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Artificial Intelligence and Public Health Communication in Africa: A Critical Synthesis of Emerging Evidence and Conceptual Gaps

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Abstract

This critical evidence synthesis interrogates how artificial intelligence (AI) is being integrated into Africa's public health communication and surveillance and identifies what works, for whom, and under what conditions. Drawing on peer-reviewed and grey literature (2013-2024), we systematically screened >180 records and thematically analyzed a final corpus of 41 documents. The synthesis maps three principal contribution domains: (a) outbreak surveillance and early warning (social listening/NLP and pathogen genomics); (b) health communication and service navigation (chatbots, SMS/WhatsApp–mediated coordination); and (c) operational decision support (e.g., vaccination uptake optimization). Evidence of effectiveness is heterogeneous but non-trivial: retrospective social media signal detection preceded official epidemic reports; a randomized trial in Malawi found a mental-health chatbot improved health-worker wellbeing; and WhatsApp use enhanced real-time immunization coordination. Yet translation from promising pilots to durable systems is constrained by structural barriers, fragile digital/electrical infrastructure, data scarcity and governance concerns (quality, privacy, ownership), regulatory fragmentation, limited local technical capacity, and financing models that foster "pilotitis." A second layer of gaps is conceptual: applications are rarely grounded in theory, seldom decolonial or equity-centered, and insufficiently adapted to low-resource

African languages, risking exclusion of marginalized communities. We argue that realizing AI's public-health value requires a dual agenda: (1) continue rigorous, context-aware evaluations to strengthen the evidence base; and (2) co-develop enabling ecosystems trusted data stewardship, harmonized and enforceable regulation/ethics, sustainable financing, multilingual NLP, and large-scale capacity building so that AI augments, rather than widens, health equity across the continent. This paper distills an actionable research and policy program to move African AI for public health from isolated exemplars to system-level impact.

Keywords

Artificial Intelligence, Public Health Communication, Africa, Surveillance, Chatbots, Social Listening; Genomics, Equity, Decolonial Design

1. Introduction

The relentless advancement of Artificial Intelligence (AI) and machine learning technologies heralds a transformative epoch for global public health systems. These tools offer unprecedented capabilities for data synthesis, pattern recognition, and predictive analytics, thereby presenting a paradigm shift in how societies monitor, understand, and respond to health threats. This potential is particularly salient for the African continent, which bears a disproportionate burden of infectious disease morbidity and mortality amidst systemic challenges related to infrastructure, financing, and human resources. The integration of AI into public health surveillance and communication frameworks is not merely an incremental improvement but a potential catalyst for a fundamental leap in health equity and crisis responsiveness (Topol, 2019; Myers et al., 2021).

The urgency for such innovation is underscored by Africa's complex and dynamic health landscape. The continent remains persistently vulnerable to outbreaks of established pathogens such as cholera, tuberculosis, malaria, and HIV/AIDS, while simultaneously confronting emerging and re-emerging threats, including COVID-19, mpox, and Zika virus (Nkengasong & Tessema, 2020). These challenges are exacerbated by structural frailties, including fragmented health information systems, a critical shortage of skilled healthcare labor, and logistical constraints in rural and remote areas. For example, Africa CDC (2024) reports ramping up SARS-CoV-2 genomics and bioinformatics training to strengthen local surveillance capacity. Furthermore, the accelerating crisis of climate change introduces new epidemiological uncertainties, altering the geographic ranges of vector-borne diseases and increasing the frequency of climate-sensitive health events, thereby demanding more agile and predictive surveillance modalities (Rocklöv & Dubrow, 2020; Tshimula et al., 2024). In this context, AI-driven solutions ranging from predictive modeling of outbreak trajectories to natural language processing (NLP) for syndromic surveillance offer a compelling strategy to

augment overstretched public health infrastructures (Tanui et al., 2024; El Morr et al., 2024; Villanueva-Miranda et al., 2025).

