Metaverse Basic and Applied Research. 2025; 4:160
doi: 10.56294/mr2025160

REVIEW

Digital Health Technology in the Metaverse Era: Innovations and Policy Critiques in Developing Countries

Tecnología sanitaria digital en la era del metaverso: innovaciones y críticas a las políticas en los países en desarrollo

Ifdil Ifdil[1,2], Annisaislami Khairati[1,2], Rima Pratiwi Fadli[1,2], Dominikus David Biondi Situmorang[3]

[1]Department of Guidance and Counseling, Faculty of Education, Universitas Negeri Padang.
[2]Center for Educational Neuroscience, Trauma, and Human Behavior, Universitas Negeri Padang.
[3]Department of Guidance and Counseling, Atma Jaya Catholic University of Indonesia, Indonesia.

Cite as: Ifdil I, Khairati A, Pratiwi Fadli R, Biondi Situmorang DD. Digital Health Technology in the Metaverse Era: Innovations and Policy Critiques in Developing Countries. Metaverse Basic and Applied Research. 2025; 4:161. https://doi.org/10.56294/mr2025161

Submitted: 29-04-2024 **Revised:** 06-10-2024 **Accepted:** 08-03-2025 **Published:** 09-03-2025

Editor: PhD. Dra. Yailen Martínez Jiménez

Corresponding Author: Dominikus David Biondi Situmorang

ABSTRACT

Digital health technology becomes a transforming power in the Metaverse age to solve healthcare issues in impoverished nations. Particularly in low- and middle-income nations (LMICs) where access to excellent treatment remains limited, innovations such as artificial intelligence (AI), mobile health (mHealth), electronic health records (EHR), and telemedicine are changing the way healthcare is delivered. Emphasizing successful projects like Baano, Hello! Caafi, and the Ayushman Bharat Digital Mission, this paper investigates innovative uses of digital health in countries including Somalia and India. Infrastructural shortcomings, inadequate digital literacy, financial shortages, and uneven regulatory systems impede widespread adoption despite these developments. Important obstacles include data security and policy consistency with global objectives as the WHO Global Strategy on Digital Health 2020–2025. Based on worldwide case studies, this article emphasizes the pressing need for more investment in digital infrastructure, better policy consistency, and capacity-building projects. Equitable and sustainable integration of digital health technologies depends on cooperative efforts of governments, healthcare providers, and communities. The results provide insightful analysis of possible routes for digital health evolution as well as strategic recommendations for future study and policy creation.

Keywords: Digital Health; Metaverse; Telemedicine; Mhealth; Developing Countries; Policy Critique; Health Technology; LMICS; Artificial Intelligence; Digital Infrastructure.

RESUMEN

La tecnología sanitaria digital se convierte en una fuerza transformadora en la era del metaverso para resolver los problemas sanitarios en los países empobrecidos. En particular, en los países de ingresos bajos y medios (PIBM), donde el acceso a un tratamiento excelente sigue siendo limitado, innovaciones como la inteligencia artificial (IA), la salud móvil (mHealth), los registros sanitarios electrónicos (EHR) y la telemedicina están cambiando la forma en que se presta la asistencia sanitaria. ¡Haciendo hincapié en proyectos exitosos como Baano, Hello! Caafi y la Misión Digital Ayushman Bharat, este artículo investiga los usos innovadores de la salud digital en países como Somalia y la India. Las deficiencias en las infraestructuras, la falta de alfabetización digital, la escasez de recursos financieros y los sistemas normativos desiguales impiden su adopción generalizada a pesar de estos avances. Entre los obstáculos importantes se encuentran la seguridad de los datos y la coherencia de las políticas con los objetivos globales, como la Estrategia Mundial de Salud

Digital 2020-2025 de la OMS. Basándose en estudios de casos de todo el mundo, este artículo hace hincapié en la urgente necesidad de aumentar la inversión en infraestructura digital, mejorar la coherencia de las políticas y llevar a cabo proyectos de creación de capacidad. La integración equitativa y sostenible de las tecnologías de salud digital depende de los esfuerzos de cooperación de los gobiernos, los proveedores de atención sanitaria y las comunidades. Los resultados proporcionan un análisis perspicaz de las posibles vías para la evolución de la salud digital, así como recomendaciones estratégicas para futuros estudios y la creación de políticas.

