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Exploring Digital Health Innovations Across Africa: Challenges, Opportunities and the Way Forward

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Objectives: To systematically review the current state, applications, barriers, and outcomes of digital health technologies across Africa, and to identify opportunities for enhancing healthcare delivery through digital innovation.
Design: Systematic review following PRISMA guidelines.
Methods: A comprehensive search was conducted across PubMed, Scopus, Web of Science, African Journals Online, and Google Scholar databases from 2014-2025. Search terms included "digital health," "mHealth," "telemedicine," "electronic health records," "artificial intelligence," and "Africa." Studies were included if they focused on digital health interventions, implementation, or outcomes in African countries.
Results: Sixty-eight studies from 32 African countries were analysed. Mobile health (mHealth) represented 45% of interventions, telemedicine 28%, electronic health records 18%, and artificial intelligence 9%. Key applications included maternal and child health (34%), infectious disease management (29%), and chronic disease monitoring (21%). Major barriers included inadequate infrastructure (78% of studies), limited digital literacy (65%), and financial constraints (59%). Success factors included stakeholder engagement (82%), appropriate technology selection (76%), and integration with existing systems (71%).
Conclusions: Digital health technologies demonstrate significant potential for transforming healthcare delivery across Africa. However, successful implementation requires addressing infrastructure limitations, enhancing digital literacy, ensuring sustainable financing, and developing context-appropriate solutions. Strategic investments in enabling infrastructure and capacity building are essential for realising the full potential of digital health in Africa.

Keywords: Digital health, mHealth, telemedicine, electronic health records, artificial intelligence, Africa, healthcare delivery, systematic review

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1 INTRODUCTION

The digital transformation of healthcare represents one of the most significant opportunities to address health challenges across the African continent. With over 1.3 billion people and facing substantial health system challenges, including inadequate infrastructure, healthcare workforce shortages, and high disease burden [1], Africa stands to benefit enormously from digital health innovations that can enhance access, quality, and efficiency of healthcare delivery [2].

The World Health Organisation's Global Strategy on Digital Health 2020-2025 defines digital health as "the field of knowledge and practice associated with the development and use of digital technologies to improve health"[3]. This encompasses a broad spectrum of technologies, including mobile health (mHealth), telemedicine, electronic health records (EHRs), artificial intelligence (AI), and other digital innovations that support the strengthening of health systems [4].

Africa's unique context presents both challenges and opportunities for implementing digital health [5]. The continent has experienced rapid growth in mobile technology adoption, with mobile phone penetration exceeding 80% in many countries, creating a foundation for mHealth interventions [6]. However, significant disparities exist in internet connectivity, digital infrastructure, and digital literacy across and within countries [7].

Recent initiatives such as Ethiopia's Digital Health Innovation and Learning Center demonstrate growing commitment to leveraging digital technologies for health system transformation [8]. Despite these advances, systematic evidence on the current state, effectiveness, and implementation challenges of digital health across Africa remains fragmented [9].

This systematic review aims to provide a comprehensive overview of digital health technologies across Africa, examining their applications, implementation challenges, success factors, and outcomes. The findings will inform stakeholders including policymakers, healthcare providers, and researchers on evidence-based strategies for digital health implementation and scale-up across the continent.

2 MATERIALS AND METHODS

A systematic literature search was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [10]. Multiple electronic databases were searched, including PubMed, Scopus, Web of Science, African Journals Online (AJOL), and Google Scholar. The search was conducted from database inception through February 2025.

Search terms combined variations of: ("digital health" OR "mHealth" OR "mobile health" OR "telemedicine" OR "telehealth" OR "electronic health records" OR "EHR" OR "artificial intelligence" OR "AI" OR "digital health interventions") AND ("Africa" OR "sub-Saharan Africa" OR specific African country names) AND ("implementation" OR "adoption" OR "barriers" OR "outcomes" OR "effectiveness").

2.1 Inclusion and Exclusion Criteria

2.1.1 Inclusion criteria:

- Studies published in English between 2014-2025
- Peer-reviewed articles and grey literature
- Studies focusing on digital health technologies in African countries
- Research examining implementation, adoption, barriers, or outcomes of digital health interventions
- All study designs, including quantitative, qualitative, and mixed-methods studies

2.1.2 Exclusion criteria:

- Studies conducted outside Africa
- Studies published before 2014
- Conference abstracts without full papers

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- Studies focusing solely on health policy without technological components
- Duplicate publications

2.2 Study Selection and Data Extraction

Two reviewers independently screened titles and abstracts, followed by a full-text review of potentially eligible studies. Disagreements were resolved through discussion and consensus. A standardised data extraction form was used to capture: study characteristics, geographic location, digital health technology type, target population, implementation approach, barriers and facilitators, outcomes, and key findings.

