

Original Research Article

Digital Health Technologies: A Boon for Equitable Healthcare Delivery

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KEYWORDS	ABSTRACT:
Artificial intelligence, Drone technology, Medical records, Rural Health Technology, Smart Health	It is every individual's right to enjoy a highest standard of health without distinction of race, religion, political belief, economic or social condition. It is seen that most rural Indian populations strive for reliable access to the healthcare required to manage and prevent serious chronic diseases. Using digital health technologies in screening, early diagnosis of diseases and surveillance can drastically change health status in rural areas. Telemedicine, artificial intelligence, drone technology, smart health India and precision public health are some of the digital technology links health care and population. Moreover, increasing use of smart devices and internet connectivity has made implementing digital technologies favourable.

1. Introduction

WHO states health as “A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.” It also highlights that ‘the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition’ [1]. One of the core principles of National Health Policy (2017) is “Leaving no one behind”. Affordability, accessibility, availability, and quality healthcare are some of the major barriers in achieving equity of health [2].

In the current scenario, no other social sector faces the catastrophe that Indian rural health care is facing. Rural residents in India make up about 86% of all medical visits, with the majority still travelling more than 100 kilometres to access facilities. Of those visits, 70-80% are paid for out of pocket, placing the patients in poverty [3]. This indicates that most rural Indian populations don't have reliable access to the healthcare required to manage and prevent serious chronic diseases like diabetes and heart disease, which account for a huge proportion of all premature morbidity and mortality. Compared to the West, these chronic illnesses strike in India far earlier, and as a result, they are now the leading cause of death for individuals in their working years and the leading contributor to "catastrophic" personal and family medical costs. Thus in India, such diseases represent an expeditiously growing cause of poverty [4].

India aims to establish universal health coverage and eliminate health inequities to achieve health equity. However, despite the progress made in India's healthcare industry, access to high-quality care is still severely hampered by factors including socio-economic class and geographic location [5]. The major obstacles in achieving healthcare equity are inadequate and unfair resource distribution, healthcare facility accessibility, the availability of qualified human resources, high-quality healthcare, out-of-pocket costs, etc.

The most vulnerable people in India are those who require healthcare the most, have the hardest time getting access to it, have the lowest chance of having their requirements satisfied, and are most at risk of suffering catastrophic medical costs [6,7]. To address issues like health inequity and to ensure optimal utilisation of resources in rural population, technological innovations can be leveraged [8]. Finding solutions to address the disparities in rural populations' access to healthcare and the escalating expenditures of healthcare systems is critical. To address the current and preventing barriers to accessing healthcare, the use of Information and Communication Technologies (ICTs) - such as computers, smartphones, the Internet, and other communication devices - for digital health or eHealth initiatives may present opportunities to lower health inequities [9].

The paragraph 26 of the 2030 agenda of Sustainable Development Goals addresses health 'To promote physical and mental health and well-being, and to extend life expectancy for all, we must achieve universal health coverage and access to quality health care. No one must be left behind' [10].

Digital Health Technologies for Screening and Diagnosis of diseases in Rural areas in India:

Importance of Rural Health:

In addition to acting as the country's 'agricultural and resource basket', providing people with the necessary crops and raw materials for an increasingly hungry country, rural communities and regions also offer significant recreational, historical, and cultural opportunities [11]. Around 71% of Indian older adults live in rural areas currently.

In comparison to older persons in metropolitan regions, those living in rural areas are more likely to live alone, have lower socioeconomic status and education levels, and have higher rates of multimorbidity and disability. Rural residents face more obstacles while trying to get to medical facilities and engage in physical activity. It seems that rural communities suffering from ailments like cardiovascular disease can benefit from connected health technologies. Compared to people living in metropolitan regions, those who live in rural areas are more prone to suffer from heart problems and CVD. Dietary decisions, a lack of access to healthcare services, a higher prevalence of smoking, and a lower level of physical activity compared to people in metropolitan areas are some of the causes [12].

Union Ministry of Health and Family Welfare figure of 2005 suggests a shortfall of 12% for sub centres (existing 1,46,026), 16% of Primary Health Centres (PHCs) (existing 23,236) and 50% Community Health Centres (CHCs) (existing 3,346) then prescribed norms with 49.7%, 78% and 91.5% of sub centres, PHCs and CHCs located in government buildings and rest in non-government buildings respectively requiring a figure of 60762, 2948 and 205 additional buildings for sub centres, PHCs and CHCs respectively [13]. CHCs and PHCs located far from rural areas result in a significant daily income loss. This results in rural residents using the affordable, but often unregistered private health care providers' services in their communities [14].