Palabras clave: Salud Digital; Metaverso; Telemedicina; M-Health; Países en Desarrollo; Crítica de Políticas; Tecnología Sanitaria; LMICS; Inteligencia Artificial; Infraestructura Digital.

INTRODUCTION

Digital health technology has turned into a transforming tool for tackling public health concerns in the Metaverse era,[1] particularly in underdeveloped nations. Some of the state-of-the-art technologies that can improve the quality and accessibility of healthcare services are artificial intelligence (AI), mobile health (mHealth), electronic health records (EHR), and telemedicine. Putting these technologies into use is challenging, particularly in low-and middle-income (LMIC) nations. There, frequent infrastructure, rules, and lack of resources impede its performance. This paper looks at recent developments in digital health technologies, evaluates present legislation, and studies healthcare systems in several nations.

Innovative digital health solutions like mHealth and telemedicine have transformed the way healthcare is delivered in remote and underserved areas. Platforms like Baano and SomDoctor make it easier to have virtual consultations in Somalia, eliminating geographical limitations and improving access to specialized medical care. mHealth solutions, like Hello! Caafi, which uses telecommunication networks to deliver health information and services, also shows the promise of mobile technology in resource-constrained contexts.[2,3] Healthcare services have become more efficient and data accuracy has increased with the use of electronic health records (EHR). Electronic immunization registration has improved the efficiency of Somalia's healthcare system.[4] Moreover, the Ayushman Bharat Digital Mission (ABDM) in India launched digital health initiatives like e-Sanjeevani and Aarogya Setu, which have improved access and healthcare outcomes.[5] Research is being done on blockchain and AI technologies to enhance diagnosis and safeguard medical records. AI-driven technologies are used in LMIC to enhance disease detection and management, while blockchain is used to protect data security and privacy.[6,7]

DEVELOPMENT

One of the key challenges in adopting digital health technology is the lack of consistent infrastructure and digital literacy. Inconsistent connectivity and poor internet penetration (27,6 %) make implementing digital health solutions in Somalia difficult.[2,8] claim that insufficient digital infrastructure and a lack of technology resources also impede the effective deployment of digital health solutions in sub-Saharan Africa. Using digital health technologies calls for data privacy and security. Often, the lack of a robust legal framework to safeguard data limits the possibilities for digital health treatments in low- and middle-income countries.[9] For instance, as telemedicine programs in India grow quickly, worries about patient data privacy have arisen, stronger laws are required.[10,11] Cost is just another obstacle to the implementation of digital health technologies. Many LMICs' digital health projects have been successful, but a shortage of financing and resources limits them.[8] The speed of mHealth projects, for instance, is rather low in sub-Saharan Africa. A lack of resources and an incapacity to monitor and assess progress account for this.[8]

Regulatory concerns and policy mismatch also make the deployment of digital health technologies more complex. Though knowledge management and health equality differ, the WHO Global Strategy on Digital Health 2020–2025 does not match Tanzania's and Germany's digital health strategies.[12] Likewise, sub-Saharan Africa has experienced the emergence of fragmented information silos resulting from insufficient thorough digital health rules.[8,13,14]

Therefore, recommendations and guidance for financing digital infrastructure are needed in the future. The effective implementation of digital health technology requires investment in digital infrastructure. To support the adoption of telemedicine, mHealth, and other digital health interventions, countries must prioritize the development of reliable internet connectivity and digital platforms.[3,4] It's also essential to improve the policy and legal frameworks. It is imperative that nations incorporate new technologies into their digital health policies and align them with global guidelines, like the WHO Global Strategy on Digital Health 2020–2025.[12,15,16] Building capacity and promoting digital literacy are also crucial. Enhancing capacity and digital literacy is necessary for the successful implementation of digital health technologies. To maximize the benefits of digital

health interventions, nations must invest in training healthcare professionals and increasing digital literacy in the community.[2,3] For digital health initiatives to be successfully adopted, governments, healthcare providers, technology developers, and communities must collaborate.[17]

CONCLUSION

Digital health technologies have the potential to transform public health in the Metaverse era for developing countries. To fully realize this potential, however, infrastructure, policy, and resource limitations need to be addressed.Countries can leverage the benefits of digital health technology to improve access, quality, and health outcomes by investing in digital infrastructure, strengthening policy frameworks, expanding capacity, promoting equity, and encouraging collaboration.Important insights into the potential and challenges of digital health, as well as suggestions for future research, can be gained from experiences in countries such as Tunisia, Nigeria, Germany, Tanzania, India, and others.

