

CASE FOR EFFICIENT DEPLOYMENT OF INFORMATION TECHNOLOGY IN INDIAN HEALTHCARE SECTOR

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ABSTRACT

Healthcare in India has emerged as an important sunshine sector registering phenomenal growth in recent years. India has world's second largest population, spread in a vast geographical area with rural-urban divide. The healthcare needs of the people at present, remain 'underserved'. Growing population, proliferation of new life-style diseases, increasing percentage of the aged and several other factors further aggravate the difficulties in delivering necessary healthcare to all people.

Public spending on healthcare infrastructure, manpower and delivery is less. Though there is higher participation of the private sector in healthcare provision, it is urban-centric, for-profit and concentrates on curative care offered at high cost to the consumer. Gasping gaps pose a serious threat to the well-being of the people.

In the mission of taking healthcare to yet-uncovered regions and population, without delays and in cost-effective mode, efficient deployment of Information Technology (I.T) can really help. Already, innovations like telemedicine, eHealth, mHealth etc. have commenced service in healthcare. Dissemination of information to create awareness to achieve success in preventive care; creation of databases on communicable and non-communicable diseases as well as on patients; links between healthcare professionals, hospitals and the people irrespective of the location and time could be better served by I.T as India has sufficient man-power and expertise in the field of Information Technology (I.T.).

This article surveys the present scenario; discusses the limitations and precautions of using I.T. in healthcare; advocates further efficient deployment of I.T. offering suggestions for improved I.T. enabled healthcare delivery in India.

Key words: *healthcare, healthcare delivery, I.T- enabled healthcare, digital devices, telemedicine, eHealth,*

INTRODUCTION

Technology, more specifically, Information Technology (I.T) surrounds and overwhelmingly impacts our modern life. It would be no exaggeration to hold that the one field that has greatly revolutionized several areas of vital concern for the welfare of the people is none other than I.T. Healthcare¹ is one such area wherein the advent and use of I.T has made rapid strides accruing immeasurable benefits to the welfare of human life. During the decades gone by, remarkable developments from the 'primitive hospital information systems' to the recent 'health information systems', as narrated by Haux (2006), have happened in the field.² A host of I.T- propelled, new-age developments like Health Information Technology (HIT),³ Healthcare Information Systems (HIS),⁴ Electronic Health Records (EHRs),⁵ eHealth,⁶ Telemedicine,⁷ mHealth⁸ etc. have already been added to the healthcare ecosystem. These are besides several I.T-enabled, cutting-edge devices like C.T. Scans, M.R.I. Scans, monitoring and wearable gadgets and so on in vogue in the field. All over the world, diagnostics, procedures, structure and organization of the entire medical field has been impacted by I.T. There is wide acknowledgement that digital technologies⁹ have greatly transformed the delivery of healthcare compared to yester-years and have created a new global healthcare landscape. Recent trends forecast that in future, technological transformation will be one of the key differentiators between successful and unsuccessful nations in providing healthcare. In this background, this article discusses the healthcare context in the world's second most populous country in the following section, and embarks upon highlighting the relevance, benefits and challenges of more and effective deployment of I.T for achieving success in healthcare provision in India.

¹ The term 'Healthcare' used herein covers not merely medical care but also all aspects of preventive care also.

² Haux, R. (2006). Health Information Systems—Past, Present, Future. *International Journal of Medical Informatics*, 75(3), 268–281. doi:10.1016/j.ijmedinf.2005.08.002

³ Health Information Technology (HIT) consists of a widerange of networking technologies, clinical databases, electronic medical/health records, and other specific biomedical, administrative and financial technologies that generate, transmit and store healthcare information.

⁴ Healthcare Information Systems (HIS) 'refers to such systems that are used to process data, information and knowledge in healthcare environments.' (Haux, Winter, Ammenwerth, & Brigl, 2004).