Linking technology and Rural health:

Compared to their urban counterparts, the population living in rural areas is older, has less access to healthcare, has greater rates of morbidity and death, and has lower physical and health-related quality of life [15]. A strong, efficient healthcare system is built on Primary health care (PHC), and providing PHC services requires the use of the right technologies. PHC is the initial point of contact between the healthcare system and patients, and it is distinguished by its community involvement, accessibility, and cost. Affordable, dependable, easily maintained, socially and culturally acceptable technologies also lessen the barriers that prevent rural residents from receiving healthcare [8]. The main goals of using technology in healthcare are to reduce costs, improve accessibility & communication, and improve health outcomes and uptake. Due to technological advancements, CR can now be developed at the patient's home, increasing accessibility [12].

The referral system, which should act as a point of entry for ongoing, complete coordination at every level of healthcare, was compromised by the inefficiency of primary care. The poor and destitute rural people must be included through community involvement if the goal of health inclusion is to be achieved [16].

Importance of Technology in Healthcare:

An important factor in the development of human civilization has been technology. The world's leading industry for embracing modern technologies is the healthcare sector [8]. The doctor-to-population ratio in India is currently 0.62:1000, but the WHO recommends a ratio of 1:1000. Since training new doctors takes time and money, the doctor-to-patient ratio will likely stay low for some time to come. Technological developments across the nation, such as active telemedicine services, can aid in lowering the deficit [17].

Role of Technology in Diagnosis of Diseases:

A historically high level of innovation in healthcare is brought about by its vast technological and medical knowledge. The early detection and management of NCDs like cancer, hypertension, and diabetes have been made easier by technologies like mHealth, wearables, highly accurate, portable, and speedier diagnostic/screening devices. These technologies have also helped to increase quality-adjusted life years (QALYs) and decrease DALYs [18].

Surveillance: Early illness detection and monitoring are the goals of the Integrated Disease Surveillance Programme (IDSP), which will assist in guiding effective policy decisions. The IDSP's main goal was to establish an all-encompassing disease surveillance system involving the federal and state governments [19]. The Pradhan Mantri Ayushman Bharat Health Infrastructure Mission (PM-ABHIM) Operational Guidelines established Integrated public health laboratories (IPHLs), which can enhance early detection and rapid response to disease outbreaks, thereby preventing the spread of infectious diseases, facilitating clinical management, and expanding the scope of surveillance, thus offer hope for addressing current health system challenges [19].

Big data / Data science: Big data is the term used to describe the vast amounts of data produced by multiple sources, including wearable technology, social media, and electronic health records. The diagnosis, treatment, and prevention of diseases can all be revolutionized by data science. The surveillance and prediction of diseases is one of the primary uses of big data in public health [8].

Technology That Links Healthcare and Population:

Telemedicine, artificial intelligence, drone technology, Smart health India and precision public health are some of the digital technology links health care and population.

1) Telemedicine:

According to the WHO, "the delivery of healthcare, where distance is a critical factor, by all medical professionals using information and communications technology for the exchange of valid information for the diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for the ongoing training of health care providers, all in the best interest of advancing the health of individuals and communities" is broadly referred to as telemedicine [20]. The practice of providing medical care in remote locations, particularly underserved ones, using telecommunication technology is known as telemedicine [21].

Telemedicine, especially after the COVID-19 pandemic, is successfully used in various fields of medicine like cardiology, psychiatry, dermatology, radiology, and ophthalmology [22]. Telemedicine has many potential applications, including: *Tele-Home Healthcare, Disaster Management, Remote Consultation, and Tele-Education* [23]. Through the eSanjeevani portal, telemedicine allows patients to receive specialist services from hubs at the local Health and Wellness Centre (HWC). This has helped alleviate the scarcity of physicians and other healthcare professionals. The use of telemedicine at HWCs (spokes) connected to doctors (hubs) has become a crucial component of the healthcare system, benefiting rural patients by lowering out-of-pocket and travel expenses [2]. Guidelines for teleconsultation is given by the Ministry of Health and Family Welfare in partnership with NITI Aayog [24].

