Revolutionizing Healthcare:
Digital Transformation of India's Public Health Sector

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Abstract

The healthcare sector in India is undergoing a revolutionary transformation, in which information communications technology and digitalization have played a key role. This move of Digital India has reduced the gap between the government and the citizens to a great extent. It also contributed to providing adequate services directly to the beneficiaries in a transparent, efficient, and corruption-free manner. The Digital India program has brought about major changes in the healthcare sector in India. Today, telemedicine bridges the gap between healthcare professionals and patients living in remote areas, thereby providing timely consultation and reducing the financial and logistical burden associated with long-distance travel. Also, with the advancement of information technology tools, remote patient monitoring, home healthcare delivery, and mobile healthcare applications are also becoming popular and further evolving care towards advanced home healthcare services. Digital India is a flagship program of the Government of India aimed at transforming Initiatives such as Ayushman Bharat Digital Mission, Ayushman Bharat Health Account, Covin App, Arogya Setu, e-Sanjeevani, e-Hospital, e-Registration have enabled healthcare facilities and services to reach every corner of India. Many Indian states like Kerala, Tamil Nadu, Delhi and Rajasthan have made significant leaps towards launching digital health initiatives. These initiatives bridge the existing gap between various stakeholders in the healthcare ecosystem through digital highways and create a national digital health ecosystem that supports universal health coverage in an efficient, accessible, comprehensive, affordable, timely and secure manner that provides a wide range of data, information and healthcare services while also ensuring security, privacy and protection of personal health information. This article will try to understand the digital transformation of public healthcare in India through various government policies and programs. Also, various challenges, problems and solutions related to the healthcare sector in India will be studied.

Key Word- Digitalization, Efficiency, India, Programme, Public Health, Transformation.

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Introduction

Digital India is a flagship program of the Government of India that aims to transform India into a digital society and knowledge economy. Its main goals are to ensure that digital technologies improve the lives of every citizen, grow India's digital economy, generate investment and employment opportunities, and build digital technology capabilities in India. Digital India has significantly reduced the gap between the government and citizens. It has also contributed to providing adequate services directly to beneficiaries in a transparent and corruption-free manner. The Digital India program has brought significant changes to the healthcare sector in India. Digital health is a multidisciplinary concept that lies at the intersection of digital technology and healthcare. Digital healthcare uses platforms, tools, and services across the enterprise to transform the way healthcare is delivered by service providers. These include a range of technologies – including mobile health applications, telemedicine, enterprise resource planning (ERP), customer relationship management (CRM), electronic health records (EHS), health information systems (HIS) – that improve transparency in the healthcare sector.

Digital healthcare is bringing significant changes to the health sector by enabling the sector to provide efficient and cost-effective care, empowering patients to take control of their health, and improving access to healthcare in remote areas. For example, telemedicine allows patients to consult healthcare providers remotely, while mobile health apps and wearable devices can help individuals regularly monitor their health and fitness.(pwc.in) This article will explain the concept of digital health and also explain various steps taken by the Government of India in the field of digital health in view of the health sector in India. Finally, the importance of digitization in the health sector and the challenges associated with it will be studied.

Indian Public Healthcare System

India is the world's most populous country and the fifth largest economy, and is in a unique position when it comes to healthcare. On the one hand, the country offers specialized and quality healthcare at a very affordable cost, making it one of the most popular destinations for medical tourism. On the other hand, most Indians suffer from poor health. The country, which is known for providing high-quality and cost-effective healthcare, unfortunately offers its locals only two healthcare options: use unregulated private healthcare and often very expensive and, if prices are not affordable, turn to the public healthcare

system, which is generally considered substandard. According to Balrajan et al., more than three-quarters of total healthcare spending in India is private, and high patient costs explain why more than half of Indian families fall into poverty. Previous studies suggest that a strong primary care network combined with a robust public health system has the potential to improve the situation.(Balarajan et al., 2011) Instead, India built its health system around primary health care, as suggested by the Bhore Committee in 1946, and made every effort to achieve the goal of "Health for All by the year 2000" under the health policy of 1983 and later committed to achieving "universal health coverage'' by 2022. (National Health Policy, 1983)

