Review

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Artificial Intelligence in African Healthcare: Catalyzing Innovation While Confronting Structural Challenges

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Abstract: Background: Artificial intelligence (AI) has emerged as a transformative force in global health, promising to improve diagnostic accuracy, optimize health systems, and enable real-time epidemiological surveillance. In Africa, where healthcare systems are often under-resourced yet rapidly digitizing, AI represents a dual opportunity: to leapfrog infrastructure limitations and to build context-specific solutions for persistent health inequities. **Objective:** This review examines the current landscape of AI in African healthcare, highlighting practical applications, emerging innovations, and systemic barriers. It explores how AI is catalyzing innovation across disease surveillance, diagnostics, supply chain management, and telehealth while unpacking the structural, ethical, and governance challenges that may hinder sustainable progress. **Methods:** A structured narrative review was conducted using peer-reviewed literature, regional policy reports, and case studies from academic and grey sources. The review synthesizes evidence from African countries actively deploying AI in healthcare and identifies common trends, gaps, and opportunities for future scale-up. **Findings:** AI-enabled interventions in Africa, such as algorithm-based TB screening, drone-assisted vaccine delivery, and chatbot-supported mental health care, demonstrate substantial potential. However, challenges persist around data governance, infrastructural disparities, algorithmic bias, and the lack of local capacity. The risk of digital colonialism remains high unless innovation is driven by African stakeholders and tailored to local contexts. **Conclusions:** For AI to meaningfully transform healthcare in Africa, investment must be channeled into ethical, inclusive, and African-led innovation ecosystems. Without addressing systemic barriers, the promise of AI may deepen health inequities rather than resolve them.

Keywords: artificial intelligence; african healthcare; health equity; machine learning; digital health

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Introduction

Africa faces a unique convergence of healthcare challenges and opportunities in the 21st century. Despite strides in reducing infectious disease burdens and increasing access to essential health services, the continent continues to bear a disproportionate share of the global disease burden, with limited healthcare infrastructure, personnel shortages, and underfunded health systems [1,2]. These

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systemic barriers have often curtailed the reach of high-quality care to underserved rural and peri-urban populations.

In parallel, digital innovation is transforming the way healthcare is delivered worldwide. Among the most promising tools is Artificial Intelligence (AI), a broad domain of computer science that uses algorithms and data to simulate human intelligence in tasks such as diagnosis, prognosis, treatment recommendations, and public health forecasting [3,4]. Global health systems, especially in high-income countries, have leveraged AI to improve clinical decision-making, streamline hospital operations, and develop early warning systems for disease outbreaks.

While Africa has often been framed as lagging in digital transformation, recent evidence suggests otherwise. Countries such as Rwanda, Nigeria, Ghana, and South Africa are pioneering localized AI applications in diagnostics, health logistics, and telemedicine [5–7]. Start-ups like Ubenwa (Nigeria), InstaDeep (Tunisia), and Zipline (Rwanda and Ghana) are pushing the boundaries of AI-enabled healthcare delivery, often in partnership with global tech firms [8–10].

However, these promising developments coexist with significant structural challenges. Africa's digital health infrastructure is marked by patchy connectivity, unreliable power supply, and limited health data interoperability [11]. Furthermore, the ethical implications of deploying AI technologies, especially those trained on non-African data, raise concerns about algorithmic bias, consent, and data sovereignty [12,13].

This review seeks to critically examine the dual narrative of AI in African healthcare: as a catalyst for innovation and as a domain fraught with systemic inequities. Our goals are threefold:

To map the current and emerging applications of AI across African health systems;

To identify the structural, ethical, and regulatory challenges impeding responsible AI deployment; and

To provide strategic recommendations for African-led innovation and governance in AI for health.

By synthesizing current literature, project case studies, and policy frameworks, we aim to provide researchers, policymakers, and practitioners with a balanced, forward-looking perspective on the potential and pitfalls of AI in transforming healthcare across Africa.

2. Artificial Intelligence in Global Health: A Brief Overview

Artificial Intelligence (AI) encompasses a suite of computational methods that enable machines to perform tasks traditionally requiring human intelligence, including pattern recognition, natural language processing (NLP), and decision-making under uncertainty [14,15]. Within healthcare, AI applications broadly fall into several categories: diagnostics, treatment recommendations, health system optimization, and public health surveillance.

Globally, AI-driven tools have shown remarkable success in augmenting medical imaging interpretation. For example, deep learning algorithms have achieved radiologist-level performance in detecting diseases such as diabetic retinopathy, lung cancer, and tuberculosis from imaging data [16–18]. Similarly, AI-powered predictive analytics have been employed to forecast patient deterioration in intensive care units, enabling early interventions that reduce mortality [19–22].

Public health has also benefited from AI innovations. During the COVID-19 pandemic, AI-enabled models tracked virus spread, informed contact tracing, and optimized resource allocation [23–26]. Beyond infectious diseases, AI has been used in chronic disease management through personalized treatment plans and virtual health assistants, enhancing patient engagement and adherence [4,27,28].

However, adoption and impact vary significantly between high-income countries (HICs) and low- and middle-income countries (LMICs). In HICs, robust electronic health records (EHRs), regulatory frameworks, and investment ecosystems have accelerated AI integration into clinical practice [29]. Conversely, LMICs face unique challenges: fragmented data systems, limited digital

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infrastructure, workforce capacity gaps, and ethical concerns related to data privacy and algorithmic bias [30–35].

Despite these hurdles, LMICs have demonstrated innovation potential by leapfrogging legacy systems and deploying AI via mobile health (mHealth) platforms and cloud-based services that circumvent infrastructure limitations [36–38]. Lessons from these contexts highlight the importance of adaptable AI solutions that prioritize inclusivity, transparency, and local ownership.

In summary, the global AI health ecosystem presents a compelling model for leveraging computational technologies to improve health outcomes. However, the heterogeneity of health system maturity, data ecosystems, and socio-political contexts necessitates tailored AI strategies to ensure equitable benefits, particularly for African health systems, which contend with specific systemic barriers and opportunities.

3. Current Landscape of AI in African Healthcare

Artificial Intelligence (AI) adoption in African healthcare is accelerating, fueled by both grassroots innovation and strategic government initiatives. The continent's youthful population, growing mobile connectivity, and rising data science capacity have created fertile ground for AI-driven health solutions tailored to local contexts [39–41]. However, uptake is uneven, reflecting disparities in digital infrastructure, investment, and policy environments across countries.

3.1. Policy and Strategic Frameworks

Several African nations have developed or are developing national digital health and AI strategies to guide innovation and investment. Rwanda's "AI for Health" strategy exemplifies a government-led approach to integrating AI into public health, focusing on diagnostics, health information systems, and training [42,43]. Similarly, Nigeria's National Artificial Intelligence Policy prioritizes health applications among other sectors, aiming to foster public-private partnerships and data governance frameworks [44,45].

At the continental level, the African Union's Digital Transformation Strategy for Africa 2020–2030 outlines AI as a critical enabler for achieving Sustainable Development Goals (SDGs), including Universal Health Coverage (UHC) [46]. The Africa CDC and Africa Health Strategy also underscore the role of AI in strengthening disease surveillance and response systems.