Notwithstanding its global proliferation, the operational integration of AI within African public health ecosystems remains nascent and markedly heterogeneous. While nations such as South Africa, Rwanda, and Ghana demonstrated the utility of AI-powered chatbots for disseminating vetted health information and countering misinformation during the COVID-19 pandemic, these initiatives often represented isolated triumphs rather than systemic integration (Ndembi et al., 2025). The Nigerian experience, as detailed by Ezeaka (2024), is emblematic of the broader continental impediments, which include a pervasive lack of standardized data infrastructure, critically limited data literacy among health professionals, profound concerns regarding data privacy and ethical compliance, and a deep digital divide that excludes marginalized populations. Consequently, the benefits of AI are risk being accrued only to technologically resourced urban centers, thereby potentially exacerbating existing health inequities rather than ameliorating them (Wahl et al., 2023).

A critical examination of the current landscape reveals two further, profound challenges. First, a significant proportion of AI applications fail to progress beyond the pilot phase or are deployed without rigorous evaluation for tangible health outcomes, a phenomenon often termed 'pilotitis' (Egermark et al., 2022). WHO's own reporting reinforces this concern: digital health programmes frequently lack monitoring or evaluation frameworks even at regional levels (WHO Regional Office for Europe, 2023). Second, there exists a conspicuous deficit of culturally and linguistically adapted tools. For instance, while NLP systems have demonstrated efficacy in improving health communication and vaccine acceptance in high-income contexts (Akpatsa et al., 2022; Cascini et al., 2022; Perikli et al., 2023), their application in Africa is limited by a failure to integrate low-resource local languages and dialectal variations, such as Yoruba or Zulu, which are critical for effective community engagement (Hu et al., 2025; Adelani, 2025; Njoga et al., 2022; Sadiq et al., 2023). Moreover, the pursuit of algorithmic fairness and transparency is often pursued through a techno-centric lens (TGov Team, 2024; World Health Organization, 2023; World Health Organization Regional Office for Europe, 2023), with only a minority of initiatives developing frameworks that consciously address deeply contextual factors such as colonial legacies, local power structures, community sentiment, and mechanisms for legal and ethical accountability (Ndembi et al., 2025; Abebe et al., 2020).

This paper, therefore, seeks to provide a comprehensive and critical analysis of the integration of AI within Africa's public health communication and surveillance apparatus. It moves beyond a mere cataloguing of applications to interrogate the conceptual, ethical, and practical gaps that hinder sustainable and equitable implementation. In capsule words, the objectives of the study are to: (1) assess evidence of AI applications, and successes in Africa, (2) barriers, and gaps. Therefore, this study raises the following questions: (1) What are the key evidence of AI

applications in Africa and its successes? (2) What barriers that hinder scalability and apparent theoretical gaps? By proffering answer to these objectives and questions, this study is of essence as it will inform future policy formulation, advance contextually grounded ethical considerations, and propose culturally relevant innovation strategies that are essential for optimizing AI's transformative potential in strengthening Africa's public health resilience.

2. Conceptual Gap

There is a conceptual gap in the discussion of artificial intelligence in Africa. There is a lack of a theoretical framework that guides the ethical use of artificial intelligence. Although the existing studies have vastly discussed the benefits of using AI in public health, not many of them have tried to anchor these innovative technologies within theoretical models. Unfortunately, this affects the ability to examine how AI can be designed and used in ways that consider the local realities, especially in rural areas with low digital literacy and inadequate infrastructure. This gap affects the development of guiding principles as Asiedu et al. (2024) argue that AI initiatives must address colonial legacies by "globalizing fairness," ensuring that local priorities and ethical values guide technology design that could foster trust and fairness in the adoption of artificial intelligence in public health. Kondo et al. (2023) also note that AI and healthcare research in Africa is still nascent and concentrated in a few regions, underscoring the need to broaden and diversify the field. It is also worth noting the decolonization of technological advancement. This calls for focusing implementation of AI that considers the local ownership, cultural resonance, and relevance. Many of the AI technologies now are designed, governed, and funded by organizations outside Africa. This results in sidelining the local system and causes technological dependence. As such, AI technology rooted in local languages, narratives, and practices needs to be developed in Africa.

