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REVIEW PAPER

Demystifying Digital Healthcare Systems: Aspects of Emerging Technologies, Initiatives, Opportunities and Issues—*The Indian Context*

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ABSTRACT

In Modern age all the matters and elements become digital and medical and healthcare system is not an exception. Advanced ICT and Computing in Healthcare results Digital Healthcare Systems for the advancement of healthcare and allied sector and industry. Initially only basic Information Technologies viz. Database, Networks, Multimedia, Networking, Software, etc. are considered as valuable and impactful, however in recent past other emerging technologies. Latest technological applications in healthcare brings several advantages and benefits of healthcare viz. speed, transparency, sharing, effective documentation, effective operations, instant and collaborated laboratory systems, etc. India is moving towards a digital economy supported by e-governance, m-governance, etc. and Digital Healthcare Systems may avail wider benefits with such additional benefits. Though there are ample advantages of Advanced ICT in Healthcare but though there are issues, challenges, and concern in Digital Healthcare viz. technological implementation and management, human resources, government norms and regulations, Data Susceptibility, Implementation loopholes, Cyber Security issues, etc. This work is a comprehensive one in regard to Digital Healthcare Systems including foundation, basic & emerging technologies, and initiative in India, challenges and issues, including possible solutions.

Keywords: Digital Healthcare Systems, Health Information Management, IT in Healthcare, Digital India, Healthcare Policies

Digital Healthcare is an alarming step for improving healthcare segment and making of new-age and sophisticated healthcare industry. Internationally different countries are putting their efforts in designing and development of new age Digital Healthcare systems. India is moving towards a new age healthcare

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services and here Digital Economy play a leading role in developing such infrastructure in modernizing this sector[1],[7]. Mobile governance, electronic governance are the need of the hour and in developing Digital Healthcare systems and in developing advanced healthcare systems entire digital literacy and skills are essential so that common people are able in use of such facilities. In India among the issues and challenges of infrastructure, Healthcare infrastructure is challenging due to several concerns viz. availability of technologies, building and infrastructure, land and intellectual infrastructure, skilled manpower, lacking of technological implementation, internet issues, cyber security concerns. It is fact that worldwide different types of diseases are rising *(The Global Nodal Health Authority, under the WHO)* and here for managing healthcare situation, Digital Healthcare may be considered as impactful and valuable. It is a fact that worldwide chronic diseases are rising and out of all the death sixty three percent death are chronic in nature and it is further studied that eighty percent of such death happen in such nations which are categorized in low or middle income range, and the increasing number of mortality held in between 1990 and 2016.

Objective of the study

This paper entitled "Demystifying Digital Healthcare Systems: Aspects of Emerging Technologies, Initiatives, Opportunities and Issues—*The Indian Context"* is focused To know the fundamentals and basics of Digital Healthcare Systems incliding uses of Health Informatics concisely. Work proposed to get about the basic and emerging technologies usesd in Digital Healthcare Systems, current projects undertaken related to the Digital and ICT based Healthcare initiatives in India, to analyze and report the major issues and challenges of implementing digital healthcare systems in Indian context, to find-out the technological and economical problems related to the Digital Healthcare Systems in India.

Methods

This chapter "Demystifying Digital Healthcare Systems: Aspects of Emerging Technologies, Initiatives, Opportunities and Issues—*The Indian Context"* is basically categorized as interdisciplinary and combine with some of the subjects such as healthcare sciences, ICT and Computing, management and policy studies. This work is prepared on existing published works, including literature reviews of the journals, books, etc. For this study various websites of Healthcare Informatics companies, ICT in Health Firms, hospital and medical organizations, have been studied, analyzed and reported.

Aspects, Features and Function of Digital Healthcare & Health Informatics Practice

Digital healthcare is doing a significant role in advancing healthcare services and telemedicine services. Like other sectors in healthcare and medicine too ICT and Computing is widely used for several applications and some of them are illustrated in Fig. 1.

Record Management of Patient details & Medical History Management—Information Technology systems are dedicated and required in data management which are easy to use, and also secure in many context and thus each patient data with patient medicine history possible to keep recorded using Digital Healthcare systems. In several context, patient records are essential in migrating one physician to another, or changing of the healthcare service providers.

Patient and Health Service Seeker Monitoring— As far as patient monitoring is concerned, computing and ICT systems are highly requited in effective healthcare record management. In certain diseases like blood pressure, heart rate, etc., ICT is required in proper patient management and thus in modern day context Digital healthcare practice is highly essential[7],[12].