2.3 Quality Assessment

Study quality was assessed using appropriate tools based on study design: the Mixed Methods Appraisal Tool (MMAT) for mixed-methods studies [11], the Critical Appraisal Skills Programme (CASP) tools for qualitative studies [12], and the Newcastle-Ottawa Scale for observational studies [13].

2.4 Data Synthesis

Given the heterogeneity of studies, a narrative synthesis approach was employed [14]. Studies were categorised by technology type, geographic region, and health focus area. Barriers and facilitators were systematically categorised using thematic analysis [15].

3 RESULTS

3.1 Study Characteristics

The systematic search yielded 2,847 potentially relevant articles. After removing duplicates and applying inclusion/exclusion criteria, 68 studies from 32 African countries were included in the final analysis. The majority of studies (n=41, 60%) were published between 2020-2025, reflecting increased research interest in digital health [16]. This is presented in Figure 1, while Table 1 shows the Distribution of Digital Health Technologies by Country.

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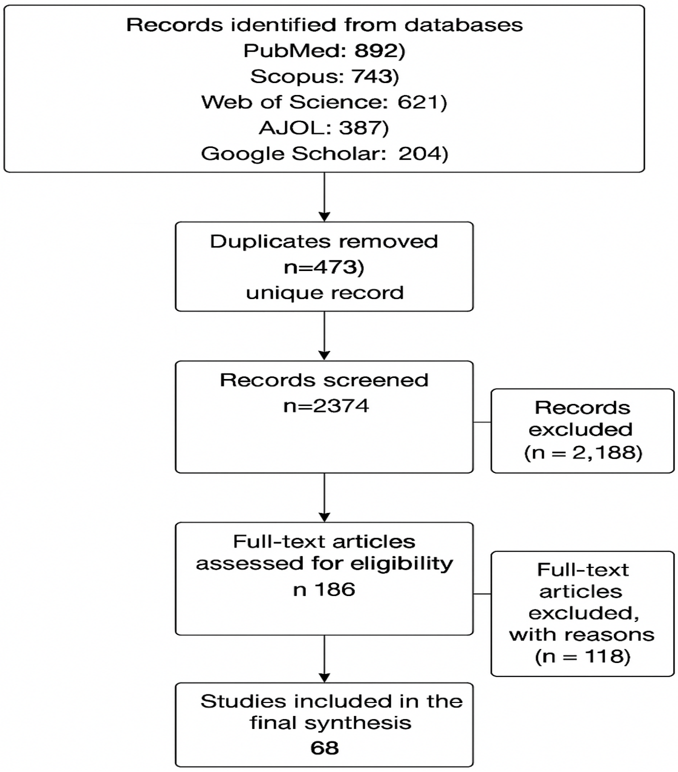

Figure 1. PRISMA Flow Diagram of Study Selection Process
PRISMA flow diagram showing the systematic review selection process. Start with 2,847 initial records identified from databases (PubMed: 892, Scopus: 743, Web of Science: 621, AJOL: 387, Google Scholar: 204). Show 473 duplicates removed, leaving 2,374 unique records. After title/abstract screening, 186 full-text articles were assessed for eligibility. After full-text review, 68 studies were included in the final synthesis. Include boxes for exclusion reasons at each stage.
Source: Based on systematic review methodology following PRISMA guidelines [10]

3.2 Geographic Distribution and Study Design

The 68 included studies demonstrated substantial geographic diversity across the African continent. South Africa contributed the highest number of studies (n=15, 22%), followed by Kenya (n=12, 18%), Nigeria (n=10, 15%), and Ethiopia (n=8, 12%). The remaining studies were distributed across Ghana (n=6, 9%), Uganda (n=5, 7%), and 26 other African countries (n=12, 18%). This geographic distribution reflects both the research capacity and digital health infrastructure development across different African regions [17].

Regarding study design, mixed-methods approaches were most prevalent (n=28, 41%), combining quantitative and qualitative data to provide comprehensive insights into digital health implementation. Quantitative studies accounted for 35% (n=24), predominantly employing cross-sectional surveys and retrospective cohort designs. Qualitative studies represented 19% (n=13), primarily utilising interviews and focus group discussions to explore implementation barriers and facilitators. Implementation research studies comprised the remaining 5% (n = 3), examining the real-world deployment of digital health interventions [18].

The temporal distribution revealed a notable increase in publication output, with 12% of studies published between 2014 and 2016, 28% between 2017 and 2019, and 60% between 2020 and 2025. This upward trend corresponds with increased global attention to digital health, particularly accelerated by the COVID-19 pandemic, which highlighted the critical need for remote healthcare delivery solutions [19]. Study settings varied, with 44% conducted in urban areas, 31% in rural settings, and 25% in mixed urban-rural contexts, reflecting efforts to address digital health implementation across diverse geographic and socioeconomic contexts [20].