3. Methodology

This study adopted a rigorous qualitative evidence synthesis methodology to critically interrogate the integration of artificial intelligence within Africa's public health communication apparatus. A systematic and replicable search strategy was employed to identify relevant peer-reviewed literature and organizational reports published between 2013 and 2024. The inclusion criteria were deliberately circumscribed to materials focusing on empirical applications of AI in public health communication within the African context, ensuring both contextual specificity and analytical depth. To mitigate publication bias and incorporate policy-relevant insights, a significant body of grey literature from entities such as the World Health Organization and the Africa CDC was also curated.

The initial search yielded over 180 materials, which were subsequently subjected to a multi-stage screening process. Irrelevant and duplicate records were excluded, resulting in a final corpus of 41 documents for in-depth critical review.

The analytical approach was guided by thematic analysis, an inductive methodology well-suited for synthesising qualitative evidence across a diverse set of sources. Key themes, including linguistic integration, ethical frameworks, and infrastructural constraints, were identified and developed through a process of iterative coding and constant comparison. The synthesis itself was conceptual and critical in nature, moving beyond mere description to construct a nuanced analysis of emerging evidence, documented successes, and persistent implementation gaps. This was achieved through comparative insight and the use of case examples, thereby illuminating the complex interplay between technological potential and contextual reality that defines the current state of AI adoption in African public health. These criteria ensured that the paper has a diverse perspective, specifically focusing on a particular context. To achieve comprehensiveness, more materials were extracted from gray literature, such as reports from reputable organizations (World Health Organization, Ministries of Health, and the African Union), conference reports. This approach aligns with Greenhalgh et al. (2018), who argue that inductive, narrative syntheses are valuable for integrating diverse qualitative evidence when formal systematic methods are impractical.

Verified studies analysis table for application of ai in public health in Africa.

S/N	Study/ Source	Country/ Region	AI Technology Type	Public Health Communication Application	Evidence of Success & Impact	Barriers & Implementation Gaps	Year	Sample Size /Scope	Study Design
1	Trad et al.	West Africa	SMS Systems	Patient triage and guidance to health facilities during Ebola outbreaks	Proposed a functional system for efficient patient routing	Conceptual model; requires real-world implementation and validation	2015	Not specified	Conceptual / Methodology Paper
2	Odlum & Yoon	Global (Ebola focus)	Social Media Analytics, NLP	Outbreak monitoring and public sentiment analysis	Demonstrated ability to track public discussion and concerns via Twitter	Data bias (Twitter users not representative); potential for misinformation	2015	Twitter data	Retrospective Data Analysis
3	Lazard et al.	USA (CDC focus)	Text Mining, NLP	Analysis of public concerns during health crises	Identified key public themes for health authorities to address	Focus on US-based audience engaging with CDC, not African context	2015	CDC Twitter chat data	Text-mining Analysis
4	Pathak et al.	Global (Platform)	(Platform Analysis)	Information dissemination on Ebola	YouTube is a significant source of public health information	High proportion of incomplete or misleading information; variable quality	2015	100 videos	Content Analysis
5	Basch et al.	Global (Platform)	(Platform Analysis)	Information dissemination on Ebola	Widespread coverage of the epidemic on the platform	Variable quality and accuracy of information sources	2015	100 most-viewed videos	Content Analysis
6	Gidado et al.	Nigeria (Lagos)	(Survey Research)	Assessing public knowledge and info sources	Mass media was primary info source; identified gaps in specific knowledge	Gaps in knowledge (e.g., transmission) persisted despite awareness	2015	1,360 respondents	Cross-sectional Survey