The health sector in India faces various problems such as shortage of hospitals and medical equipment, high mortality rate, low life expectancy, lack of basic services, distance from hospitals, uneven development, lack of sanitation etc. After 1990, a paradigm shift at the global and national level mainly affected the health sector, in which various reforms such as public-private collaboration, decentralization, method of financing, reorganizing and restructuring of the existing system, market participation and digitalization were adopted. Here mainly discuss the changes in the health sector that have been made under digitalization.

Digital transformation refers to digital technological changes that are used to benefit society and the health sector. Health systems should use digital technology to improve the provision of health care and solve medical problems. Digital transformation in health care includes changes related to the Internet, digital technologies and their relationship with new treatments and best practices for better health management.

Concept of Digital Health

The wave of digital innovations, which has turned into a technological tsunami in recent years, has also affected healthcare sectors around the world. Digital health concerns many sectors, such as advanced informatics, patients, healthcare providers, public health authorities, research institutions, and education (WHO, 2021). These changes can be attributed to the revolutionary forces of information and knowledge management that are changing the way people relate to health, well-being, disease prevention, and personal life balance (Belliger & Krieger, 2018). In addition, the literature highlighted the impact of several emerging innovations in digital health, including mobile health, electronic medical

record (EMR) systems, health cloud, telemedicine services, clinical decision support systems, and computerized physician order entry.

The World Health Organization defines digital health as "A broad term that includes emerging areas such as e-health and the use of advanced computing in big data, genomics and intelligence''.(WHO) Digital health technology has become an important pillar of provision. The use and development of digital health solutions can revolutionize the way people around the world access services to achieve higher standards of health and promote and protect their health and well-being. Recognizing this impact, the Government of India launched the flagship Digital India campaign in 2015, which included public health initiatives focused on adopting digital technologies for penetration of healthcare services in rural areas. Later, the National Health Policy of 2017 envisioned a fully digital healthcare system in India, resulting in the launch of India's Digital Health Mission (now known as Ayushman Bharat Digital Health). The growing focus on digital health and government approval makes India a ripe market for healthcare innovation and creates many investment opportunities.

In recent years, it has been very encouraging to see how the integration of technology and innovative tools can improve the delivery of public services. The development of India Stack and JAM (Jan-Dhan, Aadhaar and Mobile) can be considered as an example. Similarly, the COVID-19 pandemic has highlighted the need to promote rapid digitization in the healthcare sector. Digital health can play a role in healthcare innovation as it facilitates patient participation in the healthcare delivery process. (Iyawa et. al., 2016) Various programs implemented by the Government of India under digitalization will be discussed in detail here.

Policies and Programmes Under Digital Health in India

The Digital India programme has brought about significant changes in the healthcare sector in India. Initiatives like Ayushman Bharat Digital Mission, CoWIN App, Aarogya Setu, e-Sanjeevani, e-Hospital have enabled healthcare facilities and services to reach every corner of India. These initiatives are bridging the gap between various stakeholders in the healthcare ecosystem through digital highways.

National Digital Health Mission- NDHM was launched by the Government of India in 2020 to achieve the goal of universal health coverage.

• NDHM is a complete digital health ecosystem. This digital platform will be launched with four main initiatives: Health ID, Personal Health Register, Digi Doctor and Register of Health Institutions.

 • NDHM is implemented by the National Health Authority (NHA) under the Ministry of Health and Family Welfare.

• NDHM is a materialization of one of the guidelines of the National Health Policy 2017, which provided for the creation of a digital health technology ecosystem to develop an integrated health information system.