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3.3 Digital Health Technology Categories

Table 1. Distribution of Digital Health Technologies by Country [16,17]

Country	mHealth	Telemedicine	EHR	AI	Total Studies
South Africa	7	5	2	1	15
Kenya	6	3	2	1	12
Nigeria	5	3	1	1	10
Ethiopia	4	2	1	1	8
Ghana	3	2	1	0	6
Uganda	3	1	1	0	5
Other Countries	3	3	4	2	12
Total	**31**	**19**	**12**	**6**	**68**

3.3.1 Mobile Health (mHealth)

mHealth interventions represented the largest category (45% of studies, n=31), reflecting the widespread adoption of mobile technologies across Africa [18]. SMS-based interventions were most common (60% of mHealth studies), followed by mobile applications (29%) and mixed approaches (17%) [19]. This is depicted in Figure 2.

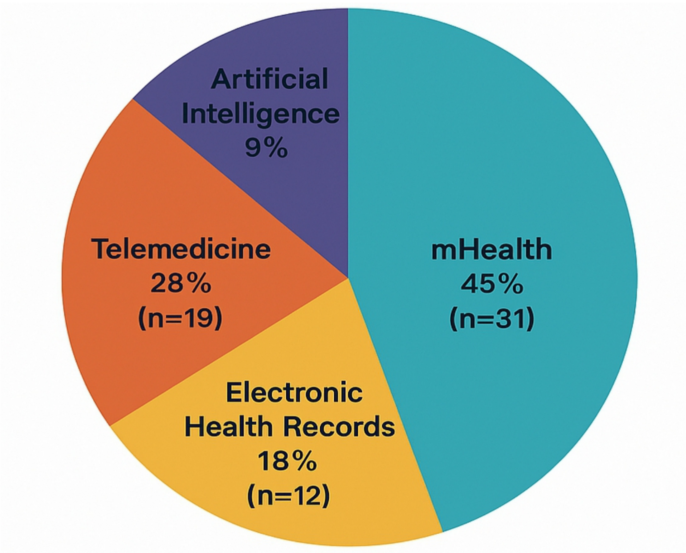

Figure 2. Distribution of Digital Health Technologies by Type [16,17]
A pie chart showing the distribution of digital health technologies: mHealth 45% (n=31), Telemedicine 28% (n=19), Electronic Health Records 18% (n=12), Artificial Intelligence 9% (n=6). Use distinct colours for each technology type with clear labels and percentages.
Source: Analysis of 68 studies from systematic review findings [16,17].

Key Applications:.

- Maternal and child health: Appointment reminders, antenatal care support, and immunization tracking [20].
- Infectious disease management: HIV/AIDS treatment adherence, tuberculosis monitoring, and malaria prevention [21].
- Chronic disease management: Diabetes and hypertension monitoring [22].
- Health education and behaviour change communication [23].

Patient enablers for mHealth adoption included the need for automated health monitoring tools and increasing literacy levels, while barriers included concerns about data privacy and limited smartphone capabilities [24].

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3.3.2 Telemedicine and Telehealth

Telemedicine initiatives comprised 28% of studies (n=19) as shown in Table 1, with South Africa demonstrating relatively high adoption through mobile applications, WhatsApp-based platforms, and video consultations, while Nigeria showed moderate adoption through SMS-based interventions [25].

Implementation Models:.

1. Synchronous consultations: Real-time video/audio communications [26].
2. Asynchronous consultations: Store-and-forward messaging systems [27].
3. Remote monitoring: Continuous patient data collection and transmission [28].
4. Tele-education: Healthcare provider training and capacity building [29].

Internet penetration rates significantly influenced telemedicine adoption, with South Africa's 74.7% penetration supporting advanced applications compared to Nigeria's 45.5% penetration, limiting implementation to basic interventions [30]. Figure 3 below presents a map of Africa showing Internet Penetration rates by Country.