Continued

7	Fung et al.	Global (Ebola focus)	Social Media Analytics	Outbreak surveillance, public engagement	Useful for tracking epidemic activity and public sentiment	Risk of misinformation spread; data reliability challenges	2016	31 studies	Systematic Review
8	Feng et al.	Sierra Leone	Mobile Phone Surveys, SMS	Tracking health-seeking behaviour during outbreaks	Effective method for rapid, remote data collection	Sampling bias (excludes those without phones); non-response bias	2018	2,009 respondents	Mobile Phone Survey
9	Joshi et al.	West Africa	NLP, Machine Learning	Early detection of epidemics	System detected signals of Ebola outbreak before official reports	Relies on social media penetration; noise in data; requires validation	2020	~2.5 million tweets	Retrospective Modeling Study
10	Owoyemi et al.	Africa (Continental)	Various AI	Review of AI in healthcare delivery	Outlined significant potential for AI to transform African healthcare	Infrastructure, data, skills, and regulatory gaps are major barriers	2020	Not specified	Review
11	Phiri et al.	Africa (Continental)	Chatbots	Health information, support, triage	Scoping review identified a growing field with diverse applications	Evidence on effectiveness is still emerging; scalability challenges	2023	29 studies	Scoping Review
12	Makoni	Africa (Continental)	AI-powered Genomics	Pathogen surveillance & outbreak attribution	Reports on a major investment ($100M) to enhance genomic capacity	Long-term sustainability and capacity building are critical challenges	2020	Initiative	News / Report Analysis
13	Botti-Lodovico et al.	West Africa	Genomic Surveillance, Data Analytics	Early-warning system for pandemics	Describes a functional early-warning system for viral threats	Requires continuous funding, collaboration, and technical capacity	2021	System description	Case Study / System Description
14	Kleinau et al.	Malawi	Chatbot	Mental wellbeing support for health workers	RCT showed effectiveness in improving mental wellbeing during COVID-19	Demonstrates efficacy in a controlled trial; real-world scalability?	2024	1,200 participants	Randomized Controlled Trial (RCT)
15	ACEGID	West Africa	Genomic Surveillance	Pathogen genomics for outbreak response	A leading center for genomic surveillance in Africa	Website description of initiatives and partnerships	n.d.	Institutional	Organizational Website
16	H3Africa Consortium	Africa (Continental)	(Policy Framework)	Ethical genetic data collection & sharing	Developed a policy framework for negotiating fairness in genomics	Addresses critical ethical and ownership challenges in practice	2015	Policy framework	Policy Analysis
17	Mboowa et al.	Africa (Continental)	Pathogen Genomics	Disease surveillance	Documents the significant growth of pathogen genomics in Africa	Highlights ongoing need for investment and capacity building	2024	Not specified	Review

Continued

18	Broad Institute	West Africa	Genomic Surveillance	Pandemic prevention via viral surveillance	News report on a successful surveillance system implementation	Report on an initiative; not a primary study	2024	Initiative	News Report
19	Gavi	Nigeria	Various AI	Improving healthcare access	Report on how AI tools are changing healthcare access in Nigeria	Journalistic report on trends and specific projects (e.g., AwaDoc)	2025	Not specified	News Article
20	Clafiya	Nigeria	AI-powered health info system	Maternal child health, immunization	Digital platform for healthcare access	Company website describing services and approach	2025	Not specified	Company Website
21	Abdulrahman (AwaDoc)	Nigeria	Whats App-based Chatbot	Medical advice, immunization support	Media article on the success and reach of the AwaDoc platform	Media coverage of a specific tool's implementation and impact	2025	29,893 users (cited elsewhere)	Media Feature
22	Gavi	Africa (Continental)	WhatsApp, popular apps	Health worker coordination, patient communication	Highlights innovative use of common apps for public health	Reports on operational use, not measured efficacy	2024	Not specified	News Article
23	Villanueva-Miranda et al.	Global	Various AI	Early warning systems for infectious diseases	Systematic review of AI applications in early warning	Focus on global context; specific African challenges may vary	2025	Multiple studies	Systematic Review
24	El Morr et al.	Global	Various AI	Epidemic/ pandemic early warning systems	Systematic scoping review of AI-based warning systems	Focus on global context; specific African challenges may vary	2024	Multiple studies	Systematic Scoping Review
25	Townsend et al.	Africa (Continental)	(Policy Analysis)	Regulatory frameworks for AI in healthcare	Mapped the complex and varied regulatory environment	Regulatory gaps and fragmentation hinder implementation	2023	Not specified	Policy Review
26	Africa CDC	Africa (Continental)	Genomics, Bioinformatics	SARS-CoV-2 surveillance and training	Announcement of capacity-building initiatives for genomics	News release on training efforts, not a study of outcomes	2024	Continental	News Release
27	Egermark et al.	Global	CDSSs, Telemedicine, Wearables, Serious Gaming	Healthcare Delivery	Argue that overreliance, limited clinical evidence and lack of sustainable financing help medtech to reach full impact.	Overreliance on big data, insufficient clinical evidence, Unsustainable financing and Adoption	2022	None	Perspective / Commentary
28	MedTechPulse	Nigeria	Whats App-based Platform	Healthcare access (AwaDoc feature)	Media feature on the success of the AwaDoc platform	Media coverage of a specific tool's implementation	2025	Not specified	Media Feature
29	Scherer	Global	Automated Outbreak Detection	Early signal detection (HealthMap/ BlueDot)	Journalistic report on systems that detected Ebola early	News article describing technologies, not a primary study	2014	Not specified	News Article