3.2. Key Actors and Innovations

AI innovations in African healthcare come from a mix of local start-ups, academic institutions, and multinational partnerships:

i. **Start-ups and Private Sector**: Companies such as Ubenwa (Nigeria) use AI to detect neonatal asphyxia via infant cry analysis, demonstrating practical AI applications that respond to specific local health challenges [47]. InstaDeep (Tunisia) applies machine learning for optimizing clinical trial designs and drug discovery [48]. Zipline (Rwanda/Ghana) combines AI with drone technology to optimize medical supply logistics in remote areas, significantly reducing delivery times for blood and vaccines [49].

ii. **Academic and Research Institutions**: Universities such as the University of Cape Town and Makerere University are building AI research hubs focused on health data science and machine learning tailored for African diseases and population health [50,51]. Collaborations with global AI centers provide training and infrastructure, fostering knowledge transfer.

iii. **International Partnerships**: Projects like the Deep Learning Indaba promote AI capacity building across Africa, nurturing a new generation of AI researchers and practitioners [52]. Moreover, collaborations with global technology companies (Google AI, Microsoft AI for Health) provide access to cloud computing resources and algorithmic expertise.

3.3. Applications in Practice

Several AI applications are already operational or in pilot phases within African health systems:

i. **Diagnostics**: AI-driven computer-aided detection (CAD) tools for tuberculosis screening via chest X-rays (e.g., CAD4TB) have been deployed in South Africa and Kenya, increasing diagnostic accuracy and enabling task shifting to less specialized health workers [53,54]. AI algorithms are also being trialed for cervical cancer screening using smartphone imaging in resource-constrained settings.

ii. **Disease Surveillance and Epidemiology**: AI-powered platforms analyze social media, health records, and environmental data to detect outbreaks earlier than traditional surveillance systems. For example, during the Ebola outbreaks, AI models were used for predicting spread patterns and resource needs [55,56].

iii. **Supply Chain Optimization**: The Zipline drone delivery network employs AI algorithms to optimize flight paths and inventory management, ensuring timely delivery of essential medical products to rural clinics [57,58].

iv. **Telemedicine and mHealth**: AI chatbots integrated into mobile health platforms provide symptom checking, triage, and health education, notably increasing access for remote and underserved populations [59,60].

3.4. Challenges and Gaps

Despite promising advances, African AI health initiatives face critical challenges:

i. **Data Scarcity and Quality**: Fragmented health information systems limit the availability of high-quality, interoperable data necessary to train robust AI models [61].

ii. **Digital Divide**: While mobile phone penetration is high, disparities persist in internet access, electricity, and digital literacy, particularly in rural and marginalized communities [62].

iii. **Limited Funding and Infrastructure**: Investment in AI health projects remains concentrated in a few countries, with many African health systems lacking basic digital infrastructure [63].

iv. **Ethical and Regulatory Frameworks**: Most African countries lack comprehensive data protection laws and AI governance frameworks tailored to healthcare, raising concerns about privacy, data sovereignty, and algorithmic accountability [64,65].

v. **Workforce Capacity**: There is a shortage of health workers trained in AI and data science, as well as interdisciplinary expertise to bridge the clinical, technical, and ethical domains [66–68].

4. Transformative Applications of AI in African Healthcare *(~900 words)*

Artificial Intelligence (AI) technologies are driving significant innovations in African healthcare, with applications spanning diagnostics, disease surveillance, health system optimization, and patient engagement. These use cases demonstrate how AI can help bridge longstanding healthcare gaps by enhancing efficiency, accuracy, and access, particularly in resource-constrained settings.

4.1. AI-Enabled Diagnostics and Clinical Decision Support

Diagnostics represents one of the most impactful domains for AI in African health systems. AI-powered image analysis tools have improved screening for prevalent diseases such as tuberculosis (TB), cervical cancer, and diabetic retinopathy, conditions with high morbidity and mortality in the region.

Tuberculosis Screening: Computer-aided detection (CAD) algorithms analyze chest X-rays to identify pulmonary TB, reducing reliance on scarce radiologists. Tools like CAD4TB have been validated in South Africa and Kenya, showing high sensitivity and specificity that facilitate earlier diagnosis and treatment initiation [69,70].

Cervical Cancer Screening: Due to the limited availability of cytology labs and specialists, AI-assisted image analysis of cervical photographs taken with smartphones provides a scalable

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alternative. Pilot programs in Uganda and Tanzania have demonstrated that AI can assist in triaging patients for further testing or treatment [71,72].

Retinal Disease Detection: AI tools for diabetic retinopathy screening deployed through telemedicine platforms enable early detection among diabetic patients, preventing blindness [73–75].

Beyond image analysis, AI-based clinical decision support systems (CDSS) are increasingly used to assist frontline health workers in diagnosing and managing diseases, particularly in rural clinics with limited specialist access. These systems integrate patient symptoms, history, and contextual data to recommend evidence-based interventions [76,77].

4.2. Disease Surveillance and Outbreak Prediction

AI contributes to strengthening Africa's capacity for infectious disease surveillance and outbreak response. Machine learning models analyze diverse data sources such as electronic health records, social media, climate data, and travel patterns to detect anomalies and predict disease spread.

Ebola and COVID-19: During the 2014–2016 Ebola outbreak and the COVID-19 pandemic, AI-powered tools aided in early detection, risk mapping, and resource allocation, enabling faster, data-driven responses [79,80].

Malaria and Other Vector-Borne Diseases: Predictive models incorporating meteorological and environmental data help forecast malaria outbreaks, informing proactive vector control measures [81,82].

AI-driven epidemiological modeling thus complements traditional surveillance systems, which are often hampered by reporting delays and under-resourced infrastructure.

4.3. Health System Optimization and Supply Chain Management

AI has transformed health logistics and supply chain management in African contexts, helping mitigate frequent stockouts and wastage of essential medicines and vaccines.

Zipline Drone Delivery: Zipline's AI-optimized drone logistics network operates in Rwanda and Ghana, delivering blood products and vaccines to remote clinics rapidly and reliably. AI algorithms optimize delivery routes, inventory management, and demand forecasting, reducing delivery times from days to hours and improving health outcomes [10,49,59].

Inventory Management: Machine learning models are increasingly applied to predict medication demand, enabling more accurate procurement and reducing expiry-related losses [83–85].

4.4. Telemedicine and mHealth Innovations

Mobile health (mHealth) platforms augmented by AI have expanded access to health information and basic diagnostic support for populations in rural and underserved areas.

Symptom Checkers and Chatbots: AI-powered chatbots deployed via mobile phones provide triage, symptom assessment, and health education, helping reduce the burden on overwhelmed health facilities [58,60].

Virtual Health Assistants: These systems offer personalized reminders for medication adherence, maternal health check-ups, and chronic disease management, improving patient outcomes through continuous engagement [86–88].

Language and Cultural Adaptation: Emerging AI applications are incorporating local languages and dialects to improve usability and acceptability among diverse African populations [89,90].

4.5. AI for Health Workforce Capacity Building

AI-driven platforms are also being used to train and support healthcare workers in Africa:

Virtual Training Simulations: AI-powered virtual patients and scenario-based training modules enable continuous education, especially for remote health workers [91,92].

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Decision Support for Task Shifting: AI tools facilitate task shifting by empowering community health workers with diagnostic and treatment guidance, expanding the reach of health services [93,94].

Structural and Ethical Challenges of AI Deployment in African Healthcare

While Artificial Intelligence (AI) offers promising avenues to enhance healthcare in Africa, its successful deployment faces multifaceted structural and ethical challenges. These challenges stem from underlying systemic issues in health and digital infrastructures, governance, and socio-cultural contexts. Addressing them is paramount to ensure AI solutions are equitable, sustainable, and aligned with the continent's health priorities.

5.1. Structural Barriers

5.1.1. Digital Infrastructure and Data Ecosystems

A fundamental barrier to AI implementation is the limited digital infrastructure across many African regions. Reliable electricity, high-speed internet, and robust health information systems remain scarce in rural and underserved areas, impeding data collection, storage, and real-time AI application [Reference Needed: WHO Global Digital Health Surveys; ITU Connectivity Reports].

