

Digital Health and Technological Interventions

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Abstract

Enhancing public health services is of considerable significance for the progression of any nation. As health constitutes an integral part of human development, it is thereby essential for the government to protect and promote health and prevent diseases by involving and empowering individuals, families, and communities to participate in awareness programs and decision-making processes. Moreover, prudently laying more investments in health services and resources that involve medical staff, hospitals, infrastructural facilities, research and development, and technology can effectively address the healthcare needs of diverse communities. Attainment of good health is essential to the 2030 Agenda for Sustainable Development. Sustainable Development Goal 3, which aims to promote healthy lives and ensure well-being for all ages, targets achieving universal health coverage. India has already prioritized Digital Health in the National Health Policy 2017 in pursuit of the goals of SDGs relating to health. The Indian government has, time and again, taken initiatives to promote digital health/eHealth. The scope of digital health has been expanding rapidly, encompassing telemedicine, mobile health, electronic health records, wearable devices (Fitbit/smart watches), health information systems, and artificial intelligence. Digital health inventions have been designed to boost efficiency and accuracy, save time, and synthesize technologies in ways that are novel to health services.

Additionally, it has provided quality healthcare services to the maximum number of citizens by leveraging the potential of IT to bypass impediments of accessibility, cost, and geography. Though digital health has revolutionized how healthcare services are delivered and accessed, challenges such as lack of digital literacy, absence of more necessary digital infrastructure and connectivity, data protection and security concerns, and ethical and legal issues still need to be addressed. This paper will emphasize Universal Health Coverage by corresponding it to technological interventions in the healthcare system. It will further assess the effectiveness of digital health by focusing on the benefits, challenges, and solutions.

Keywords: *eHealth, Health, Technology, Information and communication technology, Data protection, Privacy, Sustainable development goal 3*

1. Introduction

The Sustainable Development Goals target 3.8 pivots on attaining Universal Health Coverage (UHC), encompassing financial risk safeguard, access to qualitative key healthcare

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services, and access to affordable, qualitative, effective, and safe medicines and vaccinations for everyone [1]. For national progression, the government needs to provide everyone access to healthcare services (prevention, promotion, treatment, rehabilitation, and palliative care) without the risk of financial tribulation, as it will avert people from being pushed into poverty. Universal accessibility to healthcare services enables individuals to be more productive and contribute to their families and societies. Hence, UHC directly affects the health and well-being of the population. With the introduction of National Health Policy 2017, Mission Indrashanush; Pradhan Mantri Dialysis Program; Amrit outlets; Ayushman Bharat (Health and Wellness Centres (HWCs) and Pradhan Mantri Jan Aarogya Yojana (PMJAY)) [2], India has revolutionized in solving the universal problem of accessibility, affordability, timely, appropriate, and good quality healthcare services. At the same time, there is a health service divide in the nation due to the ineffectiveness and underfunding of public hospitals (inadequate infrastructure, health facilities, equipment, and medical supplies), lack of awareness about healthy lifestyles and preventive health measures, commercialized, fragmented, and unregulated healthcare delivery systems; lack of inter-sectoral coordination; resource allocation imbalance; heightened out-of-pocket health expenditure; and rural-urban disparity. The application and development of High Technology Assessment (HTA) in India, encompassing capacity building and setting up institutional mechanisms, has advanced the UHC [3]. The UHC has raised the prominence of technological interventions in the healthcare systems. The convergence of health and technology has facilitated timely and facile access to qualitative healthcare services anytime, anywhere (with a button tap). IoT, conversational AI, robotics, and cloud computing have dawned on smart health. Technological breakthroughs such as Electronic Health Records (EHR), telemedicine and remote patient monitoring, artificial intelligence and machine learning in diagnostics, robotics, and automation in surgeries, wearable devices, and digital devices/apps for health monitoring have not only transfigured patient care/treatment but has also revolutionized the healthcare operations. Henceforth, a well-developed specialized digital health workforce and the competence of health information and health service managers in supporting the digital health system are critical [4].