Continued

30	WHO	Global	(Guidance)	Risk communication and community engagement (RCCE)	Provides standard guidance for emergency communication	Guidance document, not an empirical study of effectiveness	2018	Not applicable	WHO Guidance Document
31	Cascini et al.	Global (COVID focus)	Social Listening, NLP	Monitoring vaccine attitudes	Systematic review confirms social media's role in shaping attitudes	Pervasive misinformation and hesitancy are major challenges	2022	Multiple studies	Systematic Review
32	Sadiq et al.	Nigeria	Social Listening, NLP	Vaccine hesitancy analysis	Content analysis of YouTube comments revealed drivers of hesitancy	Platform-specific analysis; may not be generalizable	2023	YouTube comments	Content Analysis
33	Njoga et al.	Africa (Continental)	(Review)	Understanding vaccine hesitancy	Systematic review of persisting vaccine hesitancy in Africa	Highlights deep-rooted socio-cultural and logistical barriers	2022	Multiple studies	Systematic Review
34	Mills et al.	Global (SRH focus)	(Review)	Chatbots for SRH	Realist synthesis of how chatbots can improve SRH	Evidence base is growing but needs more rigorous studies	2023	Not specified	Realist Synthesis
35	Njogu et al.	Kenya	Chatbot	SRH information and education	Exploratory study showed acceptability of a pleasure-oriented SRH chatbot	Exploratory study; effectiveness data still emerging	2023	Study participants	Exploratory Mixed-Methods
36	Yam et al.	Zambia	Chatbot	Integrating HIV prevention into FP	Developed and tested a chatbot for use in family planning clinics	Pilot study; requires scaling and long-term impact assessment	2022	Study participants	Development & Testing Study
37	McMahon et al.	Not Specified (Africa)	Whats App-based Chatbot	SRH information ("Nurse Nisa")	Pilot study on a WhatsApp-based SRH chatbot	Pilot phase; discusses both promises and challenges ("Perils")	2023	Study participants	Pilot Study
38	Mboowa et al. (PMC)	Africa (Continental)	Pathogen Genomics	Disease surveillance	Review article on the growth of pathogen genomics (PMC version)	Similar to entry 17; a review article	2024	Not specified	Review (PMC)
39	WHO AFRO	Africa (Continental)	Various Digital Tools	Health deployments & announcements	Press materials on digital tool deployments by WHO AFRO	Organizational reporting, not primary research	2022-2025	Organizational	Press Materials / Reporting
40	Masresha et al.	Nigeria	WhatsApp Messaging	Coordination of immunization campaigns	Effective tool for real-time coordination among health workers	Focus on health worker coordination, not direct public communication	2020	Health workers	Case Study
41	CARE Nigeria / Gavi	Nigeria/ Africa	WhatsApp, Chatbots	Immunization awareness, campaigning	Case studies show operational use of WhatsApp for health campaigning	Grey literature; reports on implementation rather than measured efficacy	2023-2025	Operational reporting	Case Studies / Operational Reporting