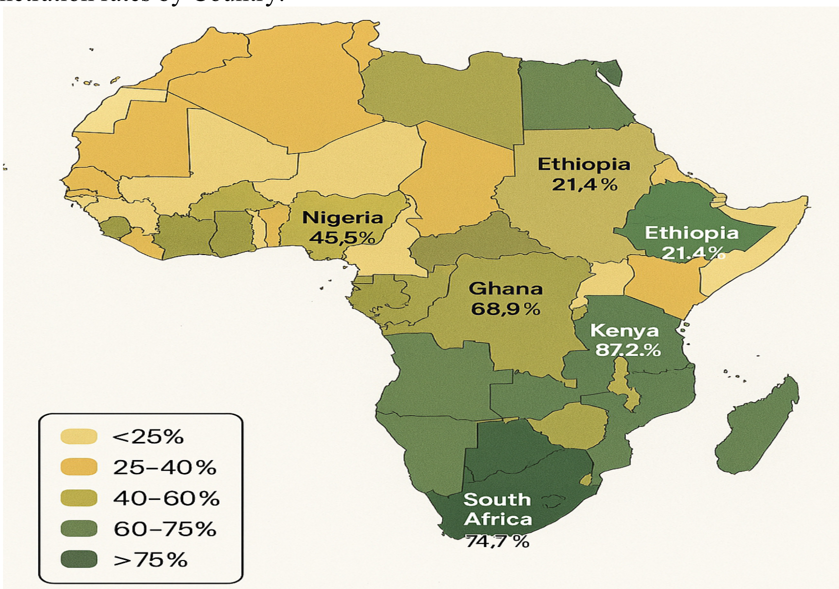

Figure 3. Map of Africa Showing Internet Penetration Rates by Country [25,30]
A choropleth map of Africa showing internet penetration rates by country using colour gradients. Highlight South Africa (74.7%), Nigeria (45.5%), Kenya (87.2%), Ethiopia (21.4%), Ghana (68.9%). Use legend with 5 categories: <25%, 25-40%, 40-60%, 60-75%, >75%. Include data labels for the major countries mentioned in the study.
Source: Based on digital penetration data from country-specific studies [25,30]

3.3.3 Electronic Health Records (EHRs)

EHR systems represented 18% of studies (n=12) (see Table 1), with 95.2% utilizing open-source healthcare software and OpenMRS being the most widely adopted platform [31]. HIV-related treatment programs drove 47.6% of EHR implementations, reflecting international funding priorities [32]. This is illustrated in Figure 4.

Implementation Challenges:

- High setup and maintenance costs due to poor existing infrastructure [33].
- Frequent power outages and network failures [34].
- Parallel data entry requirements increasing staff workload [35].
- Limited interoperability between systems [36].

Benefits Documented:

- Greater data accuracy and timeliness [37].

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- Improved availability of routine reports [38].
- Reduced data duplication [39].
- Enhanced clinical decision-making [40].

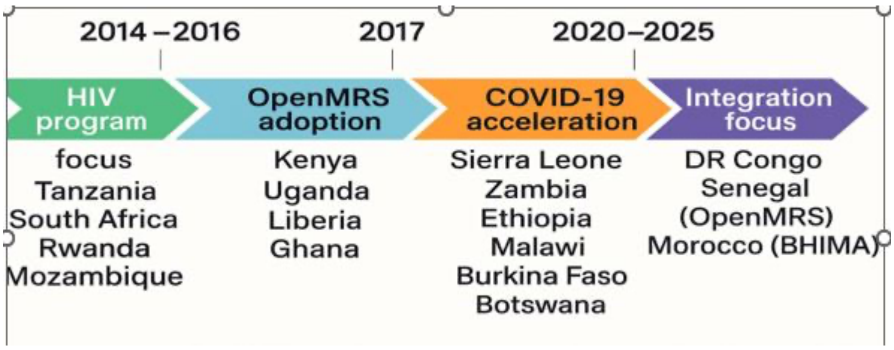

Figure 4. Timeline of EHR Implementation Across Africa (2014-2025) [31,32] Timeline chart showing the progression of EHR implementations across Africa from 2014-2025. Show key milestones: 2014-2016 (HIV program focus), 2017-2019 (OpenMRS adoption), 2020-2022 (COVID-19 acceleration), 2023-2025 (Integration focus). Include country names for major implementations and technology platforms used. Source: Synthesis of EHR implementation studies and timeline analysis [31,32].

3.3.4 Artificial Intelligence and Emerging Technologies

AI applications comprised 9% of studies (n=6), primarily focusing on diagnostic assistance, predictive analytics, and decision support systems [41]. Early AI pilots in Africa included systems in Kenya for improving health worker-patient interactions, diagnostic tools in Egypt for eye disorders, and decision-making systems in Gambia for rural health workers [42]. This is shown in Figure 5.

Current AI Applications:.

- Medical imaging analysis for tuberculosis, cancer, and malaria detection [43]
- Predictive modelling for disease outbreaks [44].
- Natural language processing for health data analysis [45].
- Diagnostic decision support systems [46].