2) Artificial Intelligence:

AI has drastically changed healthcare practices and delivery, by narrowing the gap in health disparities [25]. Disease forecasting, patient triaging, progression modelling, population based disease screening and decision-support applications are some applications of artificial intelligence in healthcare [2]. AI has streamlined patient transportation, healthcare inventory management, managing complex medical logistics, medical transportation, healthcare inventory management, and resource pooling among stakeholders [3].

3) Drone Technology:

Timely delivery of medical supplies is crucial in the healthcare industry. Drones are recognized for their ability to transport goods quickly, affordably, and safely - even to difficult-to-reach locations - when compared to other air transportation methods [26]. Drone delivery of medical goods to hard-to-reach or rural locations presents a novel solution to persistent problems with healthcare accessibility and availability [27].

4) Smart Health India:

Developed by George Institute researchers in UK, India and Australia. With the help of this exceptional low-cost, high-quality healthcare delivery system, doctors and community health workers can offer cutting-edge treatment for common chronic conditions at a significantly lower cost than they otherwise would. It makes use of cutting-edge mobile health technologies to give healthcare professionals individualized clinical decision assistance to direct Systematic Medical Appraisal Referral and Treatment (SMART) for community members [4]. In order to provide rural populations with accessible healthcare, SMART Health India has turned to ASHAs in conjunction with local physicians. With the recent expansion of SMART Health India to more than 50 villages, housing more than 2,00,000 people, the organization will use

cutting-edge new technologies that will give ASHAs patient-specific data to inform their assessment, referral, and treatment decisions [4].

5) Precision Public Health:

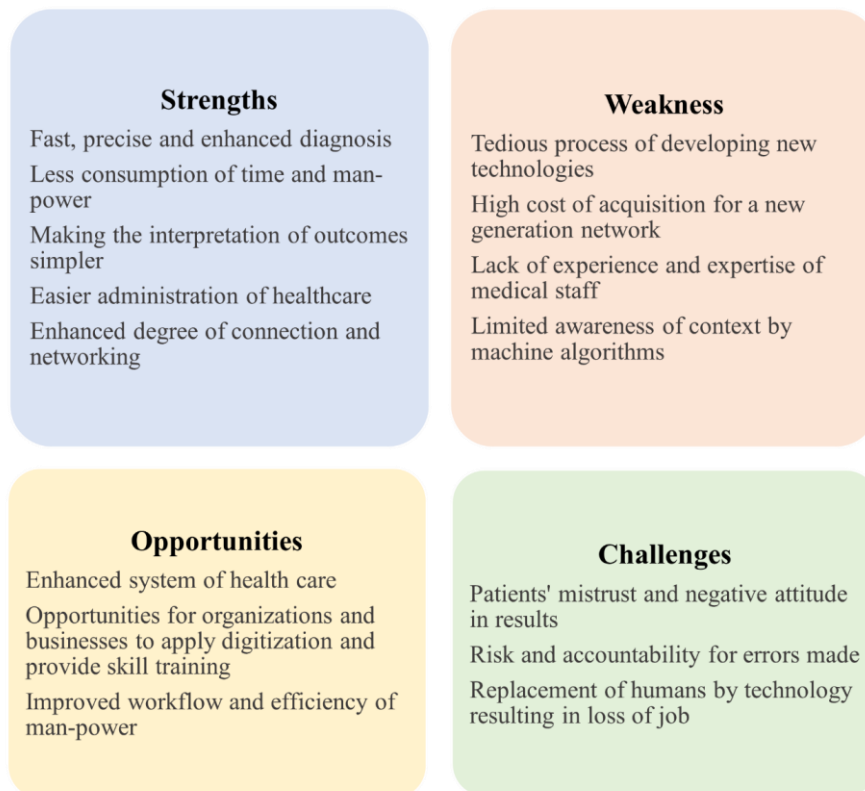
Precision public health is the application of precision medical principles to improve population health by customizing treatment and preventative plans according to lifestyle, environment, and genetics. This strategy seeks to pinpoint risk factors unique to specific population and create focused solutions [8]. The goal of this population-level approach is to enhance overall population health. Finding the unique risk factors and determinants of health for various populations and developing focused interventions to address these factors are some of precision public health's primary objectives [8].