4. Discussion of Findings

The integration of Artificial Intelligence (AI) into public health systems represents a paradigm shift with the potential to redefine disease surveillance, health communication, and service delivery. Nowhere is this potential more tantalising, or its realisation more fraught with complexity, than across the diverse and dynamic continent of Africa. This discussion synthesises evidence from a corpus of studies, detailed in the above table, to critically assess the application and documented successes of AI technologies in strengthening Africa's public health infrastructure. It subsequently conducts a rigorous examination of the persistent barriers and implementation gaps that threaten to stifle this potential, creating a chasm between technological promise and tangible impact. The analysis reveals that while AI offers transformative tools for outbreak response, health communication, and clinical support, its effective adoption is critically dependent on overcoming foundational challenges in infrastructure, data governance, and local capacity building.

I. Evidence of AI Applications and Documented Successes

The evidence collated demonstrates that AI applications in Africa are not merely theoretical but are being actively deployed across a spectrum of public health domains, with several studies reporting measurable successes.

a) Outbreak Surveillance and Early Warning Systems

A significant concentration of AI application is evident in the domain of epidemic preparedness and response, largely catalysed by the 2014-2016 West Africa Ebola outbreak. Studies by Joshi et al. (2020) and Odlum & Yoon (2015) exemplify the use of Natural Language Processing (NLP) and machine learning to mine social media data (specifically Twitter) for early signals of disease activity. Indeed, journalistic accounts of the 2014 Ebola crisis note that AI-driven systems (such as HealthMap) detected outbreak signals before official reports, showcasing AI's promise in early detection (Scherer, 2014). Joshi et al. (2020) demonstrated that an automated system could detect signals of an Ebola outbreak before official reports were released, showcasing AI's potential for radical improvements in early warning timelines. Similarly, Odlum & Yoon (2015) and Lazard et al. (2015) utilised NLP for real-time 'public sentiment analysis' and thematic tracking during health crises. Their work proved that AI could effectively map public concerns, misinformation pathways, and overall sentiment, providing health authorities with a crucial tool for crafting targeted, responsive communication campaigns (Odlum & Yoon, 2015; Lazard et al., 2015).

Beyond digital chatter, AI is being applied to genomic data for pathogen surveillance (African Centre of Excellence for Genomics of Infectious Diseases, 2025). Initiatives like the Pathogen Genomics Initiative (Makoni, 2020) and the SENTINEL system (Botti-Lodovico et al., 2021) represent a sophisticated convergence of AI and genomics. The Broad Institute (2024) reports deploying a new viral surveillance system in West Africa to help prevent the next pandemic, illustrating investment in genomic AI tools. These systems are designed to provide 'early-warning for pandemics' and enhance 'outbreak attribution' by tracking vi-

ral evolution and spread. The successful establishment of a 'functional early-warning system' as noted by Botti-Lodovico et al. (2021), marks a monumental leap in Africa's capacity to identify and respond to viral threats from a position of knowledge rather than reaction.

b) Health Communication and Information Dissemination

The role of AI in managing the complex information ecosystem of public health is another area of prolific activity (World Health Organization, 2018). However, the evidence here is dichotomous, highlighting both the power and the peril of digital platforms. Studies analysing broad platforms like YouTube (Pathak et al., 2015; Basch et al., 2015) revealed their significant role as sources of health information during the Ebola crisis (Gidado et al., 2015). However, they also uncovered a 'high proportion of incomplete/misleading information' and 'variable quality and accuracy', underscoring a major challenge that AI itself must help solve (Pathak et al., 2015; Basch et al., 2015).

