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Digital Health and Artificial Intelligence for Strengthening Healthcare Systems in Africa: A Scoping Review

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Abstract

Digital transformation may address persistent constraints in African health systems, but the breadth and maturity of implemented technologies remain unclear. This scoping review mapped empirical evidence on digital health and artificial intelligence (AI) used to strengthen health systems in Africa. PubMed/MEDLINE and Europe PMC were searched from inception to 26 August 2026 using terms for technology, African settings, system functions and implementation. Peer-reviewed empirical studies of an implemented technology and a health-system outcome were eligible. Findings were charted against the World Health Organization health-system building blocks and synthesised descriptively under PRISMA-ScR guidance. Of 1,998 records identified, 1,550 unique records were screened, 61 reports underwent full-text assessment and 58 studies from 20 countries were included. Thirty-three studies (56.9%) were published during 2023–2026. Electronic health records, health-information systems or DHIS2 were addressed in 38 studies and mobile health or short-message services in 27; clinical decision support (n=7), digital surveillance (n=6), telemedicine (n=4) and implemented AI or machine learning (n=2) were less common. Reported contributions included improved access, referral and continuity; more timely and usable data; workforce support; and strengthened clinical processes. Evidence often concerned feasibility, acceptability and scale. Recurrent constraints involved skills and training, equity of digital access, recurrent financing, workflow burden, infrastructure, interoperability and governance. Digital health can support several health-system functions simultaneously, but evidence remains geographically concentrated and dominated by implementation studies rather than robust long-term effectiveness or economic evaluations. Interoperable public infrastructure, sustainable financing, workforce capability, equitable design and accountable AI governance are priorities for responsible scale-up.

Key words: Clinical decision support systems; Electronic health records; Health equity; Health information systems; Implementation science; Telemedicine

Introduction

African health systems continue to confront uneven access to care, shortages and maldistribution of health workers, fragmented information flows, weak referral pathways, unreliable supply systems and constrained public financing. Digital technologies are not substitutes for adequate staffing, medicines or infrastructure, but they can connect functions that are otherwise separated by geography and organisational boundaries. The World Health Organization (WHO) global strategy therefore frames digital health as an enabling component of equitable and sustainable health-system strengthening rather than as an isolated technical intervention.[1]

The term digital health encompasses mobile health, telemedicine, electronic health records (EHRs), health-information systems (HIS), digital registries, surveillance platforms and clinical decision-support systems. Artificial intelligence (AI), including machine learning, adds capabilities for prediction, classification and automation, but also raises concerns about data representativeness, safety, privacy, transparency and accountability.[2] The African Union's Continental AI Strategy similarly emphasises locally relevant, ethical and inclusive development supported by data infrastructure and governance.[4]

Previous reviews have often focused on a single disease, technology or subregion. Consequently, decision-makers lack a consolidated account of where empirical implementation evidence exists, which health-system functions are being addressed, what benefits are reported and which constraints recur across settings. This review therefore aimed to map empirical evidence on implemented digital-health and AI applications for strengthening healthcare systems in Africa; describe study, geographic and technological characteristics; classify reported contributions using the WHO health-system building blocks; and identify priorities for policy, implementation and research.

Methods

Review design and protocol

This scoping review followed the framework proposed by Arksey and O'Malley, refinements by Levac and colleagues, and current Joanna Briggs Institute guidance.[5-7] Reporting was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).[8] An a priori internal protocol specified the population–concept–context question, eligibility criteria, charting fields and synthesis plan; it was not prospectively registered.

Eligibility criteria

The context comprised any African country. The concept was an implemented digital-health or AI application intended to influence at least one health-system function: service delivery, health workforce, health information, access to medicines and technologies, financing, or leadership and governance. Eligible sources were peer-reviewed empirical studies reporting implementation, feasibility, acceptability, use, performance, effectiveness, cost or another system-level outcome. Randomised, quasi-experimental, observational, mixed-methods, qualitative, cross-sectional and implementation case assessments were eligible. Reviews, protocols, editorials, commentaries, conference abstracts, purely technical model-development papers without implementation, clinical studies in which a digital system was only a data source, and studies without an African setting were excluded. No language filter was applied; studies in English, French or Portuguese were eligible.