Moreover, health data in many African countries are fragmented and often siloed within paper-based or disparate electronic systems. This fragmentation challenges the creation of comprehensive, high-quality datasets necessary for training accurate and generalizable AI models [**Reference Needed: Studies on African health data quality and interoperability**]. The paucity of annotated, labeled datasets further hinders AI development tailored to African populations, potentially exacerbating bias and reducing model effectiveness.

5.1.2. Workforce Capacity and Expertise

AI deployment requires a skilled workforce proficient in data science, machine learning, and clinical informatics, coupled with domain knowledge in public health and medicine. However, many African health systems face shortages of such interdisciplinary expertise [95,96**].**

Capacity-building initiatives, while growing, often lack scale and sustainability. Without sufficient local expertise, African countries risk dependency on external actors, limiting the autonomy to adapt AI tools to local health needs and contexts.

5.1.3. Financing and Investment

Investment in AI-enabled health innovation remains limited and unevenly distributed across Africa. Many projects rely on external donor funding or pilot grants, with few sustainable financing models to scale successful pilots into integrated health system components [**97,98**]. Private sector investment is nascent but growing, particularly in countries with more developed tech ecosystems. Encouraging domestic and regional investment through conducive policies and incentives is critical to ensure long-term sustainability.

5.2. Ethical and Regulatory Challenges

5.2.1. Data Privacy and Sovereignty

Health data are inherently sensitive. In Africa, many countries lack comprehensive data protection laws or regulatory frameworks governing data ownership, consent, and cross-border data flows [99–101]. This regulatory gap raises concerns about patient privacy, potential misuse of data, and erosion of trust.

Respecting data sovereignty is especially important given the increasing involvement of multinational technology firms in African AI health projects. Ensuring that data governance frameworks prioritize local control and benefit-sharing is critical to ethical AI deployment.

5.2.2. Algorithmic Bias and Fairness

AI models trained predominantly on data from non-African populations risk perpetuating biases and inaccuracies when applied in African contexts. For example, dermatological AI diagnostic tools trained on lighter skin tones may underperform for darker-skinned patients [102,103]. Ensuring fairness requires developing diverse, representative datasets and ongoing evaluation of AI systems for equity in performance across demographic groups.

5.2.3. Transparency and Accountability

The lack of transparency for users and regulators undermines clinical trust and complicates accountability, especially when AI-driven recommendations influence patient care or the allocation of resources [104,105]. Developing explainable AI (XAI) approaches and establishing clear lines of accountability between AI developers, healthcare providers, and policymakers is essential to safe and ethical AI integration.

5.2.4. Socio-Cultural Acceptance and Inclusion

AI tools must be culturally sensitive and inclusive to gain acceptance among healthcare workers and patients. Language barriers, literacy levels, and cultural norms influence how AI-powered applications are perceived and used [106–108]. Involving local stakeholders in AI design and deployment fosters trust, relevance, and usability, mitigating risks of marginalization or resistance.

5.3. Addressing Challenges: Recommendations

To overcome these structural and ethical challenges, the following strategies are essential:

- **Strengthen Digital Infrastructure**: Investment in broadband, electricity, and interoperable health information systems must be prioritized alongside AI initiatives.
- **Build Local Capacity**: Expand interdisciplinary education and training programs in AI, data science, and digital health tailored for African contexts.
- **Develop Ethical and Regulatory Frameworks**: Governments and regional bodies should enact comprehensive data protection laws and AI governance policies emphasizing privacy, transparency, and equity.
- **Promote Inclusive AI Design**: Foster participatory approaches that engage communities, health workers, and policymakers to ensure culturally sensitive, user-centered AI solutions.
- **Sustain Financing and Partnerships**: Encourage blended financing models combining public, private, and donor resources to scale effective AI interventions sustainably.
- **Enhance Data Governance and Sovereignty**: Implement policies that safeguard local data ownership and equitable benefit sharing, particularly in partnerships with international technology firms.

Future Directions and Policy Recommendations

The integration of Artificial Intelligence (AI) into African healthcare presents a unique opportunity to accelerate progress toward Universal Health Coverage (UHC) and Sustainable Development Goals (SDGs). To harness AI's full potential while mitigating risks, a strategic, multi-sectoral approach is imperative. This section outlines key future directions and policy recommendations to guide governments, researchers, industry stakeholders, and international partners.

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3.1. Strengthening AI Research and Innovation Ecosystems

Sustained investment in African-led AI research is critical. Governments and funding agencies should prioritize support for research institutions that:

- Develop AI models trained on African datasets reflecting local epidemiology and health system realities.
- Promote interdisciplinary collaborations bridging data science, clinical medicine, public health, and social sciences.
- Foster innovation hubs and incubators focused on scalable AI health solutions.
- Facilitate access to computational resources and data infrastructure necessary for AI development [109–111].

6.2. Enhancing Capacity Building and Education

Expanding capacity-building programs across Africa is essential to cultivate a skilled AI health workforce, including data scientists, bioinformaticians, health informaticians, and clinicians versed in AI applications. Key strategies include:

- Integrating AI and data science curricula into medical, nursing, and public health education.
- Supporting continuing professional development through workshops, fellowships, and online learning platforms.
- Encouraging south-south knowledge exchange and regional training networks such as the Deep Learning Indaba and African Institute for Mathematical Sciences (AIMS) [112–114].

6.3. Developing Robust Ethical and Regulatory Frameworks

Policymakers must enact and enforce comprehensive frameworks that govern AI use in healthcare with emphasis on:

- Data privacy, security, and patient consent aligned with international best practices and African socio-legal contexts.
- Algorithmic transparency, fairness, and accountability mechanisms.
- Guidelines for clinical validation and approval of AI tools before integration into health systems.
- Inclusive stakeholder engagement ensuring diverse representation in AI governance [115,116].

6.4. Fostering Multi-Stakeholder Partnerships

Public-private partnerships (PPPs), involving governments, academia, civil society, and industry, can catalyze AI deployment by pooling expertise, resources, and infrastructure. Such partnerships should:

- Prioritize open data initiatives and interoperable platforms to maximize AI utility.
- Ensure equitable benefit sharing and local capacity strengthening.
- Promote scalable pilots transitioning to sustainable national programs [117,118].

6.5. Addressing Equity and Inclusion

AI solutions must be designed to reduce health disparities by prioritizing:

- Accessibility for marginalized groups, including rural populations, women, and persons with disabilities.
- Multilingual interfaces and culturally sensitive content.
- Mechanisms to monitor and mitigate algorithmic bias and unintended consequences [119–122].

6.6. Investing in Infrastructure and Data Ecosystems

Investment in digital infrastructure must accompany AI adoption to ensure reliable data flows and system integration. Actions include:

- Expanding broadband coverage and affordable internet access.
- Implementing interoperable electronic health records and data standards.
- Establishing national and regional health data repositories to support AI development [123–126].

Conclusions

Artificial Intelligence is poised to revolutionize healthcare in Africa by catalyzing innovation, improving disease diagnosis, enhancing health system efficiency, and expanding access to quality care. This review has highlighted the multifaceted applications of AI, from AI-driven diagnostics and outbreak surveillance to supply chain optimization and telemedicine, demonstrating its capacity to address some of the continent's most pressing health challenges.

Yet, realizing AI's transformative potential requires more than technological innovation. Structural barriers such as limited digital infrastructure, fragmented data ecosystems, workforce shortages, and financing gaps must be overcome. Equally critical are the ethical challenges surrounding data privacy, algorithmic bias, transparency, and cultural acceptance, which demand robust governance frameworks rooted in African contexts.

Future success hinges on coordinated efforts to strengthen research and innovation ecosystems, build interdisciplinary capacity, develop and enforce ethical and regulatory standards, foster inclusive partnerships, and invest in foundational infrastructure. Prioritizing equity and local ownership throughout the AI lifecycle will ensure that technological advancements translate into tangible health benefits for all populations, including historically marginalized groups.