⁵ Electronic Health Records (EHR) have come to be commonly used almost interchangeably with HIS

⁶ eHealth describes the application of information and communications technologies across the whole range of functions that affect the health sector. eHealth includes tools for health authorities and professionals as well as personalized health systems for patients and citizens. [COCIR Glossary of Terms]. eHealth also includes HIS.

⁷ According to The American Telemedicine Association (ATA), 'Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status.

⁸ mHealth (also written as m-health) is the use of mobile communications – such as personal digital assistants and mobile phones – for health services and information. The mHealth field has emerged as a subset of telemedicine.

⁹ Digital technologies include: Electronic Health Records [HER]; telehealth; monitoring equipment, including wearable devices; electronic communications (e-communications); the use of web- and cloud-based tools; data analytics – 'big data'.

INDIAN SCENARIO IN HEALTHCARE

According to a recent report (2015) by the Bain and Co., 'healthcare in India currently faces the unique challenges of poor access, low affordability and high variation in quality'.¹⁰ Though crowded by such challenges, the FICCI observes that 'healthcare has emerged to become one of the fast growing service sectors in India. It is also believed to be the next big thing after the I.T industry.'¹¹ The vital fact about India's unique needs in healthcare is that, they stem mainly from its very large population¹² and its steady increase. Additionally, higher life expectancy- achieved through advancements in Science and Medicine –has also brought the population of the aged India to a similar increase.¹³ For an ever- increasing population mix of the young and the aged, demands in healthcare are also increasing proportionately.

The Country's healthcare system consists of an uneven mix of both the public and private sector providers of health services. The networks of public healthcare facilities at the primary, secondary and tertiary level, run mainly by State Governments, provide free or low cost medical services.¹⁴ At the same time, it is to be remembered that the spending by the Government on healthcare provision is limited and remains "low by any standard"¹⁵. This is also evidenced by the observation of the WHO that 'the total expenditure on healthcare in India is only about 4.1% of GDP, in which government expenditure is less than 1% of GDP'.¹⁶ As a consequence such deficits, the public healthcare system in the country is uneven and underserved. Public hospitals and health centers are underfunded, under-staffed and staggering with unmet demands on healthcare services. Inadequate rural coverage still exists. The country has only one government physician for 11,000 people and one bed in every government hospital serves 1833 people.¹⁷ Though the private healthcare sector is extensive, with a vast spectrum of multi-specialty / specialty corporate hospitals, nursing homes, poly- clinics, clinics, diagnostic labs, scan centers etc., its concentration is mostly in big cities. Such one-sided concentration creates explicit urban-rural gaps in availability and delivery of healthcare services. Moreover, as the

¹⁰ Aarogya Bharat: India Healthcare Roadmap for 2025, Bain & Company, Inc., 2015

¹¹ Millie Rainer. Changing Landscape of Online Healthcare Industry in India, September 10, 2016

¹² 1.3 Billion as in 2015 according to Institute for Health Metrics and Evaluation (IHME) estimate (vide The Hindu, 9 October 2016)

¹³ The geriatric age group expected to constitute 11% share by 2025. [see: Aarogya Bharat: India Healthcare Roadmap for 2025, Bain & Company, Inc,

¹⁴ Twelfth Five Year-Plan (2012-2017), Vol III, Social Sectors, Planning Commission, Government of India, 2013

¹⁵ Ibid

¹⁶ Vishal Bali, Growth of healthcare sector - road ahead?, Deccan Herald (Jul 10, 2016), Available at: <http://www.deccanherald.com/content/556941/growth-healthcare-sector-road-ahead.html>

¹⁷ According to 2015 report by National Health Profile.

private sector is mostly 'for profit', private healthcare costs are high and this creates the question of affordability for the middleclass and the poor.