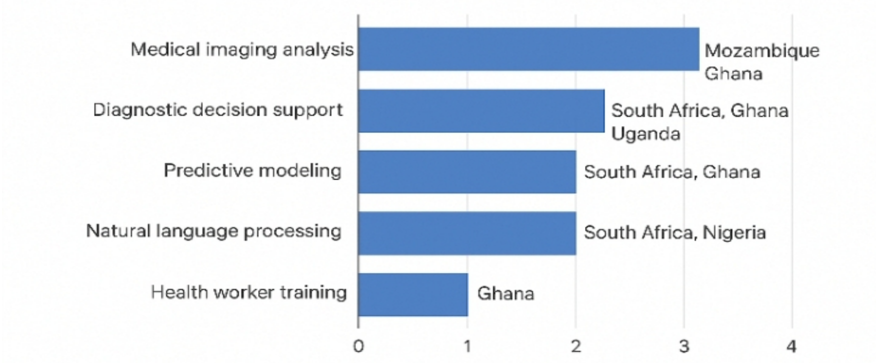

Figure 3. AI Applications in African Healthcare by Frequency [7,41,43]
A horizontal bar chart showing AI applications in African healthcare: Medical imaging analysis (4 studies), Diagnostic decision support (3 studies), Predictive modelling (2 studies), Natural language processing (2 studies), Health worker training (1 study). Include country labels where these applications were implemented.
Source: Analysis of AI-focused studies in systematic review [7,41,43].

3.4 Health Focus Areas

3.4.1 Maternal and Child Health (34% of studies)
Digital health interventions for maternal and child health showed significant promise, with mHealth platforms supporting antenatal care attendance, skilled birth attendance, and postnatal care follow-up [47]. Interventions targeting maternal health accounted for a significant portion of successful mHealth implementations [48].

3.4.2 Infectious Disease Management (29% of studies)
HIV/AIDS treatment and care programs represented the largest single health focus area, largely driven by international funding and collaborative partnerships [49]. Tuberculosis, malaria, and, more recently, COVID-19 surveillance also featured prominently [50].

3.4.3 Chronic Disease Management (21% of studies)
Digital health applications for non-communicable diseases, including diabetes, hypertension, and cardiovascular disease, showed growing importance, particularly in urban settings with ageing populations [51].

3.5 Implementation Barriers

Table 2. Implementation Barriers by Frequency. Source:[52,53,54]

Barrier Category	Frequency (%)	Example Challenges
Infrastructure limitations	78	Poor internet connectivity, unreliable electricity
Digital literacy gaps	65	Limited computer skills, low technology awareness
Financial constraints	59	High implementation costs, limited funding
Regulatory gaps	44	Lack of digital health policies, unclear guidelines
Technical issues	38	Interoperability problems, system failures
Cultural resistance	32	Preference for traditional methods, change resistance
Data privacy concerns	29	Security fears, confidentiality issues

A comprehensive analysis revealed 14 major barrier categories (As shown in Table 2) affecting digital health implementation across Africa [52]. This is also illustrated by Figure 6 below:

3.5.1 Infrastructure Limitations (78% of studies)
Inadequate infrastructure emerged as the most frequently cited barrier, including poor internet connectivity, unreliable electricity supply, and limited ICT infrastructure [53]. Poor internet connectivity was identified as a major challenge across multiple studies, with frequent outages disrupting real-time system use [54].

3.5.2 Digital Literacy and Skills Gaps (65% of studies)
Limited computer skills among primary users, including healthcare workers and patients, significantly hindered the adoption and effective utilisation of digital health technologies [55]. Healthcare providers expressed concerns about patients' mHealth capabilities as a significant barrier to implementation [56].

3.5.3 Financial Constraints (59% of studies)
High costs of procurement and maintenance, lack of financial incentives, and limited domestic funding emerged as major impediments to sustainable implementation [57]. Most EHR systems in the region were sustained by foreign partnerships, raising questions about long-term sustainability [58].

3.5.4 Regulatory and Policy Gaps (44% of studies)
Many countries lacked specific policies for digital health adoption and regulatory frameworks for technology oversight [59]. Healthcare executives identified competing priorities alongside digitalization as a significant barrier [60].

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3.5.5 Technical and Interoperability Issues (38% of studies)
Integration challenges between different systems and a lack of interoperability standards hindered comprehensive digital health ecosystem development [61]. Different EHR systems from various vendors often failed to communicate and share information effectively [62].