For African health systems grappling with a growing burden of infectious and non-communicable diseases, AI offers a pathway to leapfrog traditional constraints and accelerate progress toward Universal Health Coverage and the Sustainable Development Goals. However, this requires deliberate policy leadership and sustainable investment anchored in collaboration across governments, academia, industry, and communities.

This review serves as a call to action for all stakeholders to embrace the opportunities of AI while conscientiously confronting its challenges, ensuring that the future of healthcare in Africa is not only innovative but also equitable, ethical, and sustainable.

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References

1. Results Report 2024. (2024). https://www.theglobalfund.org/media/14794/core_2024-results_report_en.pdf.
2. Oleribe, O. E., Momoh, J., Uzochukwu, B. S., Mbofana, F., Adebiyi, A., Barbera, T., Williams, R., & Robinson, S. D. T. (2019). <p>Identifying Key Challenges Facing Healthcare Systems In Africa And Potential Solutions</p> International Journal of General Medicine, Volume 12, 395–403. https://doi.org/10.2147/ijgm.s223882
3. Khosravi, M., Zare, Z., Mojtabaeian, S. M., & Izadi, R. (2024). Artificial Intelligence and Decision-Making in Healthcare: A Thematic Analysis of a Systematic Review of reviews. Health Services Research and Managerial Epidemiology, 11. https://doi.org/10.1177/23333928241234863
4. Alowais, S. A., Alghamdi, S. S., Alsuhebany, N., Alqahtani, T., Alshaya, A. I., Almohareb, S. N., Aldairem, A., Alrashed, M., Saleh, K. B., Badreldin, H. A., Yami, M. S. A., Harbi, S. A., & Albekairy, A. M. (2023). Revolutionizing healthcare: the role of artificial intelligence in clinical practice. BMC Medical Education, 23(1). https://doi.org/10.1186/s12909-023-04698-z

 doi:10.20944/preprints202506.1824.v1

5. Mboa Nkoudou, T. H., International Centre of Expertise in Montreal on Artificial Intelligence, & International Development Research Centre. (2024). State of AI in healthcare in Sub-Saharan Africa. In J. P. Nsengimana, J. Cyizere, P. Yap, H. Lakougna, C. Sinha, N. Oum, A. Christabella, D. A. Eto, T. W. Ulrich, G. Le Peuch, C. Renaud, S. Janusz, J. Houde, B. F. Nga Ondigui, S. Fallaha, S. King, & M. Marcotte, State of AI in Healthcare in Sub-Saharan Africa. https://doi.org/10.5281/zenodo.12628185
6. Andigema, A. S., Cyrielle, N. N. T., Danaëlle, M. K. L., & Ekwelle, E. (2024). Transforming African Healthcare with AI: Paving the Way for Improved Health Outcomes. www.jscimedcentral.com. https://doi.org/10.47739/1046
7. Ephraim, R. K. D., Kotam, G. P., Duah, E., Ghartey, F. N., Mathebula, E. M., & Mashamba-Thompson, T. P. (2024). Application of medical artificial intelligence technology in sub-Saharan Africa: Prospects for medical laboratories. Smart Health, 33, 100505. https://doi.org/10.1016/j.smhl.2024.100505
8. Ubenwa - The first technology for interpreting infant cry sounds. (n.d.). https://www.ubenwa.ai/
9. InstaDeep Ltd. (2024, December 19). Home | InstaDeep - Decision-Making AI for the Enterprise. InstaDeep. https://www.instadeep.com/
10. Zipline Drone Delivery & Logistics. (n.d.). Zipline. https://www.flyzipline.com/
11. Meslamani, A. Z. A. (2023). Technical and regulatory challenges of digital health implementation in developing countries. Journal of Medical Economics, 26(1), 1057–1060. https://doi.org/10.1080/13696998.2023.2249757
12. Hanna, M., Pantanowitz, L., Jackson, B., Palmer, O., Visweswaran, S., Pantanowitz, J., Deebajah, M., & Rashidi, H. (2024). Ethical and bias considerations in artificial intelligence (AI)/Machine learning. Modern Pathology, 100686. https://doi.org/10.1016/j.modpat.2024.100686
13. Pasipamire, N., & Muroyiwa, A. (2024). Navigating algorithm bias in AI: ensuring fairness and trust in Africa. Frontiers in Research Metrics and Analytics, 9. https://doi.org/10.3389/frma.2024.1486600
14. Soori, M., Arezoo, B., & Dastres, R. (2023). Artificial intelligence, machine learning, and deep learning in advanced robotics: a review. Cognitive Robotics, 3, 54–70. https://doi.org/10.1016/j.cogr.2023.04.001
15. Xu, Y., Liu, X., Cao, X., Huang, C., Liu, E., Qian, S., Liu, X., Wu, Y., Dong, F., Qiu, C., Qiu, J., Hua, K., Su, W., Wu, J., Xu, H., Han, Y., Fu, C., Yin, Z., Liu, M., . . . Zhang, J. (2021). Artificial intelligence: A powerful paradigm for scientific research. The Innovation, 2(4), 100179. https://doi.org/10.1016/j.xinn.2021.100179
16. Hwang, E. J., & Park, C. M. (2020). Clinical implementation of deep learning in thoracic radiology: Potential applications and challenges. Korean Journal of Radiology, 21(5), 511. https://doi.org/10.3348/kjr.2019.0821
17. Hwang, E. J., Park, S., Jin, K., Kim, J. I., Choi, S. Y., Lee, J. H., Goo, J. M., Aum, J., Yim, J., Cohen, J. G., Ferretti, G. R., & Park, C. M. (2019). Development and validation of a Deep Learning–Based Automated detection algorithm for major thoracic diseases on chest radiographs. JAMA Network Open, 2(3), e191095. https://doi.org/10.1001/jamanetworkopen.2019.1095
18. Rajpurkar, P., Irvin, J., Ball, R. L., Zhu, K., Yang, B., Mehta, H., Duan, T., Ding, D., Bagul, A., Langlotz, C. P., Patel, B. N., Yeom, K. W., Shpanskaya, K., Blankenberg, F. G., Seekins, J., Amrhein, T. J., Mong, D. A., Halabi, S. S., Zucker, E. J., . . . Lungren, M. P. (2018). Deep learning for chest radiograph diagnosis: A retrospective comparison of the CheXNeXt algorithm to practicing radiologists. PLoS Medicine, 15(11), e1002686. https://doi.org/10.1371/journal.pmed.1002686
19. AI-Powered Predictive Analytics for Early Detection of Patient Deterioration: Implications for Nursing Care | Journal of Neonatal Surgery. (n.d.). https://www.jneonatalsurg.com/index.php/jns/article/view/5592
20. Yuan, S., Yang, Z., Li, J., Wu, C., & Liu, S. (2025). AI-Powered early warning systems for clinical deterioration significantly improve patient outcomes: a meta-analysis. pmc.ncbi.nlm.nih.gov. https://doi.org/10.1186/s12911-025-03048-x
21. Kuan, L. C., Chin, L. Y., De, L. J., Cheng, C. Y., Tuao, Z., Zixian, Y., & Roy, D. (2024). Predictive analysis of patient risk of death in ICU: A bibliometric analysis. SHS Web of Conferences, 194, 01005. https://doi.org/10.1051/shsconf/202419401005
22. Gonzalez, F. A., Santonocito, C., Lamasb, T., Costa, P., Vieira, S. M., Ferreira, H. A., & Sanfilippo, F. (2024). Is artificial intelligence prepared for the 24-h shifts in the ICU? Anaesthesia Critical Care & Pain Medicine, 101431. https://doi.org/10.1016/j.accpm.2024.101431