Taking ground level realities into account, the Planning Commission of India has summed up that the net availability of healthcare services both from the public and private sectors taken together is still 'quantitatively inadequate'; 'quality of healthcare services varies considerably in both the public and private sector'; 'affordability of healthcare is a serious problem for the vast majority of the population, especially in tertiary care'.¹⁸ Another factor aggravating the situation is the stark shortage of qualified and trained medical professionals to provide various aspects of healthcare. The WHO reports that only 26% of healthcare professionals are available to address the needs of 72% of the country's population in India.¹⁹ The overall shortage is 'further exacerbated by wide geographical variations, leaving especially rural areas poorly served'.²⁰ To make matters worse further, the Planning Commission (2013) expects that in the coming years "a larger proportion of the population among the aged will become vulnerable to chronic Non Communicable Diseases (NCDs)".²¹ The latest Global Burden of Disease (GBD) Report also warns that in India, there exists the largest burden of under- five mortality, increased incidence of diabetes and 20% increase in cases of chronic kidney disease, among other health/risk burdens.²²

The cumulative result of these facts and factors have placed Indian healthcare in a paradoxical situation. Of course, there are world-class hospitals but these are very few in numbers 'like oasis in a desert'. There are happy voices about higher prospects of medical tourism happening in India due to the country's ability to offer cost-effective, state of the art healthcare to those visiting from other countries for medical treatment. But the haunting reality is that the country is still struggling to take healthcare to millions of Indians living in rural, hilly and other backward regions

In such contexts, extending healthcare to the yet uncovered population and regions, tailoring them to suit the requirements of different segments in India, in cost-effective and timely manner poses great challenges. Provision of healthcare to all the people in the wake of existing limitations, most importantly demands better management of the healthcare system and delivery. There can be no doubt that better management could be achieved with ease by effective deployment of I.T as it 'has the potential to meet the demands of a rapidly changing demographic landscape whose consumption of technology is also steadily growing'.²³

¹⁸ Planning Commission of India (2013)

¹⁹ World Health Organisation (WHO) Report, 2012

²⁰ Planning Commission (2013)

²¹ Planning Commission Of India (2013)

²² 2015 Report. [For more, see: The Hindu, 9 Oct 2016. P 8]

²³ Millie Rainer. (2016) cited earlier herein.

USE OF I.T IN HEALTHCARE ELSEWHERE

At the global level, healthcare industry has been experiencing a steady transformation with I.T playing a core role in every aspect of healthcare value chain ensuring faster adaptability of advanced technologies. A clear shift in thought and implementation has made healthcare providers take notice of the ample opportunities that technology can provide.²⁴In developed countries, the use of different types of I.T in healthcare has progressed considerably since the beginning of electronic patient registration, leading to improvements in the interfacing and fusion capabilities of a large variety of computer and telecommunication technologies.²⁵Healthcare data are entering a new era with the mass adoption of EHRs, the harnessing of big data, the rise of genomics, personalized medicine, and more.²⁶It is learnt that countries like the U.S.A, have come a long way in health I.T and communication over the past 15 years with more than three-quarters of its hospitals and half of outpatient practices having installed EHR systems.²⁷

The reported trends in adoption of national health information systems elsewhere point to focused large scale deployment of I.T. Australia, Canada and England have commenced implementing large information systems towards standardization and the incorporation of new technologies. Scotland also maintains a single information system that functions in 75% of its services.²⁸In Arab Health, the prospects of deploying I.T solutions like Telemedicine and platforms that monitor patients remotely are reported 'exciting'.²⁹ In Ghana, several eHealth initiatives including Mobile telemedicine and Mobile Technology for Community Health (MOTECHE) etc. have already been implemented.³⁰It is expected that developing countries like India would be able to reduce the time and resources required to increase I.T utilization by learning relevant lessons flowing through experiences of the developed and other countries in this sphere.

