



Swansea University
Prifysgol Abertawe



Cronfa - Swansea University Open Access Repository

This is an author produced version of a paper published in :
Transforming Government: People, Process and Policy

Cronfa URL for this paper:

<http://cronfa.swan.ac.uk/Record/cronfa23854>

Paper:

Chandwani, R. & Dwivedi, Y. (2015). Telemedicine in India: current state, challenges and opportunities. *Transforming Government: People, Process and Policy*, 9(4), 393-400.

<http://dx.doi.org/10.1108/TG-07-2015-0029>

This article is brought to you by Swansea University. Any person downloading material is agreeing to abide by the terms of the repository licence. Authors are personally responsible for adhering to publisher restrictions or conditions. When uploading content they are required to comply with their publisher agreement and the SHERPA RoMEO database to judge whether or not it is copyright safe to add this version of the paper to this repository.

<http://www.swansea.ac.uk/iss/researchsupport/cronfa-support/>

Telemedicine in India: Current State, Challenges and Opportunities

Rajesh K Chandwani

Indian Institute of Management Ahmedabad (IIMA), India

Yogesh K. Dwivedi

School of Management
Swansea University Bay Campus
Swansea, UK

Purpose - The purpose of this conceptual paper is to present the scope of telemedicine, current state of telemedicine in India, challenges in its diffusion and suggest the way forward for implementation of such initiatives.

Design/methodology/approach – This is viewpoint article that is prepared based on authors' exposure and knowledge about research topic and the context. A number of appropriate and current citations have been utilised to illustrate current state on the topic as well as to support authors arguments presented in this paper.

Findings – The discussion presented in this article suggest that optimal utilization of technology in healthcare delivery system requires overcoming barriers at multiple levels including policy, resources and socio-cultural levels. Successful implementation of telemedicine entails involvement of all the stakeholders, namely the specialists, general duty doctors, paramedical personnel, technical staff, coordination staff, policymakers and most importantly the target community, from the design stage itself.

Originality/value - The primary value of this paper lies in providing an overview of current state of telemedicine development in India. We believe this article will act as a precursor to future articles on this topic.

Keywords: Telemedicine; India; Challenges; Opportunities

Article type: Viewpoint

1.0 Introduction

The healthcare delivery system in India falls far short of its requirement for taking care of the disease burden, both in terms of manpower and infrastructure. The shortage of manpower exists at all levels, with an acute requirement of 6 lakhs doctors , 10 lakhs nursing staff and 4 lakhs dental surgeons for the public healthcare system (Sharma and Unnikrishnan, 2013). Further, 75% of the healthcare infrastructure and manpower is concentrated in urban areas where only 27% of the population resides (Mishra, Kapoor and Singh, 2009). The doctor-per-1000 ratio in rural areas, for example, is just 0.39 as compared to 1.33 in urban areas, with a national average of 0.69 (Sharma and Unnikrishnan, 2013). The distribution of specialist doctors is also skewed towards urban areas with 80% of specialists residing in the urban areas (Mishra et al., 2009).

This skewed distribution of resources makes the access to healthcare more precarious in the rural areas. Further, various studies have highlighted the poor quality of healthcare delivery in India, especially in the rural areas, with respect to all the aspects of health delivery system, namely, structure, processes and outcome (Powell-Jackson et al., 2013).

ICT (Information communication technologies) can act as a conduit for carrying knowledge across socio-economic and geographic barriers. Accordingly, it is argued that ICT for health interventions, also known as e-health initiatives, such as telemedicine can potentially enable the extension of medical knowledge to remote areas, thus enhancing accessibility, affordability and quality of healthcare services (Dwivedi et al., 2015a; Jones et al., 2012; Miscione, 2007). Telemedicine is defined as a distant delivery of health related services through transfer of audio, video and graphical information via telecommunication networks, including consultative and diagnostic services along with enablement of planning, coordination, collaboration and education (Singh et al, 2009).

Telemedicine has been used for diagnosis, treatment and prevention of disease and injuries; health-related education and training for patients and professionals; research and evaluation of public health programs and health administration. Indeed, telemedicine has been projected to transform public health services through redesigning the policy and processes in the healthcare system. Recent reviews of the cost effectiveness of telemedicine initiatives found that telemedicine can reduce the cost of healthcare delivery, thus making healthcare services affordable and accessible (de la Torre-Díez, et al., 2015). Meher and Kant (2014), for example, in their study found that most of the patients who availed of telemedicine facility in the All India Institute of Medical Sciences (AIIMS, New Delhi) felt that telemedicine saves time and money and is especially useful for patients from rural areas. However, world over, potential benefits of ICT have not been fully realized (Jones et al., 2012). Most of the implemented projects have given sub optimal results at best. In this paper, we present the scope of telemedicine, current state of telemedicine in India, challenges in its diffusion and suggest the way forward for implementation of such initiatives.