23. Ding, X., Shang, B., Xie, C., Xin, J., & Yu, F. (2025). Artificial intelligence in the COVID-19 pandemic: balancing benefits and ethical challenges in China's response. Humanities and Social Sciences Communications, 12(1). https://doi.org/10.1057/s41599-025-04564-x
24. Gawande, M. S., Zade, N., Kumar, P., Gundewar, S., Weerarathna, I. N., & Verma, P. (2025). The role of artificial intelligence in pandemic responses: from epidemiological modeling to vaccine development. Molecular Biomedicine, 6(1). https://doi.org/10.1186/s43556-024-00238-3
25. Lv, C., Guo, W., Yin, X., Liu, L., Huang, X., Li, S., & Zhang, L. (2024). Innovative applications of artificial intelligence during the COVID-19 pandemic. Infectious Medicine, 3(1), 100095. https://doi.org/10.1016/j.imj.2024.100095
26. Xu, Z., Su, C., Xiao, Y., & Wang, F. (2021). Artificial intelligence for COVID-19: battling the pandemic with computational intelligence. Intelligent Medicine, 2(1), 13–29. https://doi.org/10.1016/j.imed.2021.09.001
27. Dong, C., Ji, Y., Fu, Z., Qi, Y., Yi, T., Yang, Y., Sun, Y., & Sun, H. (2025). Precision Management in Chronic Disease: An AI empowered Perspective on Medicine-Engineering Crossover. iScience, 28(3), 112044. https://doi.org/10.1016/j.isci.2025.112044
28. Arefin, S. (2024). Chronic Disease Management through an AI-Powered Application. Journal of Service Science and Management, 17(04), 305–320. https://doi.org/10.4236/jssm.2024.174015
29. Artificial Intelligence in healthcare. (2025, June 4). Public Health. https://health.ec.europa.eu/ehealth-digital-health-and-care/artificial-intelligence-healthcare_en
30. Tan, T. F., Thirunavukarasu, A. J., Jin, L., Lim, J., Poh, S., Teo, Z. L., Ang, M., Chan, R. V. P., Ong, J., Turner, A., Karlström, J., Wong, T. Y., Stern, J., & Ting, D. S. (2023). Artificial intelligence and digital health in global eye health: opportunities and challenges. The Lancet Global Health, 11(9), e1432–e1443. https://doi.org/10.1016/s2214-109x(23)00323-6
31. Adhikari, S., Ahmed, I., Bajracharya, D., Khanal, B., Solomon, C., Jayaratne, K., Mamum, K. a. A., Talukder, M. S. H., Shakya, S., Manandhar, S., Memon, Z. A., Chowdhury, M. H., Islam, I. U., Rakhshani, N. S., & Khan, M. I. (2025). Transforming healthcare through just, equitable and quality driven artificial intelligence solutions in South Asia. Npj Digital Medicine, 8(1). https://doi.org/10.1038/s41746-025-01534-0
32. McCoy, L. G., Bihorac, A., Celi, L. A., Elmore, M., Kewalramani, D., Kwaga, T., Martinez-Martin, N., Prôa, R., Schamroth, J., Shaffer, J. D., Youssef, A., & Fiske, A. (2025). Building health systems capable of leveraging AI: applying Paul Farmer's 5S framework for equitable global health. BMC Global and Public Health, 3(1). https://doi.org/10.1186/s44263-025-00158-6
33. Mennella, C., Maniscalco, U., De Pietro, G., & Esposito, M. (2024). Ethical and regulatory challenges of AI technologies in healthcare: A narrative review. Heliyon, 10(4), e26297. https://doi.org/10.1016/j.heliyon.2024.e26297
34. Kaushik, A., Barcellona, C., Mandyam, N. K., Tan, S. Y., & Tromp, J. (2024). Challenges and opportunities for data sharing related to Artificial Intelligence (AI) tools in healthcare in low- and middle-income countries: A systematic review and case study from Thailand. (Preprint). Journal of Medical Internet Research, 27, e58338. https://doi.org/10.2196/58338
35. Siafakas, N., & Vasarmidi, E. (2024). Risks of artificial intelligence (AI) in Medicine. Pneumon, 37(3), 1–5. https://doi.org/10.18332/pne/191736
36. Dushma. (2025, June 9). MHealth Adoption in Low- and Middle-Income Countries: Progress, Challenges, and Opportunities. GIPHI - We Change Lives. https://giphi.ca/2025/04/28/mhealth-adoption-in-low-and-middle-incomecountries-progress-challenges-and-opportunities/#:~:text=This%20mobile%20application%20speeds%20up,less%20than%2030%25%20before%20implementation.
37. Poulsen, A., Hickie, I. B., Alam, M., Wilson, C. E., & LaMonica, H. M. (2025). Access to mobile health in lower-middle-income countries: a review. Health and Technology. https://doi.org/10.1007/s12553-025-00948-w
38. Agarwal, S., Perry, H. B., Long, L., & Labrique, A. B. (2015). Evidence on feasibility and effective use of mHealth strategies by frontline health workers in developing countries: systematic review. Tropical Medicine & International Health, 20(8), 1003–1014. https://doi.org/10.1111/tmi.12525

39. Continental Artificial Intelligence Strategy. (2024). In United Nations Educational, Scientific and Cultural Organization, Continental Artificial Intelligence Strategy. https://au.int/sites/default/files/documents/44004-doc-EN-_Continental_AI_Strategy_July_2024.pdf
40. Vista de The impact of the AI in the regional integration between the EU and Africa | Revista Derecho y Economía de la Integración. (n.d.). https://revistas.colex.es/index.php/derechoeconomiaintegracion/article/view/275/475
41. The future of work in Africa. (2020). In J. Choi, M. A. Dutz, & Z. Usman (Eds.), Africa Development Forum. https://documents1.worldbank.org/curated/en/511511592867036615/pdf/The-Future-of-Work-in-Africa-Harnessing-the-Potential-of-Digital-Technologies-for-All.pdf
42. The AI Social Contract Index 2020. (n.d.). The AI Social Contract Index 2020, 198–200. https://s899a9742c3d83292.jimcontent.com/download/version/1648057926/module/8292101063/name/AISCI-2020-Rwanda.pdf
43. AI strategies and policies in Rwanda - OECD.AI. (n.d.). https://oecd.ai/en/dashboards/countries/Rwanda
44. National Artificial Intelligence Strategy | The Federal Ministry of Communications, Innovation and Digital Economy. (2023, November 18). The Federal Ministry of Communications, Innovation and Digital Economy. https://fmcide.gov.ng/initiative/nais/
45. AI strategies and policies in Nigeria - OECD.AI. (n.d.). https://oecd.ai/en/dashboards/countries/Nigeria
46. AFRICAN UNION UNION AFRICAINE. (2020). THE DIGITAL TRANSFORMATION STRATEGY FOR AFRICA (2020-2030). https://au.int/sites/default/files/documents/38507-doc-dts-english.pdf
47. Masso, A., Chukwu, M., & Calzati, S. (2022). (Non)negotiable spaces of algorithmic governance: Perceptions on the Ubenwa health app as a 'relocated' solution. New Media & Society, 24(4), 845–865. https://doi.org/10.1177/14614448221079027
48. Johns, L. (2024, February 14). BioNTECh to acquire InstaDeep to strengthen pioneering position in the field of AI-powered drug discovery, design and development. InstaDeep. https://instadeep.com/2023/01/biontech-to-acquire-instadeep-to-strengthen-pioneering-position-in-the-field-of-ai-powered-drug-discovery-design-and-development/
49. Ackerman, E., & Koziol, M. (2022, February 28). In the Air With Zipline's Medical Delivery Drones. IEEE Spectrum. https://spectrum.ieee.org/in-the-air-with-ziplines-medical-delivery-drones
50. Anyango, J., & Anyango, J. (2025, March 17). Makerere launches AI and Data Science Centre to drive Africa's technological development. Makerere University News. https://news.mak.ac.ug/2025/03/makerere-launches-ai-and-data-science-centre-to-drive-africas-technological-development/
51. Using AI to tailor drugs for Africa. (2024, April 22). UCT News. https://www.news.uct.ac.za/news/audio/-article/2024-04-22-using-ai-to-tailor-drugs-for-africa
52. Reports and Analysis - Deep Learning Indaba. (2019, June 18). Deep Learning Indaba. https://deeplearningindaba.com/about/resources/white-papers-reports/
53. Nzimande, N., Murphy, K., Reither, K., Bosman, S., Ayakaka, I., Glass, T. R., Vanobberghen, F., Jacobs, B. K., Signorell, A., & Ncayiyana, J. (2025). Performance of CAD4TB artificial intelligence technology in TB screening programmes among the adult population in South Africa and Lesotho. Journal of Clinical Tuberculosis and Other Mycobacterial Diseases, 100540. https://doi.org/10.1016/j.jctube.2025.100540
54. Qin, Z. Z., Van Der Walt, M., Moyo, S., Ismail, F., Maribe, P., Denkinger, C. M., Zaidi, S., Barrett, R., Mvusi, L., Mkhondo, N., Zuma, K., Manda, S., Koeppel, L., Mthiyane, T., & Creswell, J. (2024). Computer-aided detection of tuberculosis from chest radiographs in a tuberculosis prevalence survey in South Africa: external validation and modelled impacts of commercially available artificial intelligence software. The Lancet Digital Health, 6(9), e605–e613. https://doi.org/10.1016/s2589-7500(24)00118-3
55. Kwofie, S. K., Adams, J., Broni, E., Enninful, K. S., Agoni, C., Soliman, M. E. S., & Wilson, M. D. (2023). Artificial intelligence, machine learning, and big data for Ebola virus drug discovery. Pharmaceuticals, 16(3), 332. https://doi.org/10.3390/ph16030332
56. Sarumi, O. A. (2021). Machine Learning-Based Big Data Analytics Framework for Ebola Outbreak Surveillance. In Advances in Intelligent Systems and computing (pp. 580–589). https://doi.org/10.1007/978-3-030-71187-0_53