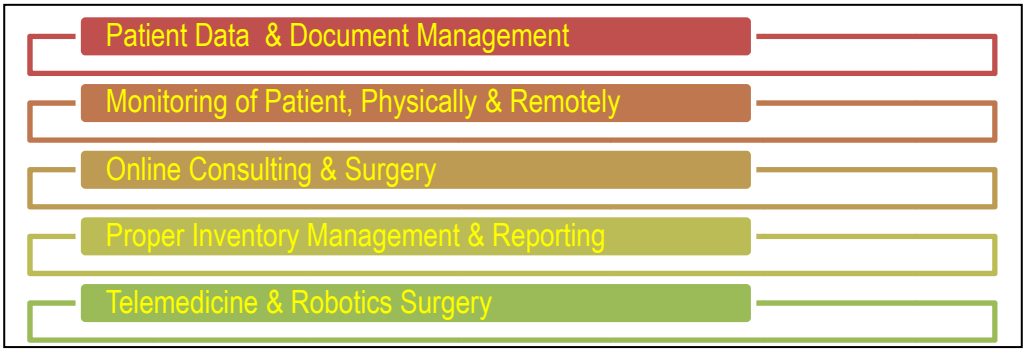


Fig. 1: Core utilizations of Digital Healthcare Systems mechanism

Inventory Management is another important services possible to bring using Information and Communication Technology in healthcare domain. Effective inventory, stock management, proper healthcare documentation is possible using Digital Healthcare based inventory. Regarding ***Surgical & Robotic Surgery***, here Digital Healthcare is valuable and growing rapidly and useful in complex and critical situation.

Digital India, ICT and Healthcare Sector in India: Basics

The body works for ICT development in India is called Ministry of Electronics and Information Technology, and they have taken a project called Digital India project which has total core three vision which includes ***Firstly,*** There should be arrangement for digital infrastructure for all of the community of the nation. ***Secondly,*** There should be proper governance in digitalization and documentation, ***Thirdly,*** Empowering and advancing citizens with computing and allied technologies. Under the Digital India initiative it is dedicated in promotion of various healthcare services which helps in in-person visit to the clinical institutions or use of electronic format or digital services[7],[11]. Using digital technologies different types of new-age healthcare services may be grown viz. m-Health and e-Health dedicated in sophisticated healthcare service systems and its delivery.

Various devices and tools like mobile, websites, software and packages, accessing the computers are the need of the hour. Digital healthcare includes online as well as onsite technological support in developing new-age digital healthcare development. Today several country including WHO is dedicated in new age and high-quality healthcare services for variety of jobs including finding the diseases, preventing healthcare measures, control of the diseases by the therapeutics, and for doing this several basic and latest technologies such as smartphone and electronic gadgets including internet, uses of the mobile apps, social media uses. Uses of the Digital Healthcare are helpful to the common people, medical professionals and physicians, allied health workers, etc. The alarming diseases like heart diseases, brain diseases, bone dysfunctions, psychological problems, lung-dysfunction including pulmonary diseases are emerging

rapidly and as a result uses of several technologies become important in improving healthcare services and also indirectly in reducing such diseases. Digital technologies and Digital Healthcare is required in number of healthcare cases which includes—

- For the identification of Diseases, self-diseases management & Distress reduction.
- Regarding creation of health awareness and solid communication with others.
- For timely healthcare services delivery & for improve the healthcare and medical conditions, and in identification of the condition of healthcare services and also maintenance of healthcare devices.
- In improving the quality of healthcare seekers, and assisting medical and healthcare core and allied professionals[2],[13].

It is a fact that, higher educational institutions and other organizations are offering greater support in building of healthy and effective digital healthcare systems for the projects such as tools, infrastructure, technologies, awareness, introducing patient-centered applications, etc. Proper regulatory initiatives are highly required in order to bring digital healthcare system from the developing to developed perspective. Indian digital navigation systems, digital devices are essential to match as per international trend. Currently India holds about 140 crore population and as a developing country there are many issues and challenges in Healthcare sector and applications of Information and Communication Technology in healthcare is considered as important concern in full-fledged manner. According to the study it is shown that about five percent of the communities are suffering with serious diseases like disability including cancers, etc. and this trend is growing rapidly. After the development of the computer systems, specially after 90s several technologies being started in practice in healthcare domain. Many crucial health problems like heart diseases, kidney diseases are alarming concern in India and apart from traditional treatment several other ICT been systems are being adopted in managing such healthcare issues. Government of India has taken several initiatives in Digital Healthcare practices and other allied bodies too help in certain context for the development of Digital Healthcare Informatics practice[4],[5]. In 1997 first healthcare IT software were introduced by CDAC (i.e. Centre for Advanced Development in Computing) and this project was supported by Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGIMS), Lucknow in Uttar Pradesh. After this, satellite based healthcare services being introduced by GRAMSAT that is under the leadership and support of ISRO, Government of India. As far as private sector is concerned, Apollo's services for advancing telemedicine considered as remarkable in promotion of telemedicine services in Indian villages using several telemedicine centres. Uses of Mercury software treated as another service and milestone in healthcare digitalization in India and for building this leading computing organization CDAC, Government of India considered as valuable and impactful [3], [10]. The Asia Heart Foundation as well as Escort Heart Institute & Research Centre have taken initiatives in building of further effort in building Digital Healthcare Service in India. Shankar NethraLaya, as well as Meenakshi Eye Mission, both from the Tamil Nadu state did a remarkable job in effective and new-age Mobile Tele-ophthalmological service. In this service, Indian Space Research Organization play a leading role. Sustainable Access in Rural India (SARI) also initiated in Tamil Nadu using Internet services and network comprises of 8,000 people and offered more than fifty villages. This project plays a leading role in developing awareness of the tele-healthcare and Digital Healthcare systems. Aravind Eye Hospital has also taken another initiative in building new-age online eye consultation services. In this project eye pictures are taken and

forwarded by the mail to the hospitals and physician take decision in in identification of the diseases and further treatment.