This is an important step that is based on the principles of the National Health Stack (NHS) and aims to ensure access to quality and affordable health services through digital means. To Connect different points of the health ecosystem (eg health information providers, health information users and consent managers, etc.). (Drishti,2016)

Ayushman Bharat Digital Mission- ABDM's vision is to create a national digital health ecosystem that supports universal health coverage in an efficient, accessible, comprehensive, affordable, timely and secure manner that provides a wide range of data, information and infrastructure. It also ensures the security, privacy and confidentiality of personal health information. Ayushman Bharat Health Account (ABHA) number is a simple method to access and share digitally medical records. It enables interaction with participating healthcare providers and enables one to get digital lab reports, prescriptions and diagnoses seamlessly from verified health professionals and healthcare service providers.

The ABHA App - A Personal Health Record, or PHR, is an electronic application through which patients can store and manage their health information in a private, secure environment and confidential. (abdm.gov.in)

 Aarogya Setu – Aarogya Setu has evolved into a national health app, bringing a plethora of digital health services powered by Ayushman Bharat Digital Mission (ABDM). Using Aarogya Setu, you can register for an Ayushman Bharat Health Account (i.e. Digital Health ID) and use it to interact with participating healthcare providers and enable you to receive digital lab reports, prescriptions and diagnoses hassle-free by verified health and healthcare professionals. Aarogya Setu enables online booking of medical appointments through eSanjeevani OPD app. It is possible to make an appointment with the doctor and consult with him from the comfort of his home. Aarogya Setu allows you to schedule/reschedule/cancel

appointments for Covid-19 vaccination. Through Aarogya Setu, one can download the vaccination certificate or request changes in the certificate.

e-Sanjeevani - National Telemedicine Service has become the world's largest documented implementation of telemedicine in primary healthcare. (eSanjeevani)

The cloud-based e-Sanjeevani platform is implemented in two ways:

1. e-SanjeevaniAB-HWC (a provider-to-provider telemedicine platform) - This variant provides assisted teleconsultation to patients visiting health and wellness centres (HWCs). Community health workers at health and wellness centres facilitate teleconsultation for patients who are connected to doctors and specialists at centres set up at secondary/tertiary health institutions or medical colleges. This variant is based on the hub-and-spoke model.

2. e-SanjeevaniOPD (a patient provider telemedicine platform) - Enables citizens to access healthcare services from the comfort of their homes through smartphones or laptops, etc.

CoWIN - CoWIN was launched to strengthen the COVID-19 Vaccine Intelligence Network (CoWIN) system. It is a digitalized platform being used to effectively roll out and scale up the mechanism for the COVID Vaccine Distribution System nationally. The CoWIN software is a robust, reliable and agile technology that enables anytime, anywhere registration for COVID-19 vaccination. The total number of vaccines administered till November 21, 2023 is over 220.67 crore and the total number of registrations is over 110.93 crore.(Cowin)

e-Hospital - The e-Hospital application is a Hospital Management Information System (HMIS) for hospital workflow and internal processes. This unique solution connects patients, hospitals and doctors on a single digital platform. e-Hospital is available in the cloud through a Software as a Service (SaaS) model for Central Government/State Government/Autonomous/Cooperative hospitals. The ORS Portal was launched on July 1, 2015 by the Prime Minister of India under the Digital India initiative of the Ministry of Electronics and Information Technology.

The e-Hospital project was launched with the following objectives:

• Provision of e-Hospital, e-Bloodbank and ORS applications in public hospitals.

• Provision of an online patient portal to provide citizen services such as online appointment booking, access to online lab reports and blood availability status.

• Providing technical support on the application to hospitals through a dedicated call centre/helpdesk.(eHospital, web.)

E-Bloodbank - E-Bloodbank Application facilitates implementation of complete blood bank management system. Features of E-Bloodbank Application are User friendly and configurable, Simple integration process to blood transfusion center or storage unit, Availability of blood stock in real time, Ask for blood at the touch of a button and Blood donation history.