57. Kremer, P., Haruna, F., Sarpong, R. T., Agamah, D., Billy, J., Osei-Kwakye, K., Aidoo, P., Dodoo, D., & Okoh-Owusu, M. (2023). An impact assessment of the use of aerial logistics to improve access to vaccines in the Western-North Region of Ghana. Vaccine, 41(36), 5245–5252. https://doi.org/10.1016/j.vaccine.2023.06.036
58. Nordling, L. (2024). New AI chatbot will make African health data more usable. Nature Africa. https://doi.org/10.1038/d44148-024-00249-w
59. IDInsight. (2022). Impact evaluation of Zipline Ghana. https://www.idinsight.org/wp-content/uploads/2022/06/Zipline-Brief-FINAL-Digital-v3.pdf
60. Phiri, M., & Munoriyarwa, A. (2022). Health Chatbots in Africa: Scoping review. Journal of Medical Internet Research, 25, e35573. https://doi.org/10.2196/35573
61. Data quality assurance (DQA). (n.d.). https://www.who.int/data/data-collection-tools/health-service-data/data-quality-assurance-dqa
62. 2025 – GSMA Mobile Connectivity Index. (n.d.). 2025 – GSMA Mobile Connectivity Index. https://www.mobileconnectivityindex.com/index.html
63. World Health Organization. (n.d.). Contact us. https://apps.who.int/gho/data/node.main-afro.HEALTHFINANCING?lang=en
64. Regulating Artificial Intelligence in Africa: Strategies and Insights from Kenya, Ghana, and the African Union. (2024, September 18). Wilson Center. https://www.wilsoncenter.org/blog-post/regulating-artificial-intelligence-africa-strategies-and-insights-kenya-ghana-and-african#:~:text=AU%20Continental%20AI%20Strategy&text=On%20AI%2C%20the%20AU%20has,for%20African%20economies%20and%20societies.
65. Hennemann, M. (2021). African Data Protection Laws and Artificial intelligence - Regulation, policy and ways forward. In Centre for Human Rights, University of Pretoria & Bavarian State Ministry of Science and Culture, Centre for Human Rights, University of Pretoria's conference "Privacy and data protection law and practice in Africa - Challenges and prospects." https://www.pulp.up.ac.za/images/edocman/edited-collections/data_privacy/Chapter%205.pdf
66. Almyranti, M., Dr, Sutherland, E., Ash, N., Dr, & Eiszele, S. (2024). ARTIFICIAL INTELLIGENCE AND THE HEALTH WORKFORCE. In OECD, OECD ARTIFICIAL INTELLIGENCE PAPERS (pp. 1–4) [Report]. OECD. https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/11/artificial-intelligence-and-the-health-workforce_c8e4433d/9a31d8af-en.pdf
67. Rony, M. K. K., Akter, K., Nesa, L., Islam, M. T., Johra, F. T., Akter, F., Uddin, M. J., Begum, J., Noor, M. A., Ahmad, S., Tanha, S. M., Khatun, M. T., Bala, S. D., & Parvin, M. R. (2024). Healthcare workers' knowledge and Attitudes regarding artificial intelligence adoption in healthcare: a cross-sectional study. Heliyon, 10(23), e40775. https://doi.org/10.1016/j.heliyon.2024.e40775
68. Chinta, S. V., Wang, Z., Palikhe, A., Zhang, X., Kashif, A., Smith, M. A., Liu, J., & Zhang, W. (2025). AI-driven healthcare: Fairness in AI healthcare: A survey. PLOS Digital Health, 4(5), e0000864. https://doi.org/10.1371/journal.pdig.0000864
69. Edem, V. F., Nkereuwem, E., Agbla, S. C., Owusu, S. A., Sillah, A. K., Saidy, B., Jallow, M. B., Forson, A. G., Egere, U., Kampmann, B., & Togun, T. (2024b). Accuracy ofComputer-Aided Detection for Tuberculosis® on paediatric chest radiographs. European Respiratory Journal, 2400811. https://doi.org/10.1183/13993003.00811-2024
70. Breuninger, M., Van Ginneken, B., Philipsen, R. H. H. M., Mhimbira, F., Hella, J. J., Lwilla, F., Van Den Hombergh, J., Ross, A., Jugheli, L., Wagner, D., & Reither, K. (2014). Diagnostic Accuracy of Computer-Aided Detection of Pulmonary Tuberculosis in Chest Radiographs: A Validation Study from Sub-Saharan Africa. PLoS ONE, 9(9), e106381. https://doi.org/10.1371/journal.pone.0106381
71. Wu, T., Lucas, E., Zhao, F., Basu, P., & Qiao, Y. (2024). Artificial intelligence strengthenes cervical cancer screening – present and future. Cancer Biology and Medicine, 1–16. https://doi.org/10.20892/j.issn.2095-3941.2024.0198
72. Du, H., Dai, W., Zhou, Q., Li, C., Li, S. C., Wang, C., Tang, J., Wu, X., & Wu, R. (2023). AI-assisted system improves the work efficiency of cytologists via excluding cytology-negative slides and accelerating the slide interpretation. Frontiers in Oncology, 13. https://doi.org/10.3389/fonc.2023.1290112