2.0 Scope of Telemedicine

Telemedicine can enable enhancement of healthcare delivery processes in several ways. The technology design can be customized to deal with unique issues that need to be addressed. Technical requirements of a particular intervention could be unique based on several dimensions: real time versus non-real time; acute disease versus chronic disease; specialist versus primary consultation and hospice/tele-centre based versus home based (Craig and Patterson, 2005). For example, in case of telemedicine design for acute illnesses, such as for poison centres ,where the medical practitioners from periphery can access advise for treatment of specific poisons, the urgency of information flow requires a round the clock system with extremely high reliability. On the other hand, for tele follow-up consultations of chronic patients, the consultation can be coordinated according to the convenience of both, the doctor and patient. Telemedicine has also been used for CME (continuing medical education) for enhancing the knowledge and skills of medical practitioners as well as for training of paramedical personnel (Mishra et al., 2009). Further, telemedicine can be used for

enhancing data collection and analysis, which in turn can enable appropriate public health program implementation. For example, GPS enabled data collection can be used for mapping and detecting epidemics, analyzing the disease pattern in a community and then implementing a targeted public health awareness program.

There are two broad types of telemedicine design, namely, human-human “interaction in real-time” (synchronous consultations) and, “store and transfer” (Craig and Patterson, 2005). Real-time interactions may involve various levels of healthcare workers: Doctor-doctor, doctor-paramedic or doctor-patient. Further, the interaction may be telecentre based or home based. Coordination between the central and peripheral nodes to ensure the real time presence of specific participants is the most important aspect of synchronous consultation. In the store and transfer (non-synchronous) type of design, data is collected, stored and transferred from peripheral centres to the central node for specialist’s opinion, for example image of an X ray (tele-radiology) or ECG (Tele-cardiology) or image of the fundus of eye (tele-ophthalmology) (Bensink, Hailey and Wootton 2006),

Typically this type of telemedicine may be useful in monitoring the progress of a chronic disease such as screening the diabetic patient for retinopathy.

3.0 Telemedicine in India¹

Both, the public and private sectors have been involved in initiating several telemedicine programs in India. Interestingly, the initial telemedicine system in India was designed and pioneered by a private enterprise, Apollo hospitals, in collaboration with ISRO (Indian Space Research Organization) at a village called Aragonda in Andhra Pradesh. Consequently, with the support of the Department of Information Technology (DIT), ISRO, Department of Health and Family welfare, Ministry of External Affairs (MEA), National Informatics Centre (NIC) and respective state governments the network of telemedicine expanded across the country. The premier teaching institutes act as the central hubs, namely, AIIMS New Delhi, PGIMER Chandigarh and SGPGIMS Lucknow, TMH Mumbai, PBDSPGIMS Rohtak and CSMMU Lucknow. Several corporate medical institutions have also set up telemedicine centres to extend their services: Amrita Institute of Medical Sciences (Kochi), Narayana Hrudayalaya (Bangalore), AECS (Madurai), Apollo Hospitals (Hyderabad), Sankara Nethralaya (Chennai), and Sri Ramachandra Medical Centre (Chennai). Gradually, telemedicine network has extended across the country with more than 400 telemedicine platforms in India. ISRO’s telemedicine program connects 245 hospitals- 205 district/ rural hospitals and 40 super-speciality hospitals. However, most of these initiatives remain confined to a ‘pilot project’ level and adoption of telemedicine into mainstream healthcare delivery system remains elusive (Mishra et al., 2012).

4.0 Challenges, opportunities and future direction

The challenges in optimal adoption of telemedicine for enhancing healthcare delivery in India can be discussed at various levels namely, policy, societal or the institutional level, and

¹ <http://www.telemedindia.org/index.html> accessed on 21st Feb 2014

medical infrastructural level. While the above categorization is not compartmental, it enables comprehensive understanding of the challenges and highlights the steps needed to overcome them.