Information sources and search

PubMed/MEDLINE and Europe PMC were searched from database inception to 26 August 2026; searches and record downloads were completed on 26–27 August 2026. The strategy combined Medical Subject Headings and free-text terms for digital health, eHealth, mobile health, telemedicine, EHR/HIS, digital surveillance, clinical decision support, AI and machine learning with terms for Africa and every African country, health-system functions and implementation. The full reproducible strategies are presented in Supplementary Table I. WHO, WHO Regional Office for Africa and African Union websites were consulted for conceptual and policy context but did not contribute empirical studies.

Selection of sources

Records were deduplicated by PubMed identifier, digital object identifier and normalised title. A deterministic, rule-based Python script applied prespecified title-and-abstract signals for African context, a digital intervention, empirical implementation and a health-system outcome; records meeting all signals were retained for full-text assessment. The reviewer verified eligibility against the full report where available and documented exclusion reasons. Screening and selection were undertaken by one reviewer.

Data charting and synthesis

For each included study, the year, country, design, implementation maturity, technology, WHO building blocks, reported outcome domains and implementation constraints were charted. Categories were allowed to overlap because one technology could affect several system functions. Descriptive counts were generated using deterministic Python scripts and checked against the source records. Results were synthesised narratively; no meta-analysis was planned because interventions, settings and outcomes were heterogeneous. Methodological quality was not formally appraised, consistent with the mapping purpose of this review.

Ethics

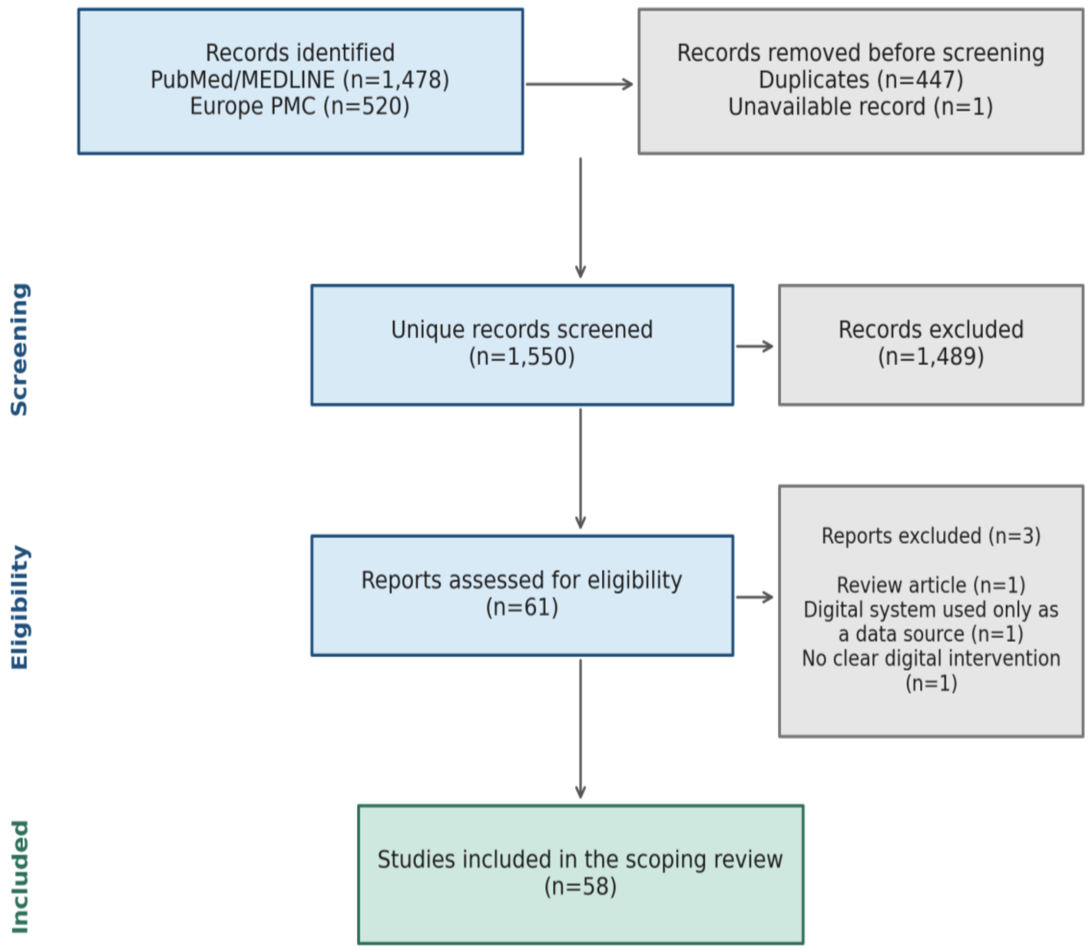
Ethics committee approval was not required because the review used publicly available published literature and involved no direct collection of human-participant data.

