Use of modern technologies for promoting health at the population level in India

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Summary

India, with a population of 1.4 billion, faces health equity challenges due to inaccessible public health systems, particularly in rural areas. Modern technologies like the internet and mobile phones are being used to bridge this gap, enhancing health equity by disseminating vital health information. Health Technology Assessment (HTA) evaluates these technologies, influencing healthcare policy and improving health outcomes. Key strategies include digital health hubs, mobile health units, public-private partnerships, and digital tools for community health workers. To scale these interventions, capacity building, infrastructure development, community engagement, and monitoring are required. Policymakers are urged to prioritize investments in health technologies based on evidence, considering cost-effectiveness, health outcomes, and health equity. Addressing data privacy and security is crucial. Future research should focus on technology-based interventions for maternal and child health.

Keywords: Technology; Health system; Population health; India; Review

Introduction

India, with a population of 1.4 billion population, has 898 million people living across 664,000 villages.[1] Access to the health systems in these villages is one of the major concerns in ensuring health equity in India.[2] Information and communication technologies are promising tools to reach communities in hard-to-access poor, rural, and isolated areas, especially in low- and middle-income countries. The World Health Organization (WHO) defines health education as learning experiences that improve health by increasing knowledge and influencing attitudes.[3] While healthcare providers have traditionally been the primary source of health education, there's a need for more accessible solutions to disseminate health information in low-resource settings.

The rise of modern technologies like the internet and mobile phones has revolutionized health-related information delivery. Their accessibility enables effective communication to diverse audiences. SMS reminders provide direct communication, mass media engages and educates through visual and auditory mediums, and mobile-health technologies and web platforms extend the reach of healthcare workers in primary care settings.[4]

At the population level, it is helpful to categorize these technologies into three main categories: communication technologies, data analysis technologies, and digital health technologies. Communication technologies such as telemedicine platforms and mobile health apps have revolutionized the way healthcare services are delivered, making them more accessible and convenient. Telemedicine provides digital access to communities and geographies that are difficult to reach, offering remote digitized education, symptomatic management, and disease monitoring. On the other hand, data analysis technologies, including big data analytics and artificial intelligence, provide valuable insights into disease trends and health behaviors, informing public health interventions. Digital health technologies like electronic health records and wearable devices play a crucial role in facilitating the collection and sharing of health data. This improves disease surveillance and management. However, it's important to note that the use of these digital technologies in healthcare could potentially exclude individuals who lack access to or awareness of these technologies, particularly in rural areas and among women and adolescent girls. To address this issue, it's essential to incorporate digital practices that can improve the availability of medical services in remote areas and promote health equity.

As per the data from the Telecom Regulatory Authority of India, the total number of active wireless subscriptions in India was approximately 1.034 billion as of March 2023.[5] This extensive mobile network

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coverage presents a significant opportunity for leveraging mobile technologies to reach underserved populations and improve health outcomes. Considering this coverage, especially at a population level in India, technologies that aid in increasing health promotion need to be studied, to make this communication more effective. A trained public health workforce capable of applying the latest technological advances and big data analytics using digital technologies can help in elucidating disease epidemiology and help in implementing public health interventions.

Challenges and barriers to technology-driven health promotion

Technologies are being used to promote health at the population level across a variety of domains in India such as communicable diseases (malaria prevention), maternal health (maternal and child health schemes, antenatal care), non-communicable diseases (tobacco consumption), and mental health (prevention of suicide). Despite the potential benefits of technology-driven health promotion, there are several challenges and barriers that need to be addressed. The use of technology in promoting health at the population level includes the technology gap in resource-poor settings, economic commitments for upgrading technology, lack of reliability of information delivered by phone, lack of technology education for patients and health providers, etc. One of the challenges of using health-related digital technologies lies in dealing with health equity. Health equity provides a fair chance for everyone to access health by addressing differences in the quality of healthcare across different populations.[6,7] The challenges of utilizing health technologies include disparities in financial income, literacy rates, and cultural diversity. Digital solutions have the potential to address such inequalities barring these challenges.

Digital health literacy, the ability to seek, find, understand, and appraise health information from electronic sources, is crucial for addressing health problems. However, disparities in health outcomes can arise when individuals lack this literacy, preventing them from effectively using digital health tools and services. Internet connectivity, the backbone of digital health, is essential for realizing the benefits of digital health technologies. Yet, in contexts where internet access may be limited or non-existent, particularly in rural or remote regions, these benefits cannot be fully realized. Recently, the implications of digital health literacy and internet connectivity for the wider social determinants of health have been acknowledged. These factors, therefore, present significant challenges to the successful use of technology in promoting population-level health.

Existing evidence

Appendix 1 provides several insights gleaned from the literature review. Research is more concentrated on early disease prevention, with less emphasis on primordial prevention. The life course approach for a healthy adult life needs to be applied to the preconception through lactation phase.[8] Maternal nutrition, postpartum depression, and family planning methods are important public health issues. The rise in malnutrition and obesity necessitates public awareness about dietary diversity and healthy eating habits.[9] Efforts to combat diseases like dengue and malaria need to be intensified. Despite technological advancements, immunization coverage among children under five has not significantly improved.[9] Awareness of the AYUSH system of medicine, which complements modern medicine, is essential for holistic health.

The effectiveness of technologies in delivering care components at the healthcare provider level is much clearer by now.[10] However, uneven resource allocation poses challenges at the population level. This opens opportunities for the government to use technology for targeted health education. One approach is installing LED screens or TVs in public places for health messages. To ensure equal healthcare access, technology must include all disadvantaged groups. Policy-wise, a tailored approach recognizing diversity may be more effective than a one-size-fits-all strategy.