²⁴Jashodhara Ghosh, *Shoving IT in Healthcare*, December 10, 2015. Available at : <http://ehealth.eletsonline.com/2015/12/need-for-inclusive-healthcare/>

²⁵ Elaine Tomasi, Luiz Augusto Facchini, & Maria de Fatima Santos Maia, Health information technology in primary health care in developing countries: a literature review. Bulletin of the World Health Organization, November 2004, 82 (11)

²⁶Heather Caspi, Healthcare looks to future in cloud computing, October 22, 2015

²⁷Extracting value from chaos: The promise of health information technology, February 29, 2016[Available at: <http://www.regenstrief.org/article/extracting-value-chaos-promise-health-information-technology>]

²⁸ See Note 19

²⁹Smart Healthcare on display at Arab Health, 28 March 2015

³⁰ For details see: Ebenezer Afarikumah, Electronic Health In Ghana: Current Status And Future Prospects, Online Journal of Public Health Informatics, Feb 2014; 5(3):230

BENEFITS OF I.T IN HEALTHCARE.

It would be nearly impossible to list all the benefits that could be derived through I.T in healthcare. Global experience, so far, has revealed that use of I.T can bring in savings in time, lower costs, error reduction and also enhancements in patient satisfaction. Further, with the aid of digital technology, the process of lab/tests and results are now being obtained faster; duplication of tests and wastage of finances are minimized. 'Improved patient outcomes; clinical professionals getting relief of time spent on managing process; better communication tools for administrative staff to carry out routine matters; integrated information and communication systems dissolving many of the current divides between primary, secondary and tertiary care'³¹ are being highlighted in a research report (2016), as major benefits in healthcare arising out of digitization.

It is a fact that 'consumers now have greater control over how they access health care options. They are 'increasingly using technology to connect with doctors and healthcare providers in a way that was not possible before.'³² Patients are bound to benefit from ease of access to their health records and they will turn to be better informed persons. Such an empowerment increases possibilities of involving the individual patients in managing their own health. I.T can serve as a potent catalyst to bring benefits to every constituent - the patients, payers, providers, governments and others- within the health ecosystem.

For healthcare systems in general and particularly for the public and private institutions providing healthcare, disease monitoring and prevention, reliable information and effective communication are crucial elements. As the healthcare organizations have a complex set of workflows, it becomes very much necessary to capture all interactions in digital/electronic format for use in subsequent references and coordinated treatments. Further, the healthcare domain is quite large, encompassing doctors, surgeons, physicians, nursing and other medical care providers, paramedics, specialist clinics, nursing homes, hospitals, diagnostic centers, clinical/pathology laboratories, physiotherapy/ wellness centers etc. There is much need to seamlessly integrate all the members and segments of the domain. The function of effecting such integration could be performed with ease and efficiency by innovative I.T designs and their applications. In many nations, I.T has been found helping in several ways including 'combating

³¹Imison C, Castle-Clarke S, Watson R and Edwards N (2016)*Delivering the benefits of digital healthcare*. Nuffield Trust.

³²Millie Rainer, (2016) cited earlier herein.

disease, promoting individual health and making health systems more effective and efficient'.³³In many other sub-verticals of healthcare- increasing employee efficiency, enhancing productivity, augmenting customer services (customer satisfaction), managing stocks and inventory movement etc.- I.T solutions hold scopes for much help. Moreover, to achieve success in 'preventive care', it is necessary to create awareness of health and healthcare among people as well as all involved in providing healthcare. Carrying out effective programmes for creating health awareness/ health education among the target segments can be better achieved in quick time through appropriate digital designs and modules.

Existence of factors in India of 'poor last-mile healthcare and easy access to technology has made telemedicine a strong growth story in healthcare industry.'³⁴Digital technology can indeed maximize the productivity of the clinician, physician and hospital systems for offering better, patient-centered, coordinated care. RFID tags and wireless sensors have also come to be used for better patient care, drug stocks management, hospital security, inventory management, tracking medical devices, maintaining medical records, patient histories etc. It is to be noted that among experts, there is wide 'consensus concerning the usefulness of computerized systems in primary health care, especially for promoting greater efficiency in management processes.'³⁵

In the context of the India's unique needs narrated earlier herein and in view of the known benefits of using I.T in healthcare, the inference is that the country needs to lay its priorities on healthcare technologies to overcome access barriers, enhance affordability through low-cost products and services and engage patients through digital health to improve care coordination. Efficient deployment of I.T in Indian healthcare sector can really bring considerable relief, by bridging the existing gaps not only between the need and delivery of healthcare but also in various other areas including time, patient diagnosis, medical research, costs and quality.