Results

Selection of sources

The searches identified 1,998 records: 1,478 from PubMed/MEDLINE and 520 from Europe PMC. After removal of 447 duplicates and one unavailable PubMed record, 1,550 records underwent title-and-abstract screening. Sixty-one reports were assessed in full and three were excluded: one review, one study in which the digital system was only a data source for a non-digital intervention, and one report without a clearly described digital intervention. Fifty-eight studies were included (Figure 1; Supplementary Table II).[9-66]

Figure 1. PRISMA-ScR flow diagram of study selection.



Study characteristics

The studies were published from 2015 to 2026; 33 (56.9%) appeared during 2023–2026. Evidence came from 20 African countries but was concentrated in Rwanda and Ghana (seven studies each), Nigeria (six), Kenya and South Africa (five each), and Ethiopia, Sierra Leone and Uganda (four each) (Figure 2). Qualitative and mixed-methods designs each accounted for 15 studies; four were randomized or cluster-controlled trials, four were quasi-experimental, two were cross-sectional, two used observational or secondary data, and 16 were implementation or case assessments. Twenty-six reports described routine use or scale-up, 17 concerned pilot or pre-implementation work, and 15 evaluated implementations without clear evidence of scale (Table I).

Figure 2. Geographic distribution of the 58 included studies. Country categories are based on the African implementation setting; one study may include an additional non-African setting.

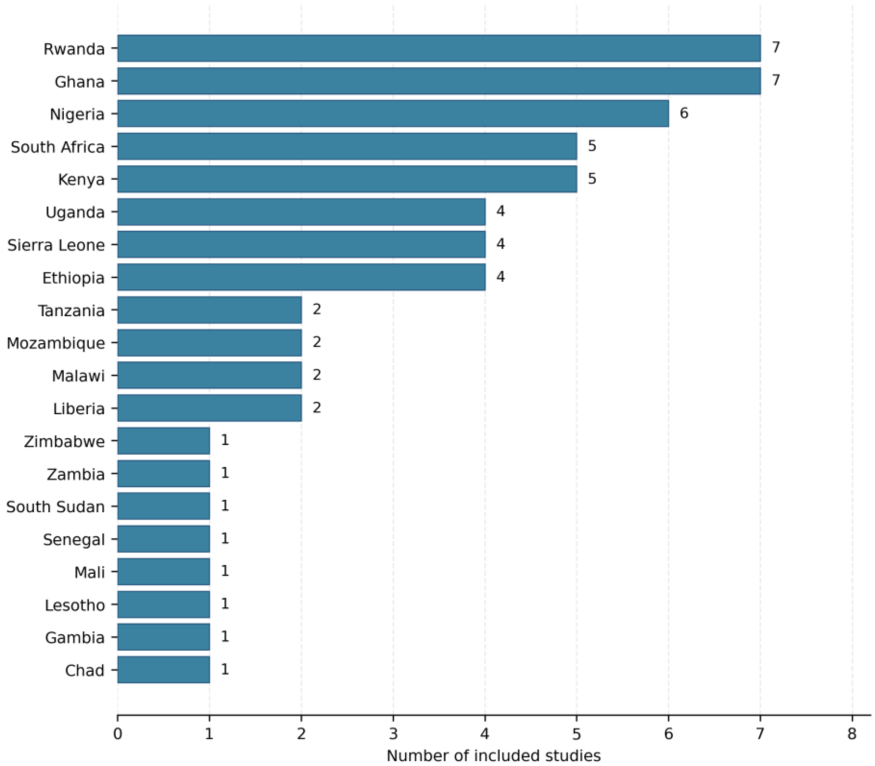


Table I. Characteristics of the 58 included studies.

