Emerging Lessons on AI-Enabled Health Care

By Klaus Tilmes

Summary

As Africa's health care systems are often underfunded, ill-equipped, understaffed, or not accessible at all, Sub-Saharan Africa has become a booming arena for digital health innovation. The use of big data and artificial intelligence (AI) has demonstrated high applicability for both outbreak control and preparedness as well as to address a range of diseases and improve public health services. COVID-19 has ignited further momentum by highlighting the promise of AI in medicine and health care, with applications ranging from disease surveillance to drug discovery, clinical diagnostics, patient care, and health system management. However, this promise will not be realized without addressing persistent inequities in terms of health care access and outcomes.

Thematic Context

The combination of rising incomes, improved health outcomes, and longer life expectancies has ignited a growing demand for medical services across Africa. At the same time, the continent continues to shoulder the world's largest disease burden.

Despite considerable attention to efforts aimed at improving public health and reducing health disparities based on socio-economic status, race, gender, and geography, striking disparities in health status persist within and among countries. Public health challenges that disproportionately affect millions of poor Africans include lack of access to piped drinking water (approximately 495 million), basic handwashing facilities (approximately 370 million), and community health services. Communicable diseases are the first cause of death, infant mortality rates are above five percent, and at least one-sixth of the population lives more than two hours away from a public hospital. The risk of disease spreading is compounded by a humanitarian challenge, where millions of people are living in refugee camps in unhealthy conditions. During COVID-19, income-related health inequalities are estimated to have worsened six times compared to 2017.

Efforts to contain the spread of the disease and reverse Africa's poor health outcomes will require public health interventions that take into consideration concerns about equity and justice. Drawing on examples from Africa's rapidly evolving digital health landscape, there are lessons for building blocks and implementation steps towards a sustainable AI-enabled health ecosystem.

Innovation's Contribution

Recent reports[1] assert that AI has the potential to revolutionize healthcare in low- and middle-income countries by improving access to services, enhancing the safety and quality of care, enabling cost savings, and serving as an educational tool. The Broadband Commission for Sustainable Development Working Group on Digital and AI in Health[2], co-chaired by the Novartis Foundation and Microsoft, has zeroed in on five use cases as potentially game-changing capabilities for Africa:

- **AI-enabled disease outbreak prediction and surveillance models**, such as UNICEF's *Magic Box* or South Africa's *Zindi*, generated risk maps to predict which African countries were likely to see imported infections during the COVID-19 onset. For malaria and dengue, remote sensing data and machine learning has helped predict outbreaks with 80%+ accuracy. These applications allow public health systems to have target resources to respond faster to emergencies.

- **AI-enabled preclinical research and clinical trials** have helped accelerate drug discovery, design, and feasibility testing[3]. Open science provides the foundation for many groundbreaking AI developments in the COVID-19 drug development and repurposing response. AI has proven to outperform conventional testing protocols for drug safety, streamline research and development efforts by automating the generation of drug-like molecules for targeting specific diseases, and create a new level of understanding for disease mechanisms and personalized treatments.

- **AI-enabled clinical diagnosis and prognosis** are being integrated into existing and new clinical workflows. Insightiv, an AI-powered radiology system using medical imaging and CT scans, is providing 98% COVID-19 test accuracy at Kigali's King Faisal Hospital. Elsewhere, researchers have applied machine learning classification and signal processing methods to detect preterm birth complications (as enabled through Cameroon's GiftedMom platform), malnutrition in children, tuberculosis, and cervical cancer.

- **AI-enabled patient-facing solutions** have expanded rapidly due to social distancing. The UK's Babyl has deployed AI-powered robots in Rwanda to conduct mass temperature screening, deliver medication to patients, and remind people to wear facemasks. Over two million Rwandans are using Babyl's AI-enabled chatbot for personalized health coaching or the delivery of non-clinical therapies. Kenya's Jacaranda Health, which is operating a fully self-sustaining chain of maternity clinics, is piloting an AI-enabled mobile phone system to capture and track patient's health trends and send customized health tips. Zimbabwe's Afya Pap is a chatbot app and digital health companion that dispenses medical advice and enables direct patient-to-doctor communication.

- **AI-enabled optimization of health operations.** With the help of natural language processing, data mining, and advanced planning, AI solutions can pool procurement for critical medical supplies (e.g., Africa Medical Supplies Platform). South Africa's Healthforce empowers nurses to perform physical examinations, take medical history, and initiate telemedicine consultations between remote doctors and their local patients. Zindi histories, a competition platform with the mission of building a data science ecosystem in Africa, organized a hackathon in Kenya to optimize the staffing of a child protection helpline. A Ghanaian start-up, minoHealth, uses AI to organize and store patients' health records in a secure cloud portal so they are continually analyzed and made available to physicians.

Recommendations

There is tremendous promise in the possibilities of AI in transforming healthcare in Africa. Achieving the aspiration of an open AI-enabled health ecosystem requires strategic vision, foundational policies and regulations to guide the application of this technology and protect the users. It also requires upfront public funding in line with countries' public health priorities, collaboration on interoperable modules, and the formation of a new workforce of African data scientists.

While AI health interventions hold definite promise, there are cross-cutting policy, regulatory, and implementation challenges that prevent their deployment from pilot to scale and prioritize AI applications for the social good. An evidence-based pathway is needed to inform key decisions and

implementation of AI. To strengthen Africa's health ecosystem, there is an overwhelming case for integrating AI applications into existing systems and institutions rather than starting from scratch or replacing an existing system.

A closer look at the building blocks of an AI-enabled healthcare ecosystem offers a holistic understanding of how these challenges could be resolved as part of an iterative innovation processs:

- Creating a strong digital health foundation for building effective AI solutions involves robust privacy legislation, interoperable digital health records, and dynamic social registries. New momentum is urgently needed for both strategy and implementation.
- Integrating AI innovations into existing primary and public health delivery systems requires a concerted effort. Data collection initiatives should be configured to create a minimum viable data set that is interoperable and minimally redundant. Existing paper records need to be converted to be machine-readable by AI applications.
- Adopting a basic regulatory framework is a precondition for a well-functioning, interoperable digital AI ecosystem among all stakeholders. Governance principles for the ethical use of data, which critically are absent in much of Africa, should specify the collection, management, protection, and sharing of patient data, balancing privacy concerns with the need to advance health innovation.
- Creating an open-source ecosystem, comprised of open datasets, shared code libraries, and common tools to annotate and anonymize data, is key for promoting a "maker culture" and addressing cross-cutting needs of AI in health. The scarcity of locally generated datasets for training AI models is a crucial gap for building AI systems in Africa.
- Securing dedicated funding from the government and philanthropies during the start-up phase can have a catalytic impact by ensuring that base products are open to all. As open ecosystems mature, public-private funding models can be employed.

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Policy experts and researchers from the African Center for Economic Transformation **(ACET)** and the Development and Economic Growth Research Programme **(DEGRP)**, in partnership with ODI, explore the critical role of innovation in Africa's recovery from COVID-19. Essays identify areas in which innovation can contribute to effective responses and offer high-level policy recommendations.

Endnotes

1. Ayomide Owoyemi et.al., "Artificial Intelligence for Healthcare in Africa" (Frontiers in Digital Health, July 2020); "Building a collaborative ecosystem for AI in healthcare in Low and Middle Income Economies" (Atlantic Council, August 2020).
2. *Reimagining Global Health through Artificial Intelligence: The Roadmap to AI Maturity* (Broadband Commission for Sustainable Development, September 2020).
3. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, Editors, *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril* (National Academy of Medicine, 2019).

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