Innovating for health equity through sustainable and inclusive eHealth systems powered by data-driven technologies

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Introduction

Healthcare is changing in ways we couldn't have imagined a decade ago. Data-driven health technologies (DDHTs) are revolutionizing how we approach healthcare, offering tools to tackle long-standing issues like unequal access, overburdened systems, and environmental sustainability. Yet, with these advancements come tough questions: How do we ensure these technologies reach everyone? Can we balance innovation with ethics and privacy? How do we make it all sustainable? As someone deeply involved with the Dynamic Coalition on Data-Driven Health Technologies (DC-DDHT), I've seen how global conversations, research, and collaboration can drive real change. This article draws on those experiences to explore how we can use technology to build a future where healthcare is accessible, inclusive, and responsible. From empowering communities with better eHealth access to making sure our tech doesn't harm the planet; the goal is simple: health systems that work for everyone.

Empowering communities through eHealth access

Healthcare inequity is deeply rooted in the absence of connectivity and resources in underserved regions. Technologies like satellite internet have emerged as lifelines, as highlighted by the European University Institute (2024). Satellite hubs enable local providers to deliver telemedicine, real-time diagnostics, and digital health education in areas with limited infrastructure. For instance, the potential of these technologies is being realized in developing regions where satellite networks bridge the last mile to connect rural clinics to global healthcare expertise (Kulesza, 2024). Libraries, often overlooked in discussions about healthcare, hold immense promise in addressing these gaps. In New Zealand, public libraries have become gateways for community health, offering resources approved by medical institutions to improve health literacy (Times Colonist, 2024). Canadian libraries lend tools such as thermal cameras to identify energy inefficiencies in homes—an innovative model that could easily be adapted to include lending AR/VR health diagnostic devices or educational resources.

Reflecting on these advancements, I see libraries as critical in democratizing healthcare access. However, their role must extend beyond offering tools; they should become hubs for public-private partnerships, where governments and tech innovators co-invest in infrastructure and training. Community-led models, particularly in African countries, could empower local libraries to deliver culturally sensitive health education alongside digital services.

Ethics and security in robotics integration

Who is responsible if something goes wrong? The developer, the healthcare provider, or the machine itself? Privacy concerns are also critical, especially as robots handle sensitive patient data. On the technical side, interoperability and cybersecurity are essential. Robots must integrate seamlessly into existing healthcare systems and protect data from breaches. Autonomous robots must be designed to align with strict ethical standards, ensuring transparent decision-making and equitable access across diverse populations (Stahl & Coeckelbergh, 2016). Cost-effective and energy-efficient designs are equally important, particularly in resource-constrained settings. These considerations align with the ITU's emphasis on green health IT, which calls for innovations that minimize environmental impact while maximizing health benefits (Jain & Doriya, 2022). Robotics is revolutionizing healthcare, offering groundbreaking applications in surgery, diagnostics, and patient care. Yet, as João Rocha Gomes noted, this innovation comes with ethical and security challenges, particularly around patient autonomy and data privacy (Gomes, 2023). For instance, robotics-powered surgeries raise questions about liability in cases of errors. Houda Chihi's work on cybersecurity emphasizes the vulnerabilities that arise with interconnected medical devices. The proliferation of the Internet of Medical Things (IoMT) necessitates robust encryption and real-time threat detection systems (Chihi, 2024). From ransomware attacks targeting hospital systems to breaches in personal health data, these risks cannot be ignored. The adoption of zero-trust cybersecurity frameworks, blockchain, and AI-based solutions offers promising directions, yet global standards are still in their infancy.
Personally, I believe the success of robotics and IoMT depends on striking a balance between innovation and regulation. While we cannot stop technological growth, we must ensure that patients' rights and safety remain at the forefront. Governments, developers, and healthcare providers need to collaborate on robust policies that address these concerns while ensuring equitable access to robotics technologies.

Libraries as catalysts for eHealth transformation

Libraries have always been repositories of knowledge, but their evolution into hubs for health equity is both timely and necessary. The metaverse offers an unprecedented opportunity to revolutionize education and healthcare by creating immersive, interactive spaces where people can learn and access services remotely, regardless of their location" (Metaverse in 2040, 2022, p. 12). In underserved regions, libraries can use metaverse technologies in some way where community members access digital tools, health information, and workshops. The concept of "gadget

libraries," as proposed by Amali De Silva-Mitchell[1], exemplifies this potential by envisioning libraries as centers lending diagnostic devices, AR/VR tools, and other healthcare innovations. Augmented and virtual reality tools are becoming essential for public access to advanced technologies, positioning libraries as vital hubs for community-based healthcare and education" (Metaverse in 2040, 2022, p. 15)

Existing models in Canada and New Zealand showcase the feasibility of this approach. For example, New Zealand's libraries provide digital health resources approved by government agencies, while Canadian libraries support environmental sustainability by lending Climate Action Kits (Times Colonist, 2024). These initiatives can be expanded to include preventive healthcare tools, from blood pressure monitors to educational AR simulations.

Reflecting on these examples, I see libraries as bridges between technology and communities. However, their success depends on localized strategies. In Africa, for instance, involving community elders and leveraging indigenous knowledge could enhance the effectiveness of library-led health programs. Libraries must also partner with NGOs and healthcare institutions to offer integrated services that go beyond technology access.