Characteristic	Category	Studies, n (%)
Publication period	2015–2019	13 (22.4)
	2020–2022	12 (20.7)
	2023–2026	33 (56.9)
Study design	Qualitative	15 (25.9)
	Mixed-methods	15 (25.9)
	Randomised/cluster controlled trial	4 (6.9)
	Quasi-experimental	4 (6.9)
	Cross-sectional	2 (3.4)
	Observational/secondary-data analysis	2 (3.4)
	Implementation/case assessment	16 (27.6)
Implementation maturity	Routine/scale-up	26 (44.8)
	Pilot/pre-implementation	17 (29.3)
	Implementation evaluation	15 (25.9)
Technology*	EHR/HIS/DHIS2	38 (65.5)

	Mobile health/SMS	27 (46.6)
	Clinical decision support	7 (12.1)
	Digital surveillance	6 (10.3)
	Telemedicine	4 (6.9)
	AI/machine learning	2 (3.4)

**Technology categories overlap. AI, artificial intelligence; DHIS2, District Health Information Software 2; EHR, electronic health record; HIS, health-information system; SMS, short-message service.*

Technologies and health-system domains

EHR, HIS or District Health Information Software 2 (DHIS2) platforms were addressed in 38 studies and mobile health or short-message services in 27. Clinical decision support (seven studies), digital surveillance (six), telemedicine (four) and implemented AI or machine learning (two) were less common; categories overlapped. The two AI studies integrated a machine-learning prediction model into Nigeria's national HIV electronic medical record and evaluated AI-enabled smartphone obstetric ultrasonography in Sierra Leone.[14,41] Most reports addressed several WHO building blocks: service delivery (51), the health workforce (49), health information (44), leadership and governance (42), financing (21), and medicines and technologies (19) (Table II).

Table II. Health-system building blocks addressed by included studies and residual evidence gaps.

WHO building block	Studies, n*	Reported contribution	Residual gap
Service delivery	51	Access, referral, continuity, remote consultation and integration of community with facility care	Few long-term comparative evaluations; uneven geographic coverage
Health workforce	49	Training, supervision, task support, decision support and access to patient information	Workload, turnover, digital skills and continuing technical support
Health information systems	44	Electronic records, registries, surveillance, reporting, data quality and decision-making	Interoperability, completeness, duplicate systems and limited routine data use
Leadership and governance	42	National platforms, institutionalisation, standards and implementation strategy	Privacy, accountability, procurement, regulation and donor fragmentation
Financing	21	Implementation cost, insurance enrolment, affordability and sustainability	Sparse economic evaluation and inadequate recurrent financing
Medicines and technologies	19	Immunisation registries, antimicrobial surveillance, diagnostics and supply-related information	Limited evidence on stock availability, supply-chain outcomes and lifecycle management

**Categories overlap; counts indicate studies in which the domain was present in the title, abstract or full-text charting. WHO, World Health Organization.*

Reported contributions to system strengthening

Digital platforms supported access, utilisation, referral or continuity in 38 studies. Examples included telemedicine-enabled primary care, mobile obstetric referral, recall and referral of community members, tuberculosis adherence support and maternal–child health monitoring.[10,17,30,36,42,62] Thirty-four studies reported data quality, reporting, surveillance or information-use outcomes. National and subnational HIS, digital registries, community information systems and case-based surveillance improved the availability or timeliness of data, although completeness and routine use varied.[11,12,19,22,24,25,33-35,46,50,56,65,66]

Workforce and clinical-process contributions included guideline training, decision support, remote supervision, task support for community health workers and faster access to actionable patient information.[9,15,18,20,21,32,40,44,45,47,49,51,53] Thirty-seven studies addressed care quality or clinical processes, while 29 addressed efficiency, workflow or workload. Cost or financial-protection issues were reported in only 15 studies, limiting conclusions on value for money despite individual evaluations of insurance, registries and information-system investments.[13,26,35]

Implementation determinants

Feasibility, acceptability or adoption was present in 44 studies and scale or sustainability in 43. Workforce capability and training was the most frequently coded constraint (40 studies), followed by inequitable digital access (34), financing and sustainability (32), workflow or user burden (31), connectivity, electricity or hardware (26), interoperability or data quality (21), and governance, privacy or regulation (17). These determinants were interdependent: weak connectivity increased documentation burden; fragmented platforms reduced data reuse; limited recurrent financing constrained maintenance and technical support; and low digital literacy or rural device access risked widening inequity (Table III).

Table III. Recurrent implementation constraints and corresponding health-system actions.