PROPOSAL OF INDIAN PLANNING COMMISSION ON I.T IN HEALTHCARE

The Planning Commission has its focus on the strategies to deliver preventive, curative and public health services. In its 12th Five Year Plan report, the Planning Commission has proposed that I.T can be used in at least four different ways to improve healthcare and systems: i) to support public health decision making for better management of health programmes and health systems at all levels, ii) to support service providers for better quality of care and follow up iii) to provide quality services in remote locations through Tele-medicine and iv) to supporting

³³Ebenezer Afarikumah, 'Electronic Health In Ghana: Current Status And Future Prospects', Online Journal of Public Health Informatics, Feb 2014; 5(3):230

³⁴ 'Telemedicine emerging as growth driver in healthcare', The Hindu, Oct 17, 2016 [p.14. Tituchy Edn]

³⁵ See Note 19

education, and continued learning in medicine and health.³⁶ The commission has also proposed to correct the lapses in the web based Health Management Information Systems (HMIS), launched during Eleventh Plan so as to make it a vastly composite HMIS. The composite HMIS, which, when made fully operational, would, among others, 'incorporate universal registration of births, deaths and cause of death, nutritional surveillance, particularly among women in the reproductive age group and children under six years of age, disease surveillance based on reporting by service providers and clinical laboratories (public and private) to detect and act on disease outbreaks and epidemics' etc.³⁷

As measures to achieve these goals, the Planning Commission has proposed to 'ensure computer with internet connectivity in every Primary Health Centre (PHC) and all higher level health facilities during the 12th Plan period.' Extension of connectivity to sub-centres either through computers or through cell phones has also been visualized. It has further been proposed to link all district hospitals by telemedicine channels to leading tertiary care centres, and to link all intra-district hospitals to the district hospital and optionally to higher centres.³⁸

By way of deploying I.T in healthcare, already some initiatives are on roll here and there. The E-health initiative, as a part of 'Digital India' drive, has been launched with the aim of providing effective and economical healthcare services to all citizens. This programme will make use of technology and portals to facilitate people maintain health records and book online appointments with various departments of different hospitals. The Tamil Nadu Health System Project focuses on 'strengthening the monitoring and evaluation through an ICT-enabled hospital management system in secondary health facilities and a health management information system (HMIS) networking the entire public health infrastructure of the state'.³⁹ The Government of West Bengal has introduced 'Digital Dispensary', to provide people from rural areas access to primary healthcare services. Another unique initiative for healthcare, 'Sehat' (Social Endeavour for Health and Telemedicine) has also been launched at a government run Common Service Centre (CSC) to empower rural citizens by providing access to information, knowledge, skills and other services in various sectors through the intervention of digital technologies and fulfilling the vision of a 'Digital India'.⁴⁰

CHALLENGES IN DEPLOYING I.T IN HEALTHCARE IN INDIA

³⁶ Vide Planning Commission, 2013 (Vol III, Social Sector)

³⁷ For more items listed for HIS, by the Planning Commission, vide the document (Vol III, 2013)

³⁸ See note 25

³⁹ Tamil Nadu Health System Project, World Bank Analysis (July 2014) Available at: <http://www.worldbank.org/en/news/feature/2014/07/21/tamil-nadu-health-system-project>

⁴⁰ India Brand Equity Foundation, <http://www.ibef.org/industry/healthcare-india.aspx>

