AIIMS telemedicine facility is a government backed initiative and is run in the form of projects. C-DAC and Bell labs have been stakeholders for projects in the past.

The telemedicine facility has chartered its responsibilities in 3 ways –

Internal – The telemedicine facility provides consultation facilities to meet its own internal requirements or its centres at other locations.

Within country – The consultation facilities are provided to other entities within the country – both private and public run.

International – This consultation facility is provided upon the requirements of the Ministry of External Affairs. In this case the consultation can either be offline consultation, where the patient is diagnosed based on the reports provided to the specialists without the patient actually being present during examination or online consultation.

Being a not for profit centre, the telemedicine facility faces a major concern of lack of incentives, both for the doctors as well as the administrative level. The doctors are provided the same salary irrespective of the number of consultations done. The only possible motivation for the doctors lies in the aspect of peer recognition, where the doctors gain some amount of branding amongst their peers for consulting with this initiative. This also is seen as a resume building exercise as well. For the facility on a whole, only altruism can be seen as a possible gain.

The lack of incentives is further aggravated by the fact that there is a severe shortage of doctors. There is gap of nearly 40% between the demand and supply. This implies that the doctors are over-burdened already and providing time for any facility which does not provide them any monetary incentive may not be reasonable to expect.

Though ISRO has been backing the telemedicine initiative across the country, indiscriminate distribution of bandwidth to various hospitals has led to poor quality of audio and video capturing at the centres. This is due to the fact that most hospitals would be using the same bandwidth at the same time, causing traffic congestion and thus poor quality reception. This is particularly prominent in the case where the weather is poor especially during monsoon.

Also, the video-conferencing facilities have been provided by C-DAC. The project with C-DAC came to a close in the month of October/November and no renegotiations have taken place for the continuation of the project. This has meant that there is no funding for the telemedicine facility currently. The videoconferencing facility is facing certain hardware issues currently and the service provided is intermittent. There have been no hardware upgrades since the inception of the project in 2005. The instruments have also now become obsolete. The programmes conceptualised by C-DAC as a part of the telemedicine initiative have also proven to be ineffective.

There are also concerns seen that the telemedicine programme is being continued upon only as a branding exercise. This is especially the case when showcasing is needed when eminent personalities of the country are taken ill and immediate consultations are needed to be done by the super-specialist doctors.

The power equation amongst doctors can also act as a major barrier. It is often seen that at smaller government run hospitals, telemedicine consultations are required to be done and more often than not, the consultants who are specialists are comparatively younger to the ones seeking consultation and help. It happens at times that the faculty seeking consultation through the telemedicine route is at the highest positions in the professional ladder in the institution they are serving at. Embarrassment and denial of the fact that a younger doctor can be much more competent acts as a deterrent for such consultations.

Telemedicine, although seen as important, begets only the obligatory service without much planning and structuring going into the facilities. The faculty-in-charge of the telemedicine department currently handles multiple roles, each of which would ideally require dedicated attention.

Another common issue that has been seen is that the faculty heading the facilities does not have a long reign as the head. The telemedicine facility at AIIMS has seen constant changes at the top for the past few years, due to which the progress planned has not been achieved. It requires a lot of planning especially when taking out schemes at the national level, and such instability at the top would ensure constant changes in such plans as well. Also, a lot of time is required in understanding the current set-up and the functioning, which hampers any quick actions to be taken up by the head when he/she comes to power.

With telemedicine being deep-rooted in technology it also becomes quite necessary for the head to not only be able to appreciate technology, but also foresee newer ones which can be roped in. Quite often in the public sector, it is the medical professionals who are seen heading these facilities despite the fact there are IT teams in these institutions as well. The alarming fact is that the IT teams and the telemedicine teams are not even seen working together. For telemedicine to be seen as a necessary and important part of the entire value chain, it would be obvious to expect that a common record database is available and upon any telemedicine consultation done, the records are automatically updated in the common database, as with any patient who has not benefitted from the telemedicine facility. Instead, separate records are maintained, and the patients have to specifically approach the telemedicine unit for the same when he/she visits the hospital for further diagnosis and treatment.

A common felt issue amongst the professionals in the telemedicine facility, the technicians, the administrative staff etc. is that without a person appreciative of and understanding technology heading at the top, due attention would not be provided to sourcing the right equipment, training needs and maintenance. The fact that the equipment at the telemedicine facility has not undergone any maintenance checks since their deployment is surprising. This could also be the major reason for the non-functioning of some of the equipment. There are

no training facilities for the technicians when they join the facility. More often than not, they learn on the job or are demonstrated to by their peers who again have learnt while on the job. In matters concerning life and health of a patient, such alacrity to training can be a severe deterrent.