The use of smartphones is increasing, with mobile internet usage in both urban and rural areas surpassing that of desktop, laptop, and tablet computers. In the meantime, 68% of people in rural India have access to the internet. Even though that's less than in cities, providing digital healthcare is getting simpler because of more affordable internet access and improved connectivity. We have barely begun to scratch the surface of what can be done to digitize healthcare in rural areas. We will be able to use more sophisticated technology to bridge the gap between rural and urban areas as internet connectivity increases [28].

Schemes Centered On Technology:

National Digital Health Mission Expansion: The National Digital Health Mission's purview extends not only beyond curative treatments, but also to encompass health promotion and preventive care for rural populations [29].

Ayushman Bharat Digital Mission: Utilizing technology to deliver Universal Health Coverage (UHC) to all rural residents is its primary focus. The goal of the mission is to increase service quality and efficiency through real-time data tracking through a number of components, including the National Health Stack. The National Digital Health Blueprint provides a blueprint for India's healthcare system's digital transformation. Every citizen has a unique ID called the Health ID, which is connected to the National Health Stack and makes it possible to create an electronic health record (EHR) for each person. The Health ID, a vital component of the Ayushman Bharat Digital Mission, raises the standard, cost, and accessibility of healthcare services for all Indians [8].



SWOC Analysis

Strengths:

- Fast, precise and enhanced diagnosis
- Less consumption of time and man-power
- Making the interpretation of outcomes simpler
- Easier administration of healthcare
- Enhanced degree of connection and networking

Weaknesses:

- Tedious process of developing new technologies
- High cost of acquisition for a new generation network
- Lack of experience and expertise of medical staff
- Limited awareness of context by machine algorithms

Opportunities:

- Enhanced system of health care
- Opportunities for organizations and businesses to apply digitization and provide skill training
- Improved workflow and efficiency of man-power

Challenges:

- Patients' mistrust and negative attitude in results
- Risk and accountability for errors made
- Replacement of humans by technology resulting in loss of job

Limitations:

Studies indicate that technology literacy, expenses, self-efficacy, attitudes, and anxiety are some reasons why older persons in rural locations have trouble accepting and using technology. Although the use of connected health technology was justified, obstacles remain

in the way of its actualization. Research on the use of digital technology in healthcare has revealed that age, perceived ease of use, aversion to change, and digital literacy are among the impediments. Furthermore, poor Wi-Fi and 4G/5G connectivity is a common problem in rural areas, which makes telehealth implementation more difficult.

India confronts a number of obstacles when it comes to using technology for public health, such as inadequate infrastructure, restricted access for some population groups, low levels of knowledge and awareness of technology, and scarce capacity and resources. Concerns exist surrounding cultural and behavioural aspects, as well as the security and privacy of personal health data. Another issue is the dependability and accessibility of data gathered by technology. Moreover, the application of technology to public health raises ethical questions.

Instead of smartphones, the majority of devices used by people living in rural areas are simple mobile phones with text and call functions only. The low rates of digital literacy usage and adoption of digital health technologies among Indian rural older individuals can be attributed to a number of factors, like low literacy, ageing, deteriorating senses, and lack of exposure and confidence with technology.

2. Conclusion

Technology has the potential to play a vital part in India's public health future. The intricate and ever-changing Indian public health system provides chances for public health innovation and calls for adopting more recent developments in order to improve public health. By giving priority to the underprivileged, enabling grassroots labourers, and fostering trust via transparent and accountable processes, India may effectively leverage the revolutionary potential of technology in the field of public health, resulting in enhanced healthcare results and a more optimistic outlook for its populace.

The aforementioned technology solutions are intended to give the impoverished, access to high-quality, reasonably priced healthcare treatments. The nation needs affordable population-specific technology solutions to support its aging population, growing NCD and infectious disease rates, and sizable impoverished population.

Future considerations of using technology to bridge healthcare inequities may be made possible by strong social support from family and local primary healthcare providers, as well as by the adoption of a low-tech solution that gets around the physical drawbacks of aging and low literacy. The rural population could be included in the digital health care by emphasizing skill enhancement, capacity building, and capability resuscitation. Therefore, it is imperative to reassess basic health care in India and to take rapid action towards reforms and real measures.

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