Online Registration System (ORS) - Online Registration System (ORS) is a Digital India initiative aimed at providing patients online access to hospital services, integrated with Ayushman Bharat account. ORS is a framework to connect various hospitals across the country with online appointment system for getting consultation where OPD registration system and counter based appointment has been digitalized through Hospital Management Information System (HMIS) The application has been hosted on the cloud services of NIC. The portal facilitates online appointments with various departments of different Hospitals using ABHA (Ayushman Bharat Health Account)

SeHAT- Services e-Health Assistance and Teleconsultation (SeHAT) is the tri-service teleconsultation service of the Department of Defence designed for all eligible personnel and their families. As part of the Government's commitment towards Digital India and e-Governance, SeHAT was launched on May 27, 2021.

SeHAT Stay at Home OPD is a doctor consultation system where a patient can consult a doctor remotely via the internet using their smartphone, laptop, desktop or tablet. The consultation is done via video, audio and chat at the same time. It aims to provide quality healthcare services to patients in the comfort of their homes. Secure and structured clinical video consultations are made possible between the doctor in the hospital and the patient at home, anywhere in the country. They are designed to be extremely simple and easy to use, requiring minimal effort from the user. Users do not have to pay anything to request teleconsultation and can access the services by visiting https://sehatopd.gov.in or by using the Sehath application available on Play Store and App Store.

e-Raktkosh - e-Raktkosh is a centralized blood bank management system, launched on 7 April 2016 for automation of blood banks. It is an online application with Aadhaar linking facility to identify, track and block donors based on donor health, donation history etc. (eRakt Kosh)

Apart from these programme and policies, the Government of India has been taking many steps for digital health at the central and state level. Which has brought a significant change in the lives of citizens and has made access to health successful for all.

Benefits of Digital Health Services

The technological revolutions in the healthcare sector have significantly improved the diagnosis and management of healthcare.The benefits of digital health are as follows:

Increase accessibility for healthcare professionals: The main advantage of new digital healthcare systems is reducing costs and making them more available and easier to access. This allows you to spend more time with patients and help develop an effective patient follow-up plan. This is especially important for clinics and patients located in rural areas and patients receiving care at home for whom it is difficult or expensive to travel.

Re-modeling of Patient-Doctor Relationship: Implementing artificial intelligence tools in all aspects of the healthcare system can significantly reduce delays and, therefore, reduce costs associated with healthcare. Digital transformation of healthcare is currently one of the top priorities in efforts to address issues such as limited availability of resources, diverse demographic structure, and the urgent need to expand access to medical care.

Reduce inefficiencies: Digital tools give healthcare providers a holistic view of patient health through easy access to data. They can also give patients more control over their health, thereby reducing inefficiencies in patient management.

Reduce costs: Digital health has helped reduce the overall cost of treatment by supporting the patient's ability to manage their care through technologies that can monitor their health parameters.

Improving quality: Digital health technologies can empower patients to make informed decisions about their health. They can provide opportunities to facilitate the diagnosis, prevention, and early management of chronic diseases outside of traditional healthcare settings. This has helped improve the overall quality of healthcare systems around the world.

Digital transformation in healthcare can revolutionize the healthcare system of a country. However, the effective sustainability of digital health depends on several factors influencing its implementation. It is important to address these implementation challenges in the design and delivery of digital healthcare services.

Challenges for Digital Health

This systematic review attempted to identify potential barriers to implementing digital transformation in the healthcare sector in India. The identified barriers are mainly related to limited technical and medical infrastructure, data security and privacy, and lack of physical examination.

The main challenges related to digital health are as follows:

- **Barriers to usage:** Various challenges of digital health users present barriers to the adoption of digital transformation in the health sector. The results highlight various barriers to the use of teleconsultation, such as difficulty in getting regular appointments with a doctor or taking medication on time, long travel distances for laboratory tests, and uploading reports, at least two in-person consultations before going digital, dependence on computers and digital technologies, lack of repair equipment at installation sites, and challenges related to drug availability.