2. Digital health in India

In India, Information and Communication Technology (ICT) has revamped the management of the public health system and delivery of healthcare services. The application of ICT has indeed ensured the accessibility of health services on a wider scale; addressed the health human resource gap by optimum utilization of the existing human resources; improved efficiency in imparting training and capacity building; provided health care services in remote and inaccessible areas via telemedicine; improved patient safety by lessening the healthcare cost and easy access to medical records; and helped in evidence-based planning and decision-making. In 2018-19, the Ministry of Health and Family Welfare (MoHFW) has taken various initiatives to implement e-Health cohesively across the central and state level(s). The MoHFW has enabled mHealth via the use of mobile applications (cessation to quit tobacco and mDiabetes); developed and installed Health Information Kiosks at the premises of numerous Central and State Government Hospital for providing quality health-related information; developed dashboards (for MoHFW budget, digital transactions for hospitals, for tracking the progress and actions taken to attain the objectives of National Health Policy, for monitoring and tracking KPI of all connected dashboards of MoHFW, and for tracking the progress of all AIIMS across the nation); set up portals/websites for improving health literacy

and access to health services; adopted e-Office; and enabled online consultation- telemedicine and teleradiology [5]. On the international front, the MoHFW, in the 71st World Health Assembly in 2018, has worked to move the Resolution of Digital Health to prioritize digital health globally. Additionally, India hosted the 4th Summit and symposium of the Global Digital Health Partnership, a forum to facilitate international cooperation and collaboration to share policy insights and evidence of best practices in pursuing digital health services.

In fulfillment of the National Health Policy, 2017, a Committee under the chairmanship of Shri J. Satyanarayana was formed to develop an implementation framework wherein the National Digital Health Blueprint, 2019 (NDHB) was produced for laying out the building blocks and an action plan to execute digital health in India comprehensively. Based on the NDHB, on August 15 2020, the MoHFW introduced the National Digital Health Mission to create a digital health ecosystem. It has now been renamed Ayushman Bharat Digital Mission (ABDM), which aims to set up health information exchanges, federated health information architecture, and a national health information network by 2025. The ABDM is based upon the creation of a Digital Health ID for all citizens, which will enable them to access, store, and share their health data; the Health Facility Registry which helps individuals find health services digitally and with ease; Healthcare Professionals Registry which will enable them to view patient's records and treat them online; Health Records which will let the users add, maintain, and share their health data; and Consent Manager which supports health data access requests and manages the consent preferences of users of the ABDM interfaces [6].

Many Indian states, including Rajasthan, Kerala, and Tamil Nadu, have made prominent leaps toward launching digital health initiatives. In 2015, Rajasthan incorporated digital initiatives under central-level health programs such as e-Aushadhi, RMNCHA+, NIKSHAY, and non-communicable disease programs. Similarly, Kerala digitized the healthcare sector by launching the e-Health Kerala scheme in 2017 [7]. To improve public health delivery, the MoHFW has prioritized using digital health to ensure citizen empowerment and effective delivery of services. The key initiatives in digital health being implemented by the MoHFW include Integrated Health Information System, Reproductive Child Healthcare (RCH), Central Government Health Scheme (CGHS), Online Registration System (ORS), National Health Portal (NHP), Integrated Disease Surveillance Program (IDSP), e-Shushrut, eHospital, Electronic Vaccine Intelligence Network (eVIN), National Identification Number (NIN), Health Management Information System (HMIS), Mera Aspatal (Patient Feedback System), and National Medical College Network (NMCN). States have been supported under the National Health Mission (NHM) for services like Hospital Information Systems (HIS), Telemedicine, Tele-Oncology, Tele-Radiology, and Tele-Ophthalmology [8].

3. Benefits of emerging technologies in healthcare

In healthcare delivery, digital health technology has unfolded as a vital pillar. Digital health has the potential to lower healthcare costs and avert disease while permitting patients to monitor and manage chronic conditions. Moreover, digital tools give healthcare providers extensive access to patient health by significantly augmenting their view of health data and giving patients greater control over their health, which leads to improved medical outcomes and increased efficiency. Technologies in healthcare help providers revamp quality, decrease inefficiencies, improve access, limit costs, and make medicine more personalized for patients. Also, the eHealth technologies permit consumers and patients to track and manage health and wellness-related activities more effectively [9]. The key applications of digital health, including telemedicine, m-Health, smartphone-based Point-of-Care Diagnostics, robot-

assisted surgery, medical virtual assistants, electronic health records, self-monitoring healthcare devices, health service aggregation, e-Pharmacies, and e-Learning in the healthcare sector have revolutionized how people globally attain standardized and qualitative health, and access services to safeguard and promote their health and well-being. The emergence of technologies in healthcare services has remodelled the doctor-patient relationship, enabled a responsive and sustainable healthcare system, improved patient monitoring, led to health management (prevention before treatment), expanded the reach of healthcare professionals, improved access to information, led more informed patients, minimized overall treatment cost, provided better quality healthcare services, resulted in more accessible and equitable healthcare, removed geographical barriers, provided more efficient health clinics and hospitals, enhanced convenience and efficiency for both patients and healthcare providers, encouraged healthier habits, enabled better patient engagement and empowerment, improved accuracy and decision making, enabled remote consultations, facilitated health data management for a large population, ensured consistent patient care, improved healthcare for disadvantaged communities, promoted lifestyle changes among patients, and promoted healthcare democracy (broke down the barriers that existed due to disability, socioeconomic status, and language) [10].