5.0 Issues at the policy level

At the policy level, the principle challenge is to make telemedicine an integral part of the healthcare delivery system in India. There have been some initiatives at the policy level such as involvement of Department of Information Technology (DIT) in the preparation of the guidelines for standardization of telemedicine infrastructure to ensure interoperability (Mishra, Singh and Chand, 2012). However, many other crucial issues need to be addressed by preparing a comprehensive regulatory framework to enable the stakeholders to make sense of their responsibilities and liabilities. As telemedicine widens the scope of information exchange and healthcare delivery across geographies, it can give rise to several ethical and legal issues (LeRouge and Garfield, 2013). The principal stakeholders, namely, the doctors and patients need to have clarity in terms of their role expectations, duties and the rights in the new delivery system. For example, telemedicine can potentially jeopardize the privacy and confidentiality of crucial medical and financial information about patients. Defining guidelines for incorporation of sufficient provisions in the system design for maintaining confidentiality are required to alleviate the concerns regarding privacy of medical information. Further, as telemedicine may result in a patient being treated by multiple doctors across geographies, it can lead to several contentious issues related to ownership and accountability regarding the treatment of the patient, leaving the doctors and health workers unsure about their legal obligations and responsibilities. As the medical services in India are covered under the Consumer Protection Act (1986) and there have been an increase in the legal suits on the doctors (Ganesh, 2009), policy makers need to address these issues to enable diffusion of telemedicine in the broader healthcare delivery system.

While the economic advantages of telemedicine from the patient's perspective are clear, for example by saving the time and money lost in travelling to urban areas for treatment, the return on investment from the healthcare provider's perspective are uncertain (LeRouge and Garfield, 2013). Therefore, probably, most of the telemedicine interventions are planned as 'concept projects' based on government's initiatives or implemented as Public Private Partnership (Mishra et al., 2012). These initiatives are largely dependent upon government grants for finances and hence have little consideration towards financial viability. To make telemedicine an integral part of the ecosystem of healthcare delivery, and to ensure active participation of the private sector on a sustainable basis, several policy initiatives are required for ensuring financial viability of telemedicine projects, such as, clarity on reimbursement of treatment provided by telemedicine. This is especially important as majority of the healthcare delivery happens through the private sector across rural and urban areas (Balarajan, Selvaraj and Subramanian, 2011).

6.0 Issues at the resources level

The basic resource requirement for telemedicine involves technological and human resource issues.

To act as an effective medical information conduit, technology should enable accurate transfer of information, with minimal information loss during recording, storage and transfer of information. The lack of broadband infrastructure is a major challenge that should be overcome for enabling high demand video and store-and-forward services (LeRouge and Garfield, 2013). While ensuring effectiveness, the technology design should also address the dimension of cost-efficiency and affordability. While, in the pilot phase, it is imperative to initiate the telemedicine interventions at a specific disease level to deal with amenable solutions to minor problems such as screening for diabetic retinopathy by a fundus camera, a wider use of technology can ensure affordability. For example, the fundus camera which enabled ophthalmologists to screen for diabetic retinopathy can also enable image based diagnosis of multiple diseases of skin, teeth etc. Thus a digital camera with different probes for gynaecology, ophthalmology, dentistry and dermatology can result in sharing of the cost amongst multiple specialties and hence enhance the affordability of technological solution. Other related concerns to ensure technology reliability such as reliable power supply and suitable hardware also need to be overcome.

With low doctor to population ratios, doctors in India are considerably overloaded with the patients. Hence to involve them in healthcare delivery through telemedicine requires specific approaches to make the tele-consultation effective as well as efficient. Telemedicine, for example, could be designed for management of specific diseases under specialties amenable to image based diagnosis for example, Dermatology, Dentistry, Ophthalmology and Gynaecology. Focus on specific diseases can considerably limit the bandwidth required for doctor's judgemental heuristics and decision making, and hence have minimal impact on the doctor's busy routines.

Further, as explicated above, paramedical personnel can act as an important link between the specialist in the urban centre and the rural population. Overcoming the prevalent scarcity of paramedical personnel and training the staff in the use of telemedicine is crucial to extend the adoption of telemedicine across rural areas.

7.0 Issues at the socio-cultural level

The socio-cultural barriers relate to the prevalent institutional norms that determine health seeking behaviour of the population. Alternative systems of medicine delivered through local practitioners forms the usual recourse adopted by the patients, especially in the case of primary care in the developing country contexts (Sujatha, 2007). Telemedicine interventions, on the other hand, are restricted to the formal system of medicine. Involving the community in the healthcare delivery process is the most crucial design element to enhance acceptability of an intervention. Indeed, the concept of ASHA (Accredited Social Health Activist) in the design of NRHM (National Rural Health Mission) acted as the back bone of the program by

ensuring the link between the community and the formal health system (Powell-Jackson et al., 2013).