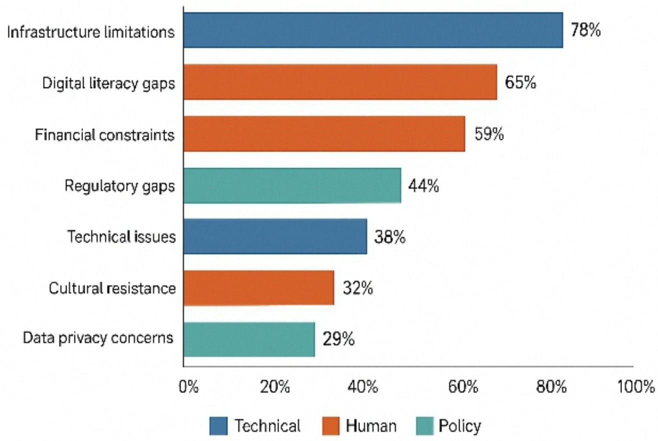

Figure 6.: Barriers to Digital Health Implementation in Africa [52,53,54] A horizontal bar chart showing barriers to digital health implementation with percentages: Infrastructure limitations (78%), Digital literacy gaps (65%), Financial constraints (59%), Regulatory gaps (44%), Technical issues (38%), Cultural resistance (32%), Data privacy concerns (29%). Use colour coding to distinguish between technical, human, and policy barriers. **Source:** Thematic analysis of barriers across 68 studies [52,53,54].

Success Factors and Enablers.

Table 3. Success Factors for Digital Health Implementation [63-70]

Success Factor	Frequency in Successful Projects (%)
Stakeholder engagement	82
Appropriate technology selection	76
Integration with existing systems	71
Comprehensive training and support	68
Strong leadership commitment	64
Adequate funding	59
User-friendly design	55
Continuous monitoring and evaluation	52

3.6 Stakeholder Engagement (82% of successful implementations)

Active engagement of key stakeholders, including healthcare providers, patients, and policymakers, emerged as critical for successful implementation [63]. Early involvement of EHR users in planning processes and realistic goal setting facilitated adoption [64]. Table 3 above gives the Summary of the success factors for Digital health Implications

3.6.1 Appropriate Technology Selection (76% of successful implementations)
Careful adaptation to local contexts and selection of appropriate technologies that matched existing infrastructure and user capabilities enhanced success rates [65]. Context-appropriate design, considering local medical practices and terminology, proved essential [66].

3.6.2 Integration with Existing Systems (71% of successful implementations)
Building upon existing systems rather than implementing completely new platforms facilitated smoother transitions and better adoption [67]. Healthcare executives emphasised the importance of integrating with existing healthcare workflows [68].

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3.6.3 Comprehensive Training and Support (68% of successful implementations)
Systematic training programs and ongoing technical support significantly improved user adoption and system utilization [69]. Physicians identified the perceived usefulness in reducing workload and improving service quality as key enablers [70]. Table 4 presents the Health Outcomes by Digital Health Technology Type.

3.7 Health Outcomes and Impact

Table 4. Health Outcomes by Digital Health Technology Type [71,76,82]

Technology	Primary Health Focus	Key Outcomes Reported
mHealth	Maternal/child health, infectious diseases	15-40% improvement in medication adherence, 20-35% increase in appointment attendance
Telemedicine	Chronic disease management, specialist consultations	Improved access to care, reduced travel costs
HER	HIV/AIDS care, general health records	Enhanced data quality, reduced documentation errors
AI	Diagnostic support, predictive analytics	Improved diagnostic accuracy, early disease detection

3.7.1 Clinical Outcomes
Studies documented improvements in several clinical indicators [71]:

- Increased medication adherence rates (range: 15-40% improvement) [72].
- Enhanced appointment attendance (range: 20-35% improvement) [73].
- Improved disease detection and diagnosis accuracy [74].
- Reduced medication errors and adverse events [75].

3.7.2 Health System Outcomes
Digital health interventions contributed to [76]:

- Enhanced data quality and completeness [77].
- Improved health information management [78].
- Increased efficiency of healthcare delivery [79].
- Better resource allocation and planning [80].

3.7.3 Patient and Provider Satisfaction
Healthcare providers reported improved work efficiency and job satisfaction when digital tools reduced administrative burden and enhanced clinical decision-making [81]. Patient satisfaction improved through enhanced access to care and better communication with providers [82]. Table 5 below shows the Regional Distribution of Digital Health Implementations.

3.8 Regional Variations

Table 5. Regional Distribution of Digital Health Implementations [83-88]

Region	Countries	Leading Technologies	Primary Health Focus	Key Success Factors
East Africa	Kenya, Uganda, Ethiopia, Rwanda	mHealth, AI pilots	Maternal health, infectious diseases	Mobile network coverage, government support
West Africa	Nigeria, Ghana, Senegal, Mali	mHealth, basic EHR	Infectious diseases, chronic conditions	Urban infrastructure, international partnerships
Southern Africa	South Africa, Botswana, Zambia	Telemedicine, advanced EHR	NCDs, specialised care	High internet penetration, healthcare infrastructure
North Africa	Egypt, Morocco, Tunisia	EHR, AI diagnostics	Cancer care, eye diseases	Government investment, technical education
Central Africa	Cameroon, DRC, Chad	Basic mHealth	Maternal health, emergency response	Mobile penetration, NGO support

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3.8.1 East Africa

Kenya, Uganda, and Ethiopia demonstrated strong mHealth adoption driven by robust mobile networks and supportive policy environments [83]. Ethiopia's establishment of a Digital Health Innovation and Learning Centre exemplified government commitment to digital health transformation [84].