Facets and requirements of Digital Healthcare Systems in India

Digital Healthcare systems deals with number of projects, plans, and initiatives and it is mainly essential for preparing and make ready variety of ICT based support in Healthcare Systems and interactive Healthcare solution offering, preparing intelligent human resources using technologies with existing healthcare systems. To offer health services in remote, village areas using ICT and allied technologies, properly. It is required in ensuring more patient centric services Digital Healthcare is required. It is required complete range of medical record management depending upon need and also minimizing the healthcare costs. It is required in monitoring various geographical territories as well as systems for effecive and new age healthcare services. It is effective and required in proper Management information systems leading to superb decision making, and new age capacity building, etc. Ministry of Health and Family Welfare (MoHFW), Government of India is dedicated in offering healthcare, medical and allied services in India, and it has taken lot of initiatives in advancing healthcare systems development. It is required in conducting several programs under National Health Mission like Reproductive Child Healthcare (RCH). Building of Digital India under the Ministry of Electronics and Information Technology and preparing eHospital, e-Shushrut, System of Online Registration (ORS), etc. are important initiative. Initiation of National Identification Number (NIN), and Mera Aspatal (Patient Feedback System) from the end of Ministry of Health and Family Welfare, Govt. of India has been initiated. These initiatives and such projects are really valuable in developing proper healthcare systems and National Health Mission (NHM) works under the central ministry where individual state can also think about the development of the enhanced Hospital Information Systems and effective Health Informatics implementation including initiation of some of the services under Digital Healthcare Systems viz. Telemedicine, Tele-Radiology, Tele-Oncology, and Tele-Ophthalmology, etc. National Health Policy 2017 was taken into consideration for the universal health care opportunities to be available each and everyone with flagship Ayushman Bharat Yojana, Pradhan Mantri-Jan ArogyaYojana (PMJAY) etc. to offer new age healthcare support. Further with Ayushman Bharat initiative it is dedicated to offer new age 21st Century Health System using cutting-edge information and digital technology pan-India basis[1],[8]. National Digital Health Ecosystem (NDE) has been initiated for the development of sophisticated development of new age and advanced health information systems building leading to Digital Economies.

Concern, Issues and Challenges of Digital Healthcare Systems

Digitalization offer ample possibilities in respect of development medical and healthcare sector in India. As far as physical infrastructure is concerned India still there are lacunas in diverse areas[3],[7]. Therefore Government need to increase the tax from the common people and use the amount in developing healthcare infrastructure including e-healthcare infrastructure. Experts also suggest that foreign direct investment (FDI) can be a good alternative for increasing economic development. India becoming a developed country in coming years and in order to offer new age healthcare India's healthcare infrastructure need to integrate with cutting-edge digital technologies. Digitization playing a leading role in advancing all kind of governance and administration and in this respect healthcare is no exception. Allied emerging ICT

components like cloud computing and virtualization, big-data management, internet of things and edge computing, AI and ML are bringing new age medical and healthcare systems for a better shape in India which is cost-effective, and advanced, accessible with global standards. Digital Healthcare Infrastructure requires more support from the researchers and academicians in building of new age healthcare systems [9],[13]. Though, it is also noted that the development of Healthcare in Digital Platform in India also having issues and challenges. Regarding ***major challenges*** few core are challenges related to the Demography, Administrative challenge, Challenge of professional inadequacy, Challenge of federal structural conflict, Cost of Digital Technologies, Digital devices and its cost, Updating aspects of Digital Technologies and Products, Expenditure related to Contents and Awareness Programs, Financial Issues for launching Digital Healthcare in Academia, Cost of Manpower, Skill Development, Patient Expenditure on Healthcare Systems, Remote People, technologies and Financial issues, etc.

SUGGESTIONS WITH CONCLUDING REMARKS

In India, number of healthcare services and technologies are being increased in recent past due to advent of several ICT devices. Such applications are dedicated in advancing healthcare mechanism for the effective delivery of healthcare services. Mobile Health and Telemedicine may impactful services for bringing new-age healthcare service. Smartphones, tablets and other electronic devices are having high impact in promoting urban as well as rural landscapes in terms of healthcare. In such service promotion it is essential to strengthening internet services with proper focus. The Telecom Regulatory Authority of India (TRAI) initiated several projects and initiatives in telecom and communication technology segment. However, there are issues in bandwidth, awareness, skilling required to operate the devices, systematic utilization of healthcare technologies by the patient and also for the healthcare professional for Digital healthcare systems development. Though there are issues of ready and skilled manpower, availability of appropriate number of skilled manpower, technological systems and its availability, effective technological integration, proper policy implementation, designing of proper healthcare systems, lack of awareness of common people, digitalization, information literacy and technology literacy, et. and all these need to attend properly in order to develop a new age Healthcare Systems in Indian context.

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