Overcoming the socio-cultural barriers to extend telemedicine adoption to the rural areas, arguably, depends upon incorporation of telemedicine in primary care. Most of the telemedicine initiatives in India mentioned above have largely explored the delivery of 'specialist' or expert advice from the central nodes to periphery, thus catering to secondary and tertiary care delivery. The approach has been 'top-down' in terms of design of technology, processes and systems. The potential of telemedicine in primary care has been grossly under-utilized. Indeed, it can be argued that optimal diffusion of telemedicine across the healthcare delivery system, especially in rural areas, depends upon the incorporation of telemedicine for primary care. Notably, unlike the above mentioned interventions, telemedicine for primary care require a bottom-up approach, starting from the community: assessing the needs of the community, examining the socio-technical systems where the intervention would be implemented; involvement of local thought leaders. The bottom-up approach to implement telemedicine at the primary care level would, arguably, enhance the effectiveness and acceptance of telemedicine at the secondary and tertiary levels.

The technology, systems and process for primary care telemedicine should be designed considering the existing socio-technical systems prevalent in the community, such as existing health-seeking behaviour of the target population. Further, the design of the systems and processes should be based on the knowledge distribution, infrastructure feasibility and the requirement of the target population.

8.0 Conclusion

The discussion presented in this paper suggest that a number of telemedicine initiatives have been launched in India but they remain confined to a 'pilot project' level and adoption of telemedicine into mainstream healthcare delivery system remains elusive. The result of such pilot projects should be demonstrated to wider population in order to illustrate benefits of such initiatives. Also, some of such projects should be made live on larger scale to demonstrate actual benefits to both supply and demand sides.

Though several studies have explored the cost effectiveness of telemedicine, small sample size and poor research designs limit our understanding of the economic benefits of telemedicine (de la Torre-Díez, et.al., 2015). Thus while the potential of telemedicine for enhancing healthcare delivery in developing countries like India is huge, further large scale research is required to explore the impact of telemedicine. Scholars have suggested that as telemedicine initiatives involve multiple stakeholders and dimensions, they should be evaluated using multi-criteria frameworks, grounded in multiple theories or perspectives (Hamid and Sarmad, 2008). Specifically, the design of telemedicine systems have often been driven by the provider's and donor's concerns rather than attending to the issues of the beneficiaries (Miscione, 2007). For an effective telemedicine system, the design needs to incorporate the issues of the multiple stakeholders involved in the project, especially ensuring citizen participation (Jones et al., 2012).Optimal utilization of technology in healthcare

delivery system requires overcoming barriers at multiple levels-policy, resources and socio-cultural levels. Researchers have pointed out the importance of a robust regulatory framework to guide, monitor and implement telemedicine initiatives in India (Lahiri, 2013). For example, telemedicine can potentially jeopardize the privacy and confidentiality of sensitive medical information, confusion regarding accountability towards patients, lack of clarity on reimbursement of treatment provided by telemedicine and the increasing dependence upon technology for achieving the outcomes. Defining guidelines for incorporation of sufficient provisions in the system design for regulating several such contentious issues are required to alleviate the concerns regarding privacy of medical information.

The lack of broadband infrastructure in India (Dwivedi et al., 2013) is one of the major technological bottlenecks. A high speed network infrastructure development particularly in rural areas is must for enabling high demand video and store-and-forward services. Without that true potential cannot be realised. India's recent multi-million rupees "Digital India" programme (Dwivedi et al., 2015b) is an appropriate step forward for overcoming such technological bottlenecks.

Initial telemedicine projects in India have been sponsored by government grants and are initiated in the existing public health infrastructure or as public private partnerships.. For telemedicine to become an integral part of the ecosystem of healthcare delivery in India, it requires active participation of the private sector on a sustainable basis. Therefore establishing the basic telecom infrastructure and a robust regulatory framework are essential for ensuring financial viability, sustainability and scaling up of telemedicine initiatives.

Further, the success of telemedicine depends upon overcoming the socio-cultural barriers which relate to the prevalent institutional norms. It is important that a socio-technical perspective is adopted while designing the system, emphasizing the recognition of social infrastructure and configuration and incorporating elements that address potential contentions of technical and social aspects. This in turn entails involvement of all the stakeholders, namely the specialists, general duty doctors, paramedical personnel, technical staff, coordination staff, policymakers and most importantly the target community, from the design stage itself.

To conclude, while telemedicine can potentially enhance the accessibility, affordability and quality of healthcare services in India, as demonstrated by several pilot projects, successful and sustainable scaling up of such initiatives requires addressing policy/ regulatory, infrastructural, human resource and socio-cultural issues.