In response, AI-driven chatbots are emerging as a promising tool for delivering accurate, accessible health information. A good case of this is the Rwanda's official 'RBC-Mbaza' COVID-19 chatbot that reached over 580,000 users (~15,000 per day) by delivering localized, up-to-date information via simple mobile text in local languages (European Commission, 2022). The scoping review by Phiri et al. (2023) documents a 'growing field' of health chatbots across Africa, applied in triage, patient education, and treatment adherence. More robust evidence comes from Kleinau et al. (2024), whose randomised controlled trial in Malawi provided clear 'evidence of success & impact' by demonstrating that a mental health chatbot effectively improved the wellbeing of health workers. Similar national level chatbot deployments in Malawi also show wide reach and adaptability (Ndemera et al., 2025). This study is particularly notable for its rigorous methodology, moving beyond conceptual promise to empirical validation. Similarly, research into chatbots for sexual and reproductive health (SRH) in Kenya and Zambia shows preliminary evidence of 'acceptability and potential effectiveness' (Mills et al., 2023; Njogu et al., 2023; Yam et al., 2022; McMahon et al., 2023). And, in Nigeria, the AwaDoc platform uses an AI-driven WhatsApp chatbot to provide personalized medical advice 24/7, making health information widely accessible to users (Abdulrahman, 2025; MedTechPulse, 2025; Clafiya, 2025). Moreover, CARE Nigeria (2024) similarly reports using WhatsApp to conduct community immunization awareness campaigns, exemplifying how such common platforms are leveraged for public health outreach.

c) Operational Efficiency and Healthcare Delivery

AI's value extends beyond information to directly optimising healthcare processes. Fung et al. (2016), in their systematic review, recognised the utility of social media analytics for 'outbreak surveillance' and tracking 'epidemic activity'. Masresha et al. (2020) found that even low-tech tools like WhatsApp dramatically improved immunization campaign coordination in Nigeria, supporting Gavi's (2024) observation that frontline health workers are deploying ordinary apps to

make an extraordinary difference. On a more logistical level, Trad et al. (2015) proposed an SMS-based system to guide patients to suitable health facilities, a concept aimed at improving triage and resource allocation during a crisis. Furthermore, Nair et al. (2022) explored the use of predictive analytics and machine learning for 'optimizing vaccination interventions' in Nigeria, a application with profound implications for overcoming one of public health's most persistent challenges.

Even commonplace platforms like WhatsApp are being co-opted as AI-adjacent tools for improving coordination. The case study by Masresha et al. (2020) found the messaging platform to be an 'effective tool for real-time coordination' among health workers during immunization campaigns in Nigeria, demonstrating that low-tech, high-access solutions can yield significant operational benefits (Gavi, 2024).

II. Critical Barriers and Implementation Gaps

Despite these promising applications, the literature uniformly identifies a suite of deep-rooted barriers that consistently impede the transition from successful pilot projects to integrated, scalable, and sustainable health solutions.

a) Foundational Infrastructural and Resource Deficits

The most fundamental barrier is the lack of robust technological and electrical infrastructure. As highlighted by Owoyemi et al. (2020) in their continental review, 'infrastructure... gaps are major barriers' to the adoption of AI for healthcare delivery. Unreliable internet connectivity, inadequate electricity supply, and low digital literacy effectively exclude large segments of the population, particularly in rural areas, from accessing AI-driven solutions. This directly creates 'sampling bias', as evidenced in Feng et al. (2018)'s mobile phone survey in Sierra Leone, which explicitly 'excludes those without phones'. An AI model trained on, or deployed for, a non-representative population risks being ineffective or, worse, exacerbating existing health inequities.

b) Data-Related Challenges: Quality, Availability, and Ethics

The lifeblood of AI is data, and here Africa faces a triple challenge. Li et al. (2024) emphasize the importance of operationalizing health data governance in low-resource settings, noting pilot initiatives in Zanzibar to establish AI-relevant data policies and frameworks. First, there is the issue of data quality and 'noise in data' (Joshi et al., 2020). Social media scraping, while powerful, can be polluted by misinformation, making it difficult for algorithms to distinguish signal from noise (Odlum & Yoon, 2015; Fung et al., 2016).

Second, there is a stark scarcity of large, curated, locally relevant datasets needed to train AI models effectively. Without these, models trained on data from other continents may perform poorly in the African context, a phenomenon known as algorithmic bias.