Health and environmental sustainability

The link between healthcare and environmental sustainability is becoming increasingly evident. From energy-intensive hospital operations to the growing reliance on electronic devices, the environmental footprint of healthcare is significant. Initiatives like zero-waste programs in Egypt, where textile recycling supports sustainable practices, demonstrate how healthcare systems can contribute to environmental goals (WUF12, 2024). Similarly, refillable container programs in the Philippines offer scalable solutions for reducing plastic waste in healthcare settings. Green health IT is an area that I believe needs greater attention. As IoMT devices and robotics become commonplace, integrating renewable energy sources and adopting circular economy principles will be essential. The ITU's emphasis on green technologies provides a blueprint, but more actionable steps are needed at the local level. Additionally, By reducing the need for physical travel and enabling virtual healthcare services, metaverse technologies can significantly lower the environmental impact of health systems" (Metaverse in 2040, 2022, p. 20). The integration of mixed reality in healthcare has the potential to enhance sustainability by enabling remote diagnostics, virtual consultations, and immersive medical training, all while conserving resources" (Metaverse in 2040, 2022, p. 18)

Reflecting on these developments, I see a dual responsibility for healthcare innovators: meeting the rising demand for services while minimizing environmental harm. This requires a shift in mindset, viewing sustainability not as a secondary goal but as a core design principle for all healthcare technologies.

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[1] This is from a summary of insights gathered from various discussions, webinars, and email exchanges led by Amali De Silva-Mitchell, the coordinator of the Dynamic Coalition on Data-Driven Health Technologies (DC-DDHT).

Strengthening the foundation for eHealth equity

Building equitable eHealth systems requires collaboration across sectors, governments, private enterprises, and civil society. DC-DDHT's focus on interoperability and bundled government-supported services highlights practical solutions for addressing barriers to adoption (DC-DDHT, 2023). For example, small and medium-sized healthcare enterprises like pharmacies and clinics often lack the resources to implement secure eHealth platforms. Government subsidies and standardized software solutions can make these technologies more accessible. From my perspective, one of the biggest challenges lies in ensuring cultural relevance. A one-size-fits-all approach will not work for global healthcare systems. Instead, localized frameworks must guide the design and implementation of eHealth platforms. This is where we must keep playing a critical role, fostering dialogue among diverse stakeholders and promoting context-specific solutions.

Conclusion

Technology is giving us the tools to reimagine healthcare, but it's up to us to use them wisely. Data-driven health technologies have the power to close the gaps in access, improve care quality, and address environmental challenges. However, they also come with responsibilities—to safeguard privacy, respect ethical boundaries, and design solutions that truly serve diverse communities. Working with the DC-DDHT has shown me that the future of healthcare isn't just about adopting the latest tools; it's about making thoughtful choices. Whether it's creating eHealth hubs in libraries, developing greener technologies, or ensuring that robotics enhance care without overshadowing the human element, collaboration and careful planning are key. The journey ahead is complex, but the potential to create a healthier, more equitable world is within reach. We must stay focused on inclusion, sustainability, and innovation. This way we can ensure that the healthcare systems of tomorrow truly work for everyone, everywhere.

References

1. DC-DDHT (2023). Annual Report 2023. United Nations Internet Governance Forum.
2. Chihi, H. (2024). Overview About Cybersecurity in Healthcare. DC-DDHT Book Series.
3. European University Institute (2024). Two sides of the same coin? Future of the internet and sustainable development. Accessed from: https://hdl.handle.net/1814/77411
4. Jain, S. & Doriya, R. (2022). Security framework to healthcare robots for secure sharing of healthcare data from cloud. International Journal of Information Technology, 14(5), pp. 2429-2439. Accessed from: https://link.springer.com/article/10.1007/s41870-022-00997-8
5. Kulesza, J. (2024). The Declaration for the Future of the Internet and its role in achieving SDGs. Retrieved from: https://hdl.handle.net/1814/77411
6. European University Institute (2024). Two sides of the same coin? Future of the Internet and Sustainable Development. Accessed from: https://hdl.handle.net/1814/77411

7. Times Colonist (2024). Libraries loaning thermal cameras to pinpoint heat-loss problem spots. Accessed from: https://www.timescolonist.com/local-news/libraries-loaning-thermal-cameras-to-pinpoint-heat-loss-problem-spots-9880796

8. WUF12 (2024). Twelfth Session of the World Urban Forum: Daily Reports. UN-Habitat.

9. Gomes, J. R. (2023). The Role of Technology in Reinventing Medical Practice. DC-DDHT Book Series.

10. De Silva-Mitchell, A. (2024). ESG and Branding: The Value for Healthcare Technologies on the Internet. DC-DDHT Book Series.

11. Rainie, L., Anderson, J. and Albright, J. (2022). The metaverse in 2040: Experts predict the future of virtual spaces and their societal impact. Pew Research Center.

12. Stahl, B.C. & Coeckelbergh, M. (2016). Ethics of healthcare robotics: Towards responsible research and innovation. Robotics and Autonomous Systems, 86, pp. 152-161