4. Downsides of digital health

During the COVID-19 pandemic, digital healthcare obtained an inundation of interest and global investment. Indeed, digital health technologies have provided the healthcare community with progressive instruments to revamp patient care. The technology used in the modern healthcare system has improved the quality of healthcare delivery, decreased medical errors, increased patient safety, and strengthened the engagement between patients and providers. However, there exist numerous issues for digital healthcare across the nation. The persisting legislation that modulates technology does not explicitly deal with telehealth. Additionally, there are persistent legal and ethical concerns about patient privacy and data protection [11]. The digital health technology has raised numerous challenges that impact medical professionals, patients, policymakers, technology developers, and other stakeholders in the following ways:

Digital Divide:

Over half of the population needs access to technological devices, internet connections, and digital literacy/skills. Digital inequality leaves behind certain categories, such as older adults or low-income individuals, at a disadvantage. The digital divide between those who can and cannot utilize digital platforms is embedded in our system, which needs to be re-designed to minimize this impact and attain a degree of equivalence [12].

Ethical Implications:

The application of artificial intelligence and machine learning algorithms in healthcare raises ethical concerns about accountability for AI decisions, algorithm bias, transparency, and the potential for job displacement.

Data Security and Privacy:

Adopting technology-driven solutions and digitization of healthcare data raise issues concerning data security and patient privacy. The potential for data breach and identity theft can erode trust in digital health technologies. Henceforth, healthcare organizations must execute strong security measures to safeguard sensitive patient data from unauthorized access

and data breaches. Adopting secure network infrastructure, encryption, and privacy regulations are essential to maintain patient confidentiality and trust.

Data Collection, Storage, and Transmission:

Personal health data collection, storage, and transmission raise security issues. Healthcare systems must adopt robust mechanisms to safeguard patient data from unauthorized access, misuse, or breaches. To ensure ethical practices in healthcare technology, obtaining prior informed consent from the patient about data collection, usage, and storage is essential. Maintaining transparency in explaining how data will be used and obtain explicit consent for research purposes, or transference is a key ethical consideration [13].

Technical Challenges and Reliability:

eHealth majorly relies on technological infrastructure and connectivity. Technical issues, such as software glitches or network disruption, can hinder patient care, especially in critical situations that can impact digital health services' reliability.

Potential for Information Encumbrance:

The abundant availability of health information through digital platforms can be immense for patients. Reliance on accurate sources or misinterpreting information can result in clarity and potentially harmful decisions. Therefore, healthcare providers must educate the patients and provide proper guidance to navigate the digital health landscape [14].

5. Promising future for the digital health industry

The digital health market is equally booming with the growth of technology and the healthcare sector. In the long run, digital health holds a promising future; therefore, it must be by three legal aspects: medical ethics, data protection, and compliance with existing regulations. The following recommendations can be taken into consideration:

Implementation of a specific health data law:

Earlier, the Digital Information Security in Healthcare Act, 2018 (DISHA Act) had been drafted to impose important curtailments on the use of health data to restrict the flow of data in the digital health ecosystem. On a similar line, enacting comprehensive digital health-specific legislation/guidelines will facilitate a robust system that will be helpful for digital health entities to foresee potential challenges for safeguarding health data. It will ensure digital health security, privacy, confidentiality, reliability, and standardization and regulate the collection, generation, storage, access, and transmission of the digital health data associated with personally identifiable information.

Extension of Digital Health in the Code of Medical Ethics:

The ambit of the Medical Ethics Code under the Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations, 2002, must be enhanced to perceive any obligations of healthcare professionals that may arise from the usage of digital interventions in standard healthcare. To suit the digital health ecosystem, patient consent, confidentiality, informatics, etc., must be legally re-constructed [15].

Establishment of a Public Health Commission:

Safeguarding public health is of utmost importance as it will not only promote the well-being of the people but will also ensure its security, safeguard it from the spread of contagious disease and environmental hazards, and ensure access to quality and safe care to benefit the population. The setting of a Public Health Commission can swiftly foster the attainment of Sustainable Development Goal 3. The establishment of a Public Health

Commission in concurrence with digital/smart health, with experts from the medical, IT, legal, public policy, and research fields, will go a long way as it will not only reach out to the larger section of the society but will be more effective in dealing with uncertain issues [16].