Constraint	Studies, n*	System action
Workforce skills and training	40	Role-specific competency development, protected training time, supportive supervision and local technical support
Equity and digital access	34	Offline and assisted options, inclusive languages and interfaces, affordability safeguards, and disaggregated monitoring
Financing and sustainability	32	Costed lifecycle plans, recurrent public budgets, transparent total-cost-of-ownership and transition from donor funding
Workflow and user burden	31	Co-design, usability testing, reduction of duplicate entry and measurement of time burden
Connectivity, electricity and hardware	26	Offline-first design, reliable power, resilient hosting, device replacement and maintenance
Interoperability and data quality	21	National standards, unique identifiers, terminology services, open interfaces and data-quality feedback
Governance, privacy and regulation	17	Clear data stewardship, security controls, audit trails, procurement requirements and AI accountability

**Categories overlap and represent coded presence, not effect size or causal attribution.*

Discussion

This review shows a rapidly expanding but uneven evidence base. More than half of the included studies were published from 2023 onwards, yet evidence remained concentrated in a small number of countries. EHR/HIS and mobile-health applications dominated, reflecting longstanding investment in routine information systems and phone-based delivery. In contrast, only two studies evaluated AI that had been implemented in a service context. The policy visibility of AI therefore substantially exceeds the present peer-reviewed evidence for system-wide effectiveness in Africa.

The principal contribution of digital health was connective rather than substitutive. Technologies linked community workers with facilities, patients with follow-up and referral, clinical encounters with decision support, and local data with district or national reporting. This explains why individual studies commonly mapped to multiple WHO building blocks. System benefit depended less on the novelty of a tool than on its integration with workflows, referral arrangements, supervision, standards and recurrent support. Stand-alone pilots could demonstrate acceptability but offered limited evidence of institutionalisation.

Implementation barriers also formed a system. Connectivity and power affected reliability; training and technical support shaped use; interoperability and data quality determined whether information could guide decisions; and recurrent finance determined whether these capabilities persisted after project funding. Equity requires particular attention. Mobile or remote services may extend reach, but device ownership, literacy, language, disability, gender, rural connectivity and user costs can reproduce or amplify exclusion. Programmes should therefore measure who does not enrol, who discontinues use and who remains dependent on non-digital pathways.

For policy and practice, five priorities emerge. First, governments should treat identity, connectivity, registries, terminology services, interoperability layers and cybersecurity as shared public digital infrastructure. Second, investment cases should include recurrent costs for hosting, devices, maintenance, connectivity, support and workforce time. Third, implementation should be co-designed with health workers and communities and accompanied by role-specific competency development. Fourth, procurement and regulation should require data portability, auditability, privacy protection and independent performance monitoring. Fifth, AI should progress through staged evaluation of local validity, clinical utility, fairness, safety and cost before scale-up; national governance should specify accountability for model updates and failures.[2-4]

This review has strengths in its explicit health-systems framing, country-inclusive search, reproducible record processing and transparent mapping of overlapping functions. It also has important limitations. Only PubMed/MEDLINE and Europe PMC were searchable; African Index Medicus was unavailable in the review environment, and Embase, Scopus, Web of Science and grey literature were not searched. Database overlap was substantial, and Francophone and Lusophone evidence may be under-represented. Screening and charting were conducted by one reviewer with rule-based computational support, creating a risk of missed records or classification error. Some categories were based on titles and abstracts, formal critical appraisal was not undertaken, and heterogeneous outcomes precluded causal or comparative synthesis. Publication in 2026 was still ongoing at the search cut-off.

In conclusion, implemented digital health is contributing to access, information use, workforce support and clinical processes across African health systems, but evidence of sustained, equitable and cost-effective scale remains incomplete. HIS and mobile-health platforms have the broadest implementation base, whereas real-world AI evidence is nascent. Future investment should prioritise interoperable public infrastructure, sustainable financing, workforce capability, equitable access and accountable evaluation rather than technology deployment alone.

Declarations

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Conflicts of interest: None declared.

Author contribution: All author conceived the review, designed the methods, undertook the searches, screening, data charting and synthesis, drafted and revised the manuscript, approved the final version and accepts accountability for the work.

Data availability: The complete search strategies and charted characteristics of all included studies are provided in the Supplementary Material. Database exports and deterministic analysis scripts are available from the corresponding author on reasonable request.

Protocol registration: The internal review protocol was not prospectively registered.

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