Third, and perhaps most critically, are the ethical questions surrounding data collection and ownership. The H3Africa Consortium (2015) directly addressed this by developing a policy framework for 'ethical genetic data collection & shar-

ing', aiming to negotiate 'fairness in genomics'. Infact, the H3Africa policy framework (de Vries et al., 2015) provides a model for ethical genomic data sharing, underscoring that data derived from African populations should be governed by fair, locally-informed protocols. This work highlights the pervasive fear of exploitation and the urgent need for robust, locally-owned governance frameworks to ensure that data extracted from African populations benefits those same populations. The absence of such frameworks is a significant implementation gap.

c) Regulatory Fragmentation and Policy Vacuum

The rapid evolution of AI has far outpaced the development of corresponding regulatory structures. The Tech Governance Project (TGov Team, 2024) describes Africa's AI governance landscape as highly fragmented, highlighting inconsistent ethical standards and data privacy policies across countries. Townsend et al. (2023)'s policy review meticulously mapped the 'complex and varied regulatory environment across Africa', identifying 'regulatory gaps and fragmentation' as key factors that 'hinder implementation'. The absence of clear guidelines on data privacy, algorithmic accountability, and clinical validation creates an environment of uncertainty for developers and health authorities alike, stifling investment and deployment.

d) Financial Constraints and Sustainability Concerns

The development and maintenance of AI systems are capital-intensive. Major initiatives like the genomic surveillance systems require 'major investment' (Makoni, 2020) and 'continuous funding' (Botti-Lodovico et al., 2021) to remain operational. The heavy reliance on external donor funding raises serious questions about long-term 'sustainability' and 'capacity building' (Makoni, 2020; Mboowa et al., 2024). Many projects risk becoming pilot studies that end when funding cycles conclude, failing to achieve the scale required for population-level impact.

e) The Scarcity of Local Capacity and Skills

The effective implementation of AI requires a skilled workforce of data scientists, software engineers, and bioinformaticians who understand both the technology and the public health context. The continental reviews by Owoyemi et al. (2020) and Mboowa et al. (2024) explicitly identify 'skills' gaps and the 'ongoing need for capacity building' as critical barriers. Without targeted investment in education and training, African institutions will remain dependent on foreign expertise, undermining local ownership and the development of context-specific solutions.

Windingly, the evidence is unequivocal: Artificial Intelligence holds formidable potential to revolutionise public health across Africa. From the retrospective detection of outbreak signals (Joshi et al., 2020) to the proven efficacy of mental health chatbots in a randomised trial (Kleinau et al., 2024), the successes documented are compelling and diverse. AI is no longer a futuristic concept but a present-day tool with demonstrated applications in surveillance, communication, and operational efficiency.

However, this discussion unequivocally argues that the primary impediment to

realising AI's full potential is not a lack of technical innovation but a constellation of structural and systemic barriers. The 'evidence of success & impact' is consistently tempered by 'barriers & implementation gaps' related to infrastructure, data governance, regulation, financing, and local capacity. The journey from a successful proof-of-concept to a scaled, sustainable public health utility is fraught with these non-technical challenges.

Therefore, the path forward requires a dual strategy. First, continued support for innovative research and piloting is essential to build the evidence base, as called for in reviews on chatbots (Phiri et al., 2023; Mills et al., 2023). Second, and more critically, there must be a concerted, multi-stakeholder effort to address the foundational barriers. This entails investing in digital infrastructure, developing transparent and equitable data policies, harmonising regulatory frameworks (Townsend et al., 2023), securing sustainable funding models, and most importantly, prioritising massive investment in local skills development and capacity building (Owoyemi et al., 2020; Mboowa et al., 2024). Without this holistic approach, the risk is that AI will become another well-intentioned intervention that ultimately widens, rather than narrows, the health inequity gap. And on a final note, Fisher and Rosella (2022) has recommended that public health organizations need clear strategic priorities and governance frameworks to harness AI safely and effectively. The technology is ready; the task now is to build the ecosystems that allow it to thrive and serve all Africans.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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