In developing countries, a particular challenge is ensuring that I.T is 'effectively mobilized to improve health outcomes and combat disease among the poorest and most remote populations.'⁴¹ As far as India is concerned, the country has the advantage of a strong IT fibre backbone and indigenous satellite communication technology with trained human resources. Telemedicine could help bring specialized healthcare to the remotest corners of the country.⁴² Yet, there are challenges to be met. Though I.T can offer myriad solutions to enhance healthcare delivery, the general challenges in implementation of I.T include: 'lack of standards; cost of I.T systems implementation'; continuing reluctance of medical, nursing and other staff to quickly adapt the technology; unfounded fears of failures of technology and above all, the mindset anchored in traditional beliefs and fears. Another challenge is the 'low use of IT in the public sector. This is largely due to cost and complexity of usage.'⁴³ Lack of appropriate and domain specific trained expertise in healthcare related I.T is one more factor to be resolved. Taking the case of the requirement for allied healthcare professionals alone (x-Ray, radiography, medical equipments, anesthesia, diabetic education counsellors etc.), it is reported that the actual requirement is 65 lakhs against the current supply of less than 3 lakhs persons.⁴⁴ We cannot expect everything from technology; real transformation can be brought mainly by the human resources and from new ways of their working. To derive the full benefits from I.T in healthcare, there is need for an interplay between the technology, the 'thought flow' (clinical decision-making) and the 'workflow' (the clinical pathway). When the I.T designs are poor, it can disrupt thought flow and workflow. Only when well-designed I.T is in place technology can optimize them.⁴⁵ This means that appropriate designs, suited to Indian context have to be made and tested prior to large scale implementation.

Issues have often been reported regarding use of technology and its failures. But, at their core, it could be observed that those issues are mostly people problems. This informs us about the need for appropriate organizational changes, emphasis on training and strong change management process. It is essential to equip personnel with the necessary tools and expertise to use new technology⁴⁶. This necessarily includes providing 'training before the technology is introduced, as well as real-time support once it is in place'.⁴⁷

⁴¹Ebenezer Afarikumah, (2014) cited earlier herein.

⁴²Information and Communication Technology in Health Care, Expert Advisory Committee on I.T Infrastructure, Min. of Health & Family Welfare, GOI. [Available at: http://pmssy-mohfw.nic.in/tech_healthcare.aspx]

⁴³Jashodhara Ghosh, (2015) cited earlier herein.

⁴⁴ Tata and GE to train 10000 in healthcare, The Hindu, October 18, 2016 [p13, Tiruchy Edn]

⁴⁵ KPMG Report 2016

⁴⁶Lovett and others, 2014; MacNeill, 2014; Sharma and Clarke, 2014; Veslemøy and others, 2014

⁴⁷Blackand others, 2011; Boonstra and others, 2014

CONCLUSION

There need be no doubt that technological innovations in healthcare is the need of the hour. To meet the need, all the stake holders shall have to work in coordination and commitment. The service providers are expected to constantly explore latest technologies keeping in mind the cost factor and also the interest of best patient care. The Governments should leverage the use of innovative technology, through adequate policy support and financial incentives. The advantages of technology in the healthcare sector are not limited to patient care alone. I.T can be effectively used for administrative and back office service functions also. Attempts for wider uses of I.T can be explored and furthered in a supportive environment. Apart from sufficient fund support from the governments and the corporates for designing appropriate I.T application modules and their deployment in the healthcare sector, a supportive regulatory system in healthcare industry and standards that help interoperability should also be in place. Individual privacy regarding their health status need to be protected assiduously.

Clinical and organizational leaders with deep knowledge of both clinical and technological systems shall have to emerge to effect beneficial synthesis between both the domains, for the welfare of humanity. These leaders shall be capable of visualizing how technology and healthcare shall be yoked to best support their work and shall also help create a fertile culture receptive to further changes to meet the emerging needs. There is great need for such a cultural change in India as the developing society can ill afford to ignore technology or resist change.