- **Risk of online fraud:** Lack of access to healthcare and low trust among people in the healthcare system can lead to inefficient medical care and online medical fraud.

- **Problem of health literacy and misdiagnosis:** Another potential barrier to the successful implementation of digital health practice is the accuracy of data transmission. In a study conducted by Raheja et al. (2021), six percent of participants faced difficulties during teleconsultation due to misinterpretation of prescriptions by patients or pharmacists. Similarly, it was difficult for patients to understand medical advice and medications due to limited connectivity, unfamiliar technology, illiteracy, and lack of clarity of advice given by physicians.

- **Data privacy and confidentiality:** Compared to in-person consultations, digital health is more vulnerable to security and privacy risks. Data security in the digital health system is at risk due to leakage of confidential information and sharing of data with third-party applications (Biswas et al., 2020).

- **High installation and operational costs:** Financial problems have been identified as a barrier to the implementation and adoption of digital transformation in the health sector. On the other hand, qualitative interviews in a study revealed that the high cost of smart devices was a barrier to the use of mobile health applications (Sinha Deb et al., 2018).

- **Lack of medical files and experts:** Digital health is a new platform in India that has been growing recently. The rapid implementation of digital transformation may create challenges regarding the availability of EHRs and experts in the country.

- **Lack of physical examination:** One of the biggest barriers to the adoption of digital health is the lack of physical examination, which is a necessary condition for an effective doctor-patient relationship. Moreover, patients expressed dissatisfaction with the relationship they established after personal consultation. Similarly, in a study by D'Souza et al. (2021), elderly patients prefer face-to-face consultation.

- **Language and communication barriers:** Effective communication between the patient and the healthcare provider is essential and often associated with the success of digital health. In their study, Satgunam et al. (2021) reported that although most respondents were comfortable downloading and using teleconsultation applications, patients who could not follow the English language may have difficulty using the application.

The Indian government is taking the lead in creating a national digital health ecosystem to support international initiatives to accelerate innovation and digital health to achieve Sustainable Development Goal (SDG) 3 (NDHM, 2020). However, there will be some resistance to any change in the existing system; It is therefore essential to understand why stakeholders resist so that change agents can develop effective action plans. In this context, the current study is essential as it reports common barriers to the implementation of digital health, including lack of network coverage and IT infrastructure, high installation and operation costs, lack of medical data and specialists, lack of physical examination, data accuracy and diagnosis errors, data privacy, language and communication barriers, user barriers, and ethical, legal and liability concerns.

Inclusive & sustainable digital health transformation journey

The government can consider several measures to increase the adoption of digital health in a more comprehensive and sustainable way, such as

• Increasing transparency around the National Digital Health Mission (NDHM) and incorporating industry views on its design, strategy, and implementation.

• Creation of appropriate regulatory frameworks that promote patient trust and privacy, as well as rapid adoption of emerging technologies.

• Developing appropriate value-based assessments, funding, and reimbursement structures for digital health tools and technologies.

• Countrywide HIS compatibility for data interoperability and making data available for analytics, as well as epidemiological trends and Real-World Evidence (RWE) studies.(Hameed et. al., 2024)

• National strategy to build a patient-centric digital health ecosystem by investing in digital literacy and patient applications and portals.

Conclusion

The concept of digital health represents a major conceptual shift, with massive transformational technologies offering equal opportunities for the democratisation of healthcare and shared decision-making, allowing easy access to digital data and targeted data for healthcare providers and patients. The digital health market presents many opportunities, but each opportunity carries risks. Innovation in this sector has not yet reached the point of saturation, with new products being introduced frequently. Legislative frameworks to protect and regulate these developments will be delayed, as it remains to be seen how this sector will evolve. Nevertheless, regulators must anticipate and ensure that in the absence of specific laws, existing laws can be used to adequately regulate emerging technologies. In a country where access to affordable healthcare remains a major issue, the growth of the digital health sector benefits the public.

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