Assessment of technology enabled interventions at population level

Most of the articles that have studied the impact on the community or population level have reported a positive impact on health-related outcomes (Appendix 1). More studies need to assess the impact of artificial intelligence-based apps on health-related outcomes. To enhance the impact of technology-based health interventions, community involvement in their design and implementation is essential, ensuring alignment with the community's specific needs and preferences. Simultaneously, equipping healthcare providers with comprehensive training and support for leveraging technology in health promotion is crucial, enabling them to effectively deliver these interventions and educate patients about their benefits. Additionally, continuous evaluation of these interventions through effectiveness studies allows for necessary adjustments to ensure they achieve the desired impact on health outcomes.

HTA's impact on healthcare policy

Health Technology Assessment (HTA) is a systematic approach used by the WHO to evaluate health technologies or interventions. It helps in assessing the impacts of a particular health technology or intervention.[11] A review conducted by Prinja et al. concluded that standard guidelines for HTA in India need to be adapted

considering the diverse nature of HTAs.[12] The findings of HTA studies in India have influenced healthcare policy, decision-making, and resource allocation. They have also led to the adoption of new health technologies, improved health outcomes, and cost savings in the healthcare system. A study by Chatterjee et al. on the cost-effectiveness of different strategies for tuberculosis control in India helped to inform national policy on tuberculosis control.[13] Most of these studies focus on evaluating the cost-effectiveness of healthcare interventions, promoting evidence-based decision-making in healthcare, and providing technical support for HTA in India.[14–18] Overall, HTA has emerged as an important tool for informing healthcare decision-making in India. However, there are existing gaps in the HTA framework that need to be addressed.

Implementation of health-promoting strategies

To leverage the potential of modern technology in health promotion, several strategies can be implemented:

Digital Health Hubs: Establish digital health hubs in rural and remote areas. These hubs can provide access to telemedicine, health education, and digital health records. They can also serve as points for data collection for public health surveillance.

Mobile Health Units: Deploy mobile health units equipped with telemedicine capabilities and digital health technologies. These units can reach underserved areas, providing essential health services and digital health interventions.

Public-Private Partnerships: Promote partnerships between public health entities and commercial agencies to utilize their technological capabilities for the delivery and advertisement of health messages. This approach can lead to innovative solutions for health promotion and disease prevention.

Community Health Workers & Digital Tools: Equip community health workers with digital tools for health promotion, disease prevention, and data collection. This strategy not only enhances their outreach capabilities but also significantly improves the overall effectiveness of their work in the communities they serve.

Incentives for Use of Digital Health Tools: Provide incentives to healthcare providers and patients for the use of digital health tools. Incentivizing the use of digital health tools in private healthcare through financial benefits and recognition can not only foster wider adoption but also bridge the health gap in hard-to-reach areas.

Regulations for Health Apps: Implement regulations for health apps to ensure they meet standards of accuracy, privacy, and security.

National Digital Health Mission Expansion: Expand the scope of the National Digital Health Mission to include preventive health and health promotion, not just curative services.

Digital Literacy Programs: Strengthen the digital literacy programs under New India Literacy Programme (NILP) of Government of India to enable more people to use digital health tools effectively.

Health Technology Assessment (HTA) Body: Establish a dedicated HTA body to evaluate new health technologies and guide their implementation in the public health system.

Scaling up of interventions

A comprehensive approach is needed to effectively scale up these interventions. This begins with capacity building, which involves training healthcare providers and community health workers on the use of digital health tools. Infrastructure development for establishing digital health hubs in rural and remote areas. Community engagement is also essential to tailor interventions to meet the community's specific needs and preferences. Monitoring and evaluation should be conducted regularly to assess the effectiveness of the interventions and ensure they are achieving the desired impact on health outcomes.

Before implementing a new digital health initiative, a health equity impact assessment could be conducted to ensure that the initiative does not inadvertently widen health disparities. This could involve assessing factors such as access to technology, digital literacy levels, and potential barriers for disadvantaged groups. By incorporating such methodologies into our planning and evaluation processes, we can ensure that our efforts to leverage modern technologies for health promotion are both effective and equitable.

Ethical considerations

To ensure privacy of personal health data in digital health systems, several measures need to be implemented such as data encryption, security audits and access controls. Anonymization of personal health data and transparent data collection practices and privacy policies can prevent the misuse of personal health data for commercial purposes, thereby fostering public trust in digital health systems. Health apps that collect patient data must have robust security measures in place to protect this data from potential breaches. Patients must have control over who can access their health data and for what purposes. Before collecting or using patient data, healthcare providers must obtain informed consent from the patients. By establishing clear standards and regulations for data governance and interoperability, privacy laws can enhance public trust and awareness of digital health interventions.

Future directions

Building on the proven benefits of technology in healthcare and the recognition of existing research gaps,

policymakers have a unique opportunity to craft policies that foster a positive shift in attitude towards health. To effectively prioritize investments in health technologies and interventions, governments should adopt an evidence-based approach, which includes assessing the cost-effectiveness of the digital interventions, their impact on health outcomes and health equity, and potential risks and benefits. This might have a synergistic effect on India's attempt to attain universal health coverage.

Challenges such as data privacy and security need to be addressed for the effective implementation of these technologies. More research is needed to evaluate the effectiveness of technology-based interventions for improving maternal and child health outcomes which are more critical in terms of public health relevance in India. To maximize the impact of digital technologies, it is imperative to fortify the capacity of healthcare systems by training the frontline workers on using these technologies.[19–38]

Declaration of interests
No conflicts of interest to declare.

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