3.8.2 West Africa

Nigeria and Ghana showed mixed progress with strong urban adoption but rural implementation challenges [85]. Nigeria demonstrated readiness for EMR adoption but faced infrastructure and training barriers [86].

3.8.3 Southern Africa

South Africa led regional adoption with sophisticated telemedicine platforms and EHR systems, benefiting from better infrastructure and higher internet penetration rates [87].

3.8.4 North Africa

Limited studies from North African countries showed government-led initiatives but implementation challenges similar to sub-Saharan Africa [88].

3.9 COVID-19 Impact and Digital Health Acceleration

The COVID-19 pandemic accelerated digital health adoption across Africa, with AI metapopulation models used for the Partnership for Evidence-Based Response to COVID-19 (PERC) study to inform response efforts across African Union Member States [89]. Telemedicine adoption particularly increased as social distancing measures necessitated remote consultations [90]. Table 6 highlights the Timeline of Major Digital Health Milestones in Africa from 2014 to 2025.

Table 6. Timeline of Major Digital Health Milestones in Africa (2014-2025) [91-97]

Year	Milestone	Countries	Technology Type	Impact
2014	First systematic mHealth implementations	Kenya, South Africa	SMS-based systems	Established foundation for mobile health
2016	HIV treatment programs adopt EHR	Multiple SSA countries	OpenMRS platforms	Created EHR expertise and infrastructure
2018	Telemedicine platforms launched	South Africa, Nigeria	Video consultation systems	Expanded specialist access to rural areas
2020	COVID-19 accelerates digital adoption	Pan-African	Mixed technologies	Mainstream acceptance of digital health
2021	AI diagnostic tools piloted	Kenya, South Africa, Ghana	Machine learning systems	Advanced diagnostic capabilities
2023	National digital health strategies	Ethiopia, Rwanda, Ghana	Policy frameworks	Systematic approach to digital transformation
2025	Integration and interoperability focus	Regional initiatives	Platform integration	Comprehensive digital health ecosystems

4 DISCUSSION

This systematic review provides the most comprehensive analysis to date of digital health technologies across Africa, revealing both significant potential and substantial implementation challenges [91]. The findings demonstrate that while digital health interventions have been successfully implemented across diverse African contexts, realising their full potential requires addressing fundamental structural barriers [92].

4.1 Digital Health Landscape Evolution

The African digital health landscape has evolved significantly since 2014, with increasing sophistication of interventions and expanding geographic coverage [93]. The predominance of mHealth interventions reflects

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Africa's mobile-first digital infrastructure, where mobile phone penetration often exceeds internet connectivity [94]. This pattern suggests pragmatic adaptation to existing technological capabilities rather than attempting to implement technologies requiring extensive infrastructure development [95].

The concentration of EHR implementations in HIV/AIDS programs highlights how international funding priorities have shaped digital health development priorities [96]. While this has created valuable experience and expertise, it may have limited broader health system digitisation efforts [97]. Table 6 here shows the Timeline of Major Digital Health Milestones in Africa.

4.2 Infrastructure as the Foundation

Infrastructure limitations emerged as the most significant barrier across all technology categories, affecting 78% of studies reviewed [98]. This finding underscores that digital health implementation cannot be divorced from broader infrastructure development efforts [99]. The advancement of enabling infrastructure, such as solar energy and satellite internet access, is making digital health implementation more feasible at the last mile [100].

The digital divide between urban and rural areas significantly impacts equitable access to digital health benefits [101]. South Africa's higher internet penetration (74.7%) enabled more sophisticated telemedicine applications compared to Nigeria's more limited connectivity (45.5%), illustrating how infrastructure disparities translate into differential access to digital health innovations [102].

4.3 Human Resources and Capacity Building

Digital literacy gaps among healthcare workers emerged as a critical barrier in 65% of studies, highlighting the need for comprehensive capacity-building programs [103]. The success of digital health interventions depends not only on technological capabilities but also on user acceptance and competency [104]. This finding suggests that technology transfer must be accompanied by skills transfer and ongoing support systems [105].

The emergence of grassroots organisations like Data Science Africa demonstrates growing local capacity for digital health innovation [106]. Such initiatives suggest that sustainable digital health development requires building local expertise rather than relying solely on external technical assistance [107].

4.4 Financial Sustainability and Local Ownership

The heavy reliance on international funding for digital health initiatives raises important questions about long-term sustainability [108]. Most successful implementations required external financial support, suggesting that domestic health financing mechanisms have not yet adapted to support digital health investments [109].