 doi:10.20944/preprints202506.1824.v1

73. Orbis. (2024, February 6). First-of-its-Kind study finds artificial intelligence screenings improve eye care access in Sub-Saharan Africa. Orbis. http://orbis.org/en/news/2022/ai-africa#:~:text=First-of-its-Kind%20Study%20Finds%20Artificial%20Intelligence%20Screenings%20Improve%20Eye%20Care%20Access%20in%20Sub-Saharan%20Africa.&text=Orbis%20announces%20new%20research%20findings%20demonstrating%20that,loss%20due%20to%20diabetes%20in%20the%20region.
74. Mathenge, W. C. (2019). Artificial intelligence for diabetic retinopathy screening in Africa. The Lancet Digital Health, 1(1), e6–e7. https://doi.org/10.1016/s2589-7500(19)30009-3
75. Bellemo, V., Lim, Z. W., Lim, G., Nguyen, Q. D., Xie, Y., Yip, M. Y. T., Hamzah, H., Ho, J., Lee, X. Q., Hsu, W., Lee, M. L., Musonda, L., Chandran, M., Chipalo-Mutati, G., Muma, M., Tan, G. S. W., Sivaprasad, S., Menon, G., Wong, T. Y., & Ting, D. S. W. (2019). Artificial intelligence using deep learning to screen for referable and vision-threatening diabetic retinopathy in Africa: a clinical validation study. The Lancet Digital Health, 1(1), e35–e44. https://doi.org/10.1016/s2589-7500(19)30004-4
76. Matthys, B., Monnier, N., Ngaradoumadji, M., Toubangue, Y., Delcroix, P., Pereira, M., Schmitz, T., Armour-Marshall, J., Zahorka, M., Sugimoto, K., Léchenne, M., Revault, D., Wyss, K., & Montolnan, A. (2025b). Development and implementation of a digital clinical decision support system to increase the quality of primary healthcare delivery in a refugee setting in Chad. BMC Primary Care, 26(1). https://doi.org/10.1186/s12875-025-02818-w
77. Nortey, J. N. N., Takyi, K., Adabo, A., & Suleiman, R. (2023b). Clinical Decision Support Systems implementation in Africa: a systemic review. medRxiv (Cold Spring Harbor Laboratory). https://doi.org/10.1101/2023.10.07.23296693
78. Abebe, G. F., Alie, M. S., Yosef, T., Asmelash, D., Dessalegn, D., Adugna, A., & Girma, D. (2025). Role of digital technology in epidemic control: a scoping review on COVID-19 and Ebola. BMJ Open, 15(1), e095007. https://doi.org/10.1136/bmjopen-2024-095007
79. Ankolekar, A., Eppings, L., Bottari, F., Pinho, I. F., Howard, K., Baker, R., Nan, Y., Xing, X., Walsh, S. L., Vos, W., Yang, G., & Lambin, P. (2024). Using artificial intelligence and predictive modelling to enable learning healthcare systems (LHS) for pandemic preparedness. Computational and Structural Biotechnology Journal, 24, 412–419. https://doi.org/10.1016/j.csbj.2024.05.014
80. Colubri, A., Hartley, M., Siakor, M., Wolfman, V., Felix, A., Sesay, T., Shaffer, J. G., Garry, R. F., Grant, D. S., Levine, A. C., & Sabeti, P. C. (2019). Machine-learning Prognostic Models from the 2014–16 Ebola Outbreak: Data-harmonization Challenges, Validation Strategies, and mHealth Applications. EClinicalMedicine, 11, 54–64. https://doi.org/10.1016/j.eclinm.2019.06.003
81. Zheng, J., Lu, S., Li, Q., Li, Y., Xue, J., Gavana, T., Chaki, P., Xiao, N., Mlacha, Y., Wang, D., & Zhou, X. (2024). Deciphering the climate-malaria nexus: A machine learning approach in rural southeastern Tanzania. Public Health, 238, 124–130. https://doi.org/10.1016/j.puhe.2024.11.013
82. Khan, O., Ajadi, J. O., & Hossain, M. P. (2024b). Predicting malaria outbreak in The Gambia using machine learning techniques. PLoS ONE, 19(5), e0299386. https://doi.org/10.1371/journal.pone.0299386
83. Ahmadirad, Z. (2025). The role of AI and machine learning in supply chain optimization. ijsetpub.com. https://doi.org/10.63053/ijset.77
84. Musa, S. M., Haruna, U. A., Aliyu, L. J., Zubairu, M., & Lucero-Prisno, D. E. (2025). Leveraging AI to optimize vaccines supply chain and logistics in Africa: opportunities and challenges. Frontiers in Pharmacology, 16. https://doi.org/10.3389/fphar.2025.1531141
85. Atadoga, N. A., Obi, N. O. C., Osasona, N. F., Onwusinkwue, N. S., Daraojimba, N. a. I., & Dawodu, N. S. O. (2024). AI in supply chain optimization: A comparative review of USA and African Trends. International Journal of Science and Research Archive, 11(1), 896–903. https://doi.org/10.30574/ijsra.2024.11.1.0156
86. Langston, E. M., Hattakitjamroen, V., Hernandez, M., Lee, H. S., Mason, H. Ç., Louis-Charles, W., Charness, N., Czaja, S. J., Rogers, W. A., Sharit, J., & Boot, W. R. (2025). Exploring Artificial Intelligence-Powered Virtual Assistants to Understand their Potential to Support Older Adults' Search Needs. Human Factors in Healthcare, 100092. https://doi.org/10.1016/j.hfh.2025.100092

87. Maher, C., Singh, B., Wylde, A., & Chastin, S. (2024). Virtual health assistants: a grand challenge in health communications and behavior change. Frontiers in Digital Health, 6. https://doi.org/10.3389/fdgth.2024.1418695
88. Chavali, D. P., Dhiman, V. K., & Katari, S. C. (2024). AI powered Virtual Health Assistants: Transforming patient engagement through virtual nursing. IJPS Journal. https://doi.org/10.5281/zenodo.10691495
89. Ndembi, N., Rammer, B., Fokam, J., Dinodia, U., Tessema, S. K., Nsengimana, J. P., Mwangi, S., Adzogenu, E., Dongmo, L. T., Rees, B., O'Connor, B., Crowell, T. A., James, W., Colizzi, V., Ngongo, N., & Kaseya, J. (2025). Integrating artificial intelligence into African health systems and emergency response: Need for an ethical framework and guidelines. Journal of Public Health in Africa, 16(1). https://doi.org/10.4102/jphia.v16i1.876
90. Alaran, M. A., Lawal, S. K., Jiya, M. H., Egya, S. A., Ahmed, M. M., Abdulsalam, A., Haruna, U. A., Musa, M. K., & Lucero-Prisno, D. E. (2025). Challenges and opportunities of artificial intelligence in African health space. Digital Health, 11. https://doi.org/10.1177/20552076241305915
91. Wang, J., & Li, J. (2024). Artificial intelligence empowering public health education: prospects and challenges. Frontiers in Public Health, 12. https://doi.org/10.3389/fpubh.2024.1389026
92. Sun, L., Yin, C., Xu, Q., & Zhao, W. (2023, July 15). Artificial intelligence for healthcare and medical education: a systematic review. https://pmc.ncbi.nlm.nih.gov/articles/PMC10408516/#:~:text=Results:%20Studies%20have%20shown%20that,we%20have%20made%20some%20suggestions.'
93. Rony, M. K. K., Alrazeeni, D. M., Akter, F., Nesa, L., Das, D. C., Uddin, M. J., Begum, J., Khatun, M. T., Noor, M. A., Ahmad, S., Tanha, S. M., Deb, T. R., & Parvin, M. R. (2024). The role of artificial intelligence in enhancing nurses' work-life balance. Journal of Medicine Surgery and Public Health, 3, 100135. https://doi.org/10.1016/j.glmedi.2024.100135
94. Al-Surmi, A., Bashiri, M., & Koliousis, I. (2021). AI based decision making: combining strategies to improve operational performance. International Journal of Production Research, 60(14), 4464–4486. https://doi.org/10.1080/00207543.2021.1966540
95. Mienye, I. D., Sun, Y., & Ileberi, E. (2024). Artificial intelligence and sustainable development in Africa: A comprehensive review. Machine Learning With Applications, 100591. https://doi.org/10.1016/j.mlwa.2024.100591
96. Digital Health and Innovation (DHI). (2021, August 18). Global strategy on digital health 2020-2025. https://www.who.int/publications/i/item/9789240020924
97. Sokunbi, T. O., & Akinbi, E. O. (2024). The cost of the reemergence of monkeypox: An overview of health financing in Africa. Health Policy OPEN, 7, 100132. https://doi.org/10.1016/j.hpopen.2024.100132
98. Collaborative report unveils the transformative role of Artificial Intelligence and Data Science in advancing global health in Africa | Science for Africa Foundation. (n.d.). https://scienceforafrica.foundation/media-center/collaborative-report-unveils-transformative-role-artificial-intelligence-and-data
99. Shao, D., Ishengoma, F., Nikiforova, A., & Swetu, M. (2024). Comparative analysis of data protection regulations in East African countries. Digital Policy Regulation and Governance. https://doi.org/10.1108/dprg-06-2024-0120
100. Abdulrauf, L. (2024). The complex path to digital constitutionalism in Africa. In Oxford University Press eBooks. https://doi.org/10.1093/oxfordhb/9780198877820.013.45
101. Munung, N. S., Staunton, C., Mazibuko, O., Wall, P. J., & Wonkam, A. (2024). Data protection legislation in Africa and pathways for enhancing compliance in big data health research. Health Research Policy and Systems, 22(1). https://doi.org/10.1186/s12961-024-01230-7
102. Hasanzadeh, F., Josephson, C. B., Waters, G., Adedinsewo, D., Azizi, Z., & White, J. A. (2025). Bias recognition and mitigation strategies in artificial intelligence healthcare applications. Npj Digital Medicine, 8(1). https://doi.org/10.1038/s41746-025-01503-7
103. Grzybowski, A., Jin, K., & Wu, H. (2024). Challenges of artificial intelligence in medicine and dermatology. Clinics in Dermatology, 42(3), 210–215. https://doi.org/10.1016/j.clindermatol.2023.12.013