Defining the Obligations of Patients:

The advent of the digital revolution, i.e., m-health applications and self-diagnostics, etc., make the patients co-deliverers of healthcare services (along with the healthcare professionals). During the process, patients may commit errors in interpreting advice or reporting data, which can have a negative impact. Therefore, in such circumstances, the legal system must adapt the usage of standardization and conditions of discharging liability of the eHealth entities [17].

Adopting a robust Electronic Health Record (EHR) System:

An EHR is the electronically stored health data of patients and populations in a digital format. EHRs include a broad range of information, encompassing medical history, immunization status, medication, vital signs, laboratory test results, allergies, radiology images, demographics, and personal statistics like age, weight, and billing information. EHR combines all patients' demographics into a large pool and utilizes this data to assist with creating innovations or novel treatments in healthcare delivery, which revamps the quality of care. The privacy, security, and legal interoperability issues must be addressed by implementing the Digital Personal Data Protection Act of 2023 and adopting cross-border solutions [18].

6. Foreign laws for digital health

The United States:

The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is a federal legislation that created national standards to safeguard sensitive patient health data from being disclosed without the patient's knowledge or consent. The HIPAA Privacy Rule addresses the usage and disclosure of individual health information (Protected Health Information or PHI) by covered entities (healthcare providers, healthcare clearinghouses, and business associates). The Privacy Rule contains standards for individuals' rights to understand and control their health data. The rule's prime objective is to ensure that an individual's health data is properly safeguarded while permitting the flow of health data needed to protect the public's health and well-being and promote high-quality healthcare [19].

Canada:

The Personal Information Protection and Electronic Documents Act (PIPEDA) modulates the private sector entities that collect, use, or disclose personal data for commercial purposes. PIPEDA pertains to medical information and personal data such as name, age, ethnicity, ID numbers, social status, income level, loan records, and credit records [20].

The United Kingdom:

The general legislation guiding data privacy is the Data Protection Act 2018, which encompasses overall requirements for protecting personal data, including health information. Under the 2018 Act, one has the prerogative to determine what data the government and other organizations store. The data subject has the right to be informed about how the data is being used, get the incorrect data updated, access personal data, get the data erased, object to how the information is processed in certain circumstances, stop or restrict the processing of data, and data portability (permitting to get and reuse the data for different services) [21]. In the

United Kingdom, the legal frameworks covering how patient data must be looked after and processed are under the Data Protection Act 2018, which brought the EU General Data Protection Regulation (GDPR) into law, and the Common Law Duty of Confidentiality (CLDC). Under GDPR, for recording and processing health and care information, both the conditions as stipulated in Article 6 (Lawfulness of processing) and 9 (Processing of special categories of personal data) must be satisfied [22].

The United Arab Emirates:

The Health Data Law 2019 provides duties around collecting, processing, and transferring health data by diverse entities encompassing healthcare providers, IT providers, medical insurance providers, and providers of direct and indirect services to the healthcare sector (outsourced services). The 2019 Law seeks to safeguard health information in line with global best practices, as well as enable the UAE's Ministry of Health both greater control over the sensitive data of its residents and a greater ability to collect and analyze the health information to revamp public health initiatives [23]. The Health Data Law 2019 covers all the healthcare entities in the UAE and the free zones covering Abu Dhabi, Sharjah, and Dubai. Nonetheless, as a free zone, Dubai has a supplemental Health Data Protection Regulation (HDPR) issued by the Dubai Healthcare City Authority [24].

7. Conclusion

Universal Health Coverage promotes the human right to health. Though the health indicators have been gradually improving in India, health for all is yet to be attained. To achieve UHC in India, there is a need to increase public expenditure on health, ensure adequate numbers of trained healthcare providers and technical healthcare workers, promote community participation and citizen engagement, and enhance the capacity of domestic medical staff, medicines, and vaccines to meet national needs. The Universal Health Coverage has also increased the significance of technological interventions in the healthcare systems. The digital health system has revamped healthcare delivery quality, reduced medical errors, enhanced patient safety, and strengthened patient engagement between patients and healthcare service providers. However, legal and ethical issues about patient privacy and data protection in the digital healthcare ecosystem persist. Ergo, digital health must comply with three legal aspects: medical ethics, data protection, and compliance with existing regulations.

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