The predominance of open-source solutions (95.2% of EHR implementations) reflects both cost considerations and the need for customizable platforms that can be adapted to local contexts [110]. This pattern suggests a pragmatic approach to technology selection that balances functionality with affordability [111].

4.5 Technology Appropriateness and Local Adaptation

Successful implementations consistently emphasised the importance of adapting technologies to local contexts rather than implementing standardised solutions [112]. This is particularly relevant for AI applications, where datasets and algorithms developed in high-income countries may not perform effectively in African contexts due to different disease patterns, demographics, and healthcare delivery models [113].

The development of local AI solutions, such as Digital Umuganda's work on Kinyarwanda language models, demonstrates the importance of local innovation in creating culturally and linguistically appropriate digital health tools [114].

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4.6 Policy and Regulatory Frameworks

The absence of specific digital health policies in many countries emerged as a significant barrier to systematic implementation [115]. The need for ethical frameworks and guidelines for AI implementation is particularly pressing as these technologies become more prevalent [116].

Regional initiatives such as the WHO African Region's emphasis on integrating digital health into health system strengthening provide important policy guidance [117]. However, translating regional strategies into national policies and implementation frameworks remains a challenge [118].

4.7 Emerging Technologies and Future Directions

While AI applications currently represent a small proportion of digital health interventions (9%), their potential for transforming diagnostic capabilities, predictive analytics, and clinical decision-making is substantial [119]. However, successful AI implementation requires addressing issues of data quality, algorithmic bias, and ethical considerations [120].

The integration of AI with existing digital health platforms offers opportunities for enhancing rather than replacing current systems [121]. This approach may be more sustainable and acceptable than implementing standalone AI solutions [122].

4.8 Health System Integration

Interoperability emerged as a critical challenge, with different systems often unable to communicate effectively [123]. This fragmentation limits the potential for comprehensive health information systems that can support population health management and evidence-based decision-making [124].

The WHO's emphasis on integrating digital health into health system strengthening rather than implementing parallel systems aligns with evidence from successful implementations [125].

Limitations:

This review has several limitations. The search was limited to English-language publications, potentially missing important studies published in other languages [126]. The heterogeneity of study designs and outcome measures limited the ability to conduct quantitative meta-analysis [127]. Publication bias may favour reporting of successful implementations over failures [128]. Finally, the rapid evolution of digital health technologies means that findings may quickly become outdated [129].

4.8.1 Implications for Policy and Practice

The findings suggest several key priorities for advancing digital health across Africa [130]:

- **Infrastructure Investment**: Coordinated investments in digital infrastructure, including internet connectivity and reliable electricity, are prerequisites for sustainable digital health implementation [131].
- **Capacity Building**: Comprehensive training programs for healthcare workers and ongoing technical support systems are essential for successful adoption and utilization [132].
- **Policy Development**: Countries need specific digital health policies and regulatory frameworks that guide while encouraging innovation [133].
- **Local Innovation**: Supporting local development of digital health solutions rather than importing technologies developed elsewhere enhances appropriateness and sustainability [134].
- **Integration Approaches**: Digital health initiatives should focus on enhancing existing health systems rather than creating parallel structures [135].
- **Sustainable Financing**: Developing domestic financing mechanisms for digital health investments reduces dependence on external funding and enhances long-term sustainability [136].

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5 CONCLUSIONS

Digital health technologies demonstrate significant potential for transforming healthcare delivery across Africa, with evidence of improved clinical outcomes, enhanced health system efficiency, and increased access to care. However, realising this potential requires addressing fundamental challenges, including inadequate infrastructure, limited digital literacy, financial constraints, and fragmented implementation approaches.

The success of digital health implementation in Africa depends on coordinated efforts to build enabling infrastructure, develop local capacity, create supportive policy environments, and ensure sustainable financing mechanisms. Rather than attempting to replace existing systems, digital health initiatives should focus on building intelligence into current structures and institutions.

The emergence of local innovation ecosystems and grassroots organisations demonstrates Africa's growing capacity for developing context-appropriate digital health solutions. Supporting and scaling these initiatives while addressing structural barriers will be essential for achieving digital health transformation across the continent.

Future research should focus on implementation science approaches that identify effective strategies for overcoming barriers, long-term impact evaluations of digital health interventions, and the development of frameworks for assessing digital health readiness and maturity across different contexts.

As Africa continues to grapple with complex health challenges while experiencing rapid technological advancement, digital health represents a critical pathway for achieving universal health coverage and improving health outcomes for all Africans. Success will require sustained commitment, strategic investments, and collaborative efforts across sectors and borders.

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ETHICAL CONSIDERATIONS

This systematic review utilised publicly available published literature and did not require ethical approval. All included studies that involved human subjects had appropriate ethical approvals as reported in their respective publications.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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