REFERENCES

1. Kim, K., Yang H, Lee J, & Lee WG. Metaverse wearables for immersive digital healthcare: a review. Advanced Science. 2023;10(31):2303234.

2. Ahmed MM. Revolutionizing healthcare in Somalia: the role of digital innovations in enhancing access and quality. Exploration of Digital Health Technologies. 2024;2(6):360-368.

3. Jones-Esan L, Somasiri N, Lorne K. Enhancing Healthcare Delivery Through Digital Health Interventions: A Systematic Review on Telemedicine and Mobile Health Applications in Low and Middle-Income Countries (LMICs). 2024.

4. Ahmed MM, Dirie NI, Mohamud AK, et al. Advancing digital healthcare in Somalia: a review of modern technologies and their implications. BMC Digital Health. 2024;2(1):1-6.

5. Velan D, Mohandoss H, Valarmathi S, Sundar JS, Kalpana S, Srinivas G. Digital health in your hands: A narrative review of exploring Ayushman Bharat's digital revolution. World Journal of Advanced Research and Reviews. 2024;23(3).

6. Popescu SM, Mansoor S, Wani OA, et al. Artificial intelligence and IoT driven technologies for environmental pollution monitoring and management. Frontiers in Environmental Science. 2024;12:1336088.

7. Omidian H. Synergizing blockchain and artificial intelligence to enhance healthcare. Drug Discovery Today. 2024:104111.

8. Ogundaini OO, Mlitwa NB. A situational review of national Digital Health strategy implementation in sub-Saharan Africa. The Journal for Transdisciplinary Research in Southern Africa. 2024;20(1):1476.

9. Al Meslamani AZ. Technical and regulatory challenges of digital health implementation in developing countries. In. Vol 26: Taylor & Francis; 2023:1057-1060.

10. Naik A, Sarkar B. Health and Policy Innovations in India: Exploring the Potential of Telehealth.

11. Pandey M, Khan H. Digital Healthcare, Legal Care: Analyzing Doctors' Rights amidst Technological Growth in Indian Medical Tourism. Issue 3 Int'l JL Mgmt & Human. 2024;7:529.

12. Holl F, Kircher J, Hertelendy AJ, Sukums F, Swoboda W. Tanzania's and Germany's digital health strategies and their consistency with the World Health Organization's global strategy on digital health 2020-2025: comparative policy analysis. Journal of Medical Internet Research. 2024;26:e52150.

13. Aboye GT, Simegn GL, Aerts J-M. Assessment of the barriers and enablers of the Use of mHealth systems in Sub-saharan Africa according to the Perceptions of Patients, Physicians, and Health Care Executives in Ethiopia: qualitative study. Journal of medical Internet research. 2024;26:e50337.

14. Auza-Santiváñez JC, Carías Díaz JA, Vedia Cruz OA, Robles-Nina SM, Sánchez Escalante C, Apaza Huanca B. Gamification in personal health management: a focus on mobile apps. Gamification and Augmented Reality. 2024; 2:31. https://doi.org/10.56294/gr202431

15. Saheb T, Saheb T. Digital health policy decoded: Mapping national strategies using Donabedian's model. Health Policy. 2024:105134.

16. Jiménez Pérez GA. Benefits and challenges of using AI in heritage education. EthAIca. 2024; 3:102. https://doi.org/10.56294/ai2024102

17. Gashu KD. The Digital Ecosystem and Major Public Health Informatics Initiatives in Resource-Limited Settings. In: Public Health Informatics: Implementation and Governance in Resource-Limited Settings. Springer; 2024:97-140.

FUNDING

The authors declared no funding was received for this paper.

CONFLICT OF INTEREST

The authors declare no conflict of interest in this paper.

AUTHOR CONTRIBUTIONS

Conceptualization: Ifdil Ifdil, Annisaislami Khairati, Rima Pratiwi Fadli.

Investigation: Ifdil Ifdil, Annisaislami Khairati, Rima Pratiwi Fadli.

Methodology: Ifdil Ifdil, Annisaislami Khairati, Rima Pratiwi Fadli.

Writing - original draft: Ifdil Ifdil, Annisaislami Khairati, Rima Pratiwi Fadli, Dominikus David Biondi Situmorang.

Writing - review and editing: Ifdil Ifdil, Annisaislami Khairati, Rima Pratiwi Fadli, Dominikus David Biondi Situmorang.