The expectations from the authorities at the top about the requirements of their role are in contradiction to the expectations of the ones below them. They believe that the one heading the facility should be ideally from a medical background and being able to understand the various aspects of consultation using telemedicine and not just the technical aspects of it. While the expectations from both sides are right when seen from their point of view, it would be the best when a professional with a medical background while also being appreciative of and understanding technology heads the facility. When the IT team and the telemedicine units are functioning separately, it is important for the facility head to work in tandem with the IT team. The computer centre and the telemedicine facility were functioning together, amidst the hype surrounding telemedicine at AIIMS when it was initially launched. This functioning makes a lot more sense when seen from the technological perspective. Also, patients were able to achieve seamless service with their records etc. The internal 'politics', as stated by insiders, however, has caused the telemedicine facility to be hived off from the computer centre and is currently functioning as a separate centre. This, together with a lack of stability at the top has resulted in a lack of direction in the telemedicine initiatives.

The international consultations facilities are also sometimes run as obligations to the Ministry of External Affairs. The case with the Pan-African telemedicine consultation and tele-education initiative is one such example. There are language issues that are seen especially in the case with French speaking nations in Africa where communication and thus, consultation becomes difficult.

Telemedicine consultation would be a much needed facility for the AIIMS with the coming up of 6 new medical institutions (with standards at par with AIIMS) in India. It would be important to maintain the standards of the medicine in each of these hospitals. For this, however, good quality faculty would be required in large numbers which might not be readily available. Telemedicine consultation from the AIIMS to each of these hospitals in the initial phases of operation could be an ideal solution. The health ministry has also ensured that lectures on pre-clinical diagnosis and treatment are provided by the faculty at AIIMS.

Telemedicine consultations have been seen to be successful when such initiatives have been driven by individuals and teams rather than by mandates from the top authority. A related example would be consultations done by a US team of doctors about the use of prosthetic legs were well received. This was a success largely by the self-interests of the orthopaedic surgeons back at AIIMS.

The Pan-African telemedicine initiative at AIIMS is currently functioning well. A large part of the initial success has been due to the fact that the doctors have incentives in providing the required consultation and lectures.

Telemedicine facilities across institutions have common legal aspects regarding the level of responsibility the consulting institutions take on themselves. Any consultation proceeds with a caveat that ensures that the consulting institution is not responsible for any wrong diagnosis that might have occurred. The caveat that for any kind of consultation provided is only suggestive and any diagnosis provided is only a recommendation provides these consulting institutions the required indemnity. It is assumed that the diagnosis and recommendations provided by the consulting institutions are co-related with the clinical impressions of the patient and only upon confirmation are the recommended procedures followed. This secures the consulting institutions from issues that could occur due to faulty images being received as

a result of either network issues (where the network provider could be culpable) or due to mishandling of data by the centre seeking consultation. However, there are no laws that have been framed for accountability in cases of disputes. Neither have any standard operating procedures been defined for identifying the culpable party. The Ministry of Law could do well by finding out or defining what the standard operating procedures should be. The recent dissolution of the Medical Council of India has also acted as a detriment towards the forming of such standards and procedures.

Perspectives in the Public and Private Sectors

The private hospitals have approached telemedicine more as a brand building exercise. This does not discount the fact that a lot of good work is being done by these hospitals in reaching out to the rural masses. The amount of efforts made by these institutions such as Apollo is commendable. Other bodies in the corporate sector have also looked at telemedicine initiatives as one way of addressing their corporate social responsibility requirements. Some institutions have taken a slightly different route by providing funding for health education etc. by using the telemedicine set-up. Conversion, however, is important for these private sector players. Profitability being the underlying driver for these initiatives, the number of patients who were consulted in the main hospital as a result of the preliminary consultation and diagnosis at the telemedicine centres is extremely critical for the continued efforts of the telemedicine facilities. With medical tourism gaining popularity in India, this becomes a huge driver of growth for telemedicine initiatives in the private sector. The low cost spend on healthcare facilities in India drives foreign nationalities to specialists who are gaining immense recognition outside. Thus, these private hospitals are setting up a number of consultation facilities abroad which act as a primary source of contact with the specialists back in India via the telemedicine route.

Addressing the need of the corporate sector within the country also has adopted the telemedicine route. With professionals higher up in the order unable to make time for meeting specialists, especially the travel involved, telemedicine comes to the aid. Only upon diagnosing the ailment as critical does the professional need to meet the specialist in another region for the required detailed consultation. In cases of normal health check-ups the corporate sector is taking to the telemedicine route. The corporate sector is beginning to be a tremendous source of revenues for the private institutions. This is especially the case when these institutions partner with the organizations in ensuring the health of the employees. Regular health check-ups and medical camps are taken up in these organizations using the telemedicine facility, and high conversions are seen later.

For institutions in the public sector, as suggested earlier, altruistic reasons are the main drivers for telemedicine initiatives taken up. Acting in a not-for profit methodology the primary motivation only remains that of reaching out to the rural masses. Conversions are made only when there is a need for the patients to visit the hospital for further diagnosis and treatment. For the doctors and the medical staff, peer recognition is the main motivator for being a part of the telemedicine initiatives. Being recognised around different institutions and medical colleges is the primary gain, as there is no additional incentive for them for the consultations they provide. Doctors, however, also see this as a resume building exercise and a way of bettering their career prospects.

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