104. Weiner, E. B., Dankwa-Mullan, I., Nelson, W. A., & Hassanpour, S. (2025). Ethical challenges and evolving strategies in the integration of artificial intelligence into clinical practice. PLOS Digital Health, 4(4), e0000810. https://doi.org/10.1371/journal.pdig.0000810
105. Cheong, B. C. (2024). Transparency and accountability in AI systems: safeguarding wellbeing in the age of algorithmic decision-making. Frontiers in Human Dynamics, 6. https://doi.org/10.3389/fhumd.2024.1421273
106. Marko, J. G. O., Neagu, C. D., & Anand, P. B. (2025). Examining inclusivity: the use of AI and diverse populations in health and social care: a systematic review. BMC Medical Informatics and Decision Making, 25(1). https://doi.org/10.1186/s12911-025-02884-1
107. Awosiku, O. V., Gbemisola, I. N., Oyediran, O. T., Egbewande, O. M., Lami, J. H., Afolabi, D., Okereke, M., & Effiong, F. (2025). Role of digital health technologies in improving health financing and universal health coverage in Sub-Saharan Africa: a comprehensive narrative review. Frontiers in Digital Health, 7. https://doi.org/10.3389/fdgth.2025.1391500
108. Oke, G. I., & Sibomana, O. (2025). Adoption of digital health technology in Nigeria: A scoping review of current trends and future directions. Advances in Public Health, 2025(1). https://doi.org/10.1155/adph/4246285
109. Policy briefs. (2024, February 19). POLIWATCH AFRICA. https://poliwatch.africa/index.php/resources/policy-briefs
110. Murithi, B. K., Onyango, C. A., & Muchwat, K. (n.d.). The State of AI in Africa - A policy brief. In The State of Artificial Intelligence in Africa 2023 Report. https://cipit.strathmore.edu/artificial-intelligence/#1684756067281-dafd0a75-19eb
111. Global Center on AI Governance. (n.d.). https://www.globalcenter.ai/research/strengthening-africa-s-ai-ecosystem-through-open-source-innovation-and-policy-alignment
112. Radoli, I. (2025, January 10). Building Data science Capacity across Africa: The Data Science Without Boarders Pathfinder Tour - APHRC. APHRC. https://aphrc.org/blogarticle/building-data-science-capacity-across-africa-the-data-science-without-boarders-pathfinder-tour/
113. Exploring AI's potential to transform education in Africa. (2024, April 8). Mastercard Foundation. https://mastercardfdn.org/en/articles/exploring-ais-potential-to-transform-education-in-africa/
114. Ojedeji, S. O., & Adejuwon, A. M. (2024). Training future Educational leaders: Incorporating AI in capacity building and professional development. https://ujlle.org.ng/index.php/ujlle/article/view/302
115. Continental Artificial Intelligence Strategy | African Union. (n.d.). https://au.int/en/documents/20240809/continental-artificial-intelligence-strategy
116. Health Ethics & Governance (HEG). (2021, June 28). Ethics and governance of artificial intelligence for health. https://www.who.int/publications/i/item/9789240029200
117. Admin. (2024, November 11). Adoption of Digital Health Technologies in Sub-Saharan Africa. Didida. https://didida-health.eu/adoption-of-digital-health-technologies-in-sub-saharan-africa/
118. Case study: Lesotho's Healthcare PPP Project – Replicable Success Factors – AFRI Fund Capital. (n.d.). https://afrifundcapital.com/case-study-lesothos-healthcare-ppp-project-replicable-success-factors/
119. Ghanem, S., Moraleja, M., Gravesande, D., & Rooney, J. (2025). Integrating health equity in artificial intelligence for public health in Canada: a rapid narrative review. Frontiers in Public Health, 13. https://doi.org/10.3389/fpubh.2025.1524616
120. Dankwa-Mullan, I. (2024). Health equity and ethical considerations in using artificial intelligence in public health and medicine. Preventing Chronic Disease, 21. https://doi.org/10.5888/pcd21.240245
121. Dychiao, R. G., Nazer, L., Mlombwa, D., & Celi, L. A. (2024). Artificial intelligence and global health equity. BMJ, q2194. https://doi.org/10.1136/bmj.q2194
122. Gurevich, E., Hassan, B. E., & Morr, C. E. (2022). Equity within AI systems: What can health leaders expect? Healthcare Management Forum, 36(2), 119–124. https://doi.org/10.1177/08404704221125368
123. Abiodun, K. (2025). Digital infrastructure & sustainable data centers investment in Africa: Role of Tier III & Tier IV. International Journal of Multidisciplinary Research and Growth Evaluation, 6(1), 1878–1888. https://doi.org/10.54660/.ijmrge.2025.6.1-1878-1888

 doi:10.20944/preprints202506.1824.v1

124. Harris, R. (2024, August 10). The healthcare crisis in Sub-Saharan Africa: African Mission Healthcare. https://africanmissionhealthcare.org/the-healthcare-crisis-in-sub-saharan-africa/
125. Gültekin, İ., Jaiswal, K., Eyo, U. E., The Graduate Institute of International and Development Studies, & The World Economic Forum. (n.d.). AI for AI: Using Artificial Intelligence to Accelerate Investment. In Source: Image Generated Using Artificial Intelligence. https://www.graduateinstitute.ch/sites/internet/files/2024-09/AI4AI_-Using-AI-to-Accelerate-Investments.docx---Khushi-Jaiswal.pdf
126. https://www.afdb.org/sites/default/files/documents/publications/strategy_for_quality_health_infrastructure_in_africa_2022-2030.pdf.