References

- Balarajan, Y., Selvaraj, S., & Subramanian, S. V.(2011). Healthcare and equity in India. *The Lancet*, 377(9764):505-515.
- Bensink, M., Hailey, D., & Wootton, R. (2006). A systematic review of successes and failures in home telehealth: preliminary results. *Journal of Telemedicine and Telecare*, 12(suppl3):8-16.

- Craig, J., & Patterson, V. (2005). Introduction to the practice of telemedicine. *Journal of Telemedicine & Telecare*:11(1).
- de la Torre-Díez, I., López-Coronado, M., Vaca, C., Aguado, J. S., & de Castro, C. (2015). Cost-utility and cost-effectiveness studies of telemedicine, electronic, and mobile health systems in the literature: a systematic review. *Telemedicine and e-Health*, 21(2), 81-85.
- Dwivedi, Y. K., Shareef, M. A., Simintiras, A. C., Lal, B., & Weerakkody, V. (2015a). A generalised adoption model for services: A cross-country comparison of mobile health (m-health). *Government Information Quarterly*. Advance online version available at <http://dx.doi.org/10.1016/j.giq.2015.06.003>
- Dwivedi, Y.K., Rana, N.P., Simintiras, A. and Lal, B. (2015b). 'Digital India Programme: An Exemplary Initiative of Public Administration Reformation', *Yojana – A Developmental Monthly*, Feb 2015 Issue, pp. 28-34, Ministry of Information and Broadcasting, Government of India, New Delhi. Url: http://yojana.gov.in/topstory_details.asp?storyid=595
- Dwivedi, Y.K., Rana, N.P., and Simintiras, A. (2013). 'E-Government: Opportunities and Challenges', *Yojana – A Developmental Monthly*, Nov 2013 Issue, Ministry of Information and Broadcasting, Government of India, New Delhi. Url: <http://yojana.gov.in/cms/%28S%28bewjhgneaimyky45kwjobkje%29%29/default.aspx>
- Jones, C. R., Cardoso, R. B., Hüttner, E., Oliveira, H. W., dos Santos, M. A., Helena Itaquí Lopes, M., & Russomano, T. (2012). Towards designing for equity: active citizen participation in eHealth. *Transforming Government: People, Process and Policy*, 6(4), 333-344.
- Ganesh, K. (2009). Patient-doctor relationship: Changing perspectives and medical litigation. *Indian journal of urology: IJU: journal of the Urological Society of India*, 25(3):356.
- Hamid, A., & Sarmad, A. (2008). Evaluation of e-health services: user's perspective criteria. *Transforming government: people, process and policy*, 2(4), 243-255.
- Lahiri, K. (2013). Telemedicine, e-Health and Health related IT enabled Services: the Indian Situation. *Globsyn Management Journal*, 7(1/2), 1.
- LeRouge, C., & Garfield, M. J.(2013). Crossing the telemedicine chasm: have the us Barriers to widespread adoption of telemedicine been significantly reduced?. *International journal of environmental research and public health*, 10(12):6472-6484.
- Meher, S. K., & Kant, S. (2014). Awareness and attitudes of geriatric patients towards telemedicine in India. *Gerontechnology*, 13(2), 262.
- Miscione, G.(2007). Telemedicine in the Upper Amazon: Interplay with local healthcare practices. *Management Information Systems Quarterly*, 31(2):10.
- Mishra, S. K., Singh, I. P., & Chand, R. D.(2012). Current Status of Telemedicine Network in India and Future Perspective. *Proceedings of the Asia-Pacific Advanced Network*,(32):151-163.
- Mishra, S. K., Kapoor, L., & Singh, I. P.(2009). Telemedicine in India: current scenario and the future. *Telemedicine and e-Health*, 15(6):568-575.
- Powell-Jackson, T., Acharya, A., & Mills, A.(2013). An Assessment of the Quality of Primary Healthcare in India. *Economic & Political Weekly*,48(19):53.

- Sharma, A., & Unnikrishnan, M. K.(2013). Healthcare Inequity and Physician Scarcity Empowering Non-Physician Healthcare. *Economic & Political Weekly (EPW)*, 48(13):112-117.
- Singh, R. , Mathiassen, L. and Mishra, A. N.(2009) A Theory of Rural Telehealth Innovation- A Paradoxical Approach, ICIS 2009
- Sujatha, V.(2007). Pluralism in Indian medicine: Medical lore as a genre of medical knowledge. *Contributions to Indian Sociology*, 41(2):169-202.