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A situational review of national Digital Health strategy implementation in sub-Saharan Africa

Authors:
Oluwamayowa O. Ogundaini[1]
Nhlanhla B.W. Mlitwa[2]

Affiliations:
[1]Department of Digital Transformation and Supply Chain Management, Graduate School of Business Leadership (SBL), University of South Africa, Midrand, South Africa

[2]Department of Research, Graduate School of Business Leadership (SBL), University of South Africa, Midrand, South Africa

Corresponding author:
Oluwamayowa Ogundaini,
ogundoo@unisa.ac.za

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As the global communities approach 2030, towards achieving the United Nations (UN) Sustainable Development Goal (SDG) 3 (*Good health and well-being*), there are commendable technology-driven efforts in sub-Saharan Africa (SSA) to address health care system-related challenges, including the development of national Digital Health strategies. While these strategies are supposed to drive health care systems strengthening for health security, the extent to which they are being operationalised, implemented and impact measurement is scarcely reported. The Digital Health strategies have expiry timelines and do not consider the integration or implications of Industry 4.0 technology advancements on the health sector. The authors make a probable claim that national Digital Health strategies may not achieve their objectives without adequate re-assessments and that the scarce reporting constitutes a transdisciplinary gap between government-led health authorities, health care practitioners and academic research collaboration. Hence, the objective of this article was to conduct a review of existing peer-reviewed literature that have somewhat investigated implementation of Digital Health strategies in SSA. The findings suggest that inadequate capacity to monitor and report progress, limited available resources and the lack of Digital Health leadership are three of the critical factors that contribute to the uncoordinated and slow pace at which national Digital Health strategies are being operationalised in SSA.

Transdisciplinary contribution: The article advocates for a transdisciplinary approach through strategic stakeholder engagement between relevant health authorities, academia, industry and non-scientific stakeholders to coordinate, monitor, assess and in reporting extent of national Digital Health strategies implementation, towards UN SDG 3.

Keywords: digital health strategies; health care systems; SDG 3; health security; sub-Saharan Africa.

Introduction

Technology advancements and digital transformation have become a critical resource to driving businesses, how people interact, communicate as well as the automation of service delivery. In the health sector, Digital Health (DH) or electronic health (eHealth) refers to application of information and communication technologies (ICTs) and internet to support health and related fields.[1,2,3,4] In other words, two disciplines including 'Digital' and 'Health' intersect to transform the efficiencies and experiences of health care systems. In recognition of the enabling role of digital technologies to transform health care systems, the World Health Organization (WHO) developed a global strategy for Digital Health 2020 – 2025.[5] The strategy is aligned to 2015 United Nations (UN) Sustainable Development Goal (SDG) 3 – 'to promote good health and well-being'. In line with the SDGs thinking, the Africa Union (AU) Agenda 2063 makes provision to ensure universal health coverage (UHC).[6] The provisions of the SDGs and AU Agenda align with an estimated total of 42 countries in Africa that have developed a national Digital Health strategy or policy to institutionalise ICT applications prior to and after 2015.[7]

According to Kante and Ndayizigamiye,[8] a DH policy is defined as statements of intention, regulations, laws and directives to manage the lifecycle of digital technologies applications in the health sector. National DH strategies are developed by key local and international stakeholders to guide countries around the globe on the role of ICTs as a critical enabler towards realising the vision, health needs and priorities of their health care systems.[9,10] The goal of the strategies is to strengthen health care systems; ensure resilience by building human capacity; highlighting areas for advanced technologies investments; scale up use of Digital Health interventions (DHI) and promote a conducive environment to innovate. The benefits of DHI range from improving information management to enhance diagnosis and treatments; for disease surveillance; enabling equitable access to care and positive patient outcomes.[4,11]

Digital Health intervention would assist countries towards addressing contextual barriers to the delivery of quality, safe health care services and ultimately, positive patient outcomes.[4] Thus, at the core of national DH strategies are components or strategic priorities including leadership and governance, investments, stakeholder engagement, people centred approach, regulations, digital infrastructure, health workforce, interoperable digital applications and services.[5,12] While several countries in SSA have developed national DH strategies to leverage health ICTs, health care systems remain overburdened, hard-to-reach populations in SSA still have limited access to quality health care and implementation of the strategies remain scarcely reported except for countries such as South Africa.[6,9,13] A study by Biggs et al.[14] alludes to the situation that, existing methods to evaluate and measure DH benefits are at varied maturity levels because of the complexity of health care systems, which require contextual understanding of the users, settings and policy environment. The causal factors for the scarcely reported DH strategy implementation and outcomes evidence are seldom discussed or addressed unlike the attention to challenges associated with DH implementation in SSA countries.

The authors of this review argue that the scarce reporting constitutes a complex gap because of the multi-stakeholder role and involvement in the formulation, implementation and monitoring of DH strategies. Hence, it requires a transdisciplinary approach to problem-solving.[15] This kind of approach crosses several disciplines' boundaries including but not limited to government, health sector, technology industry and communities.[16] For instance, the approach requires a joint effort of diverse scientific and non-scientific stakeholders including health authorities (international, national and sub-national levels), health consumers, software vendors, non-government organisations (NGOs) and academic researchers.

These stakeholders, from their nuanced perspectives need to reach a consensus on understanding the complexity of assessing the health care systems' vision, needs and priorities through national DH strategies' performance. Later, the disciplines, experiences, knowledge insights and inputs from stakeholder are coordinated towards collaboratively generating a new and actionable knowledge base to redress the problem at stake.[17] In this way, a participatory engagement method(s) is used to co-develop a holistic solution to monitor, assess and report the implementation of national DH strategies in SSA countries.

There are a host of countries that have developed national DH strategies in SSA to guide the uptake and implementation of health ICTs, to support and enhance health care service delivery. Scholars have argued for the need to conduct a readiness assessment on eHealth implementation before developing a strategy plan.[6,18] The argument is supported by claims that there are contextual challenges that should be addressed to create an enabling environment for the implementation of health ICTs. The challenges associated with the implementation of DHI in SSA countries have been documented by several authors.[19,20,21] These challenges can be categorised into infrastructure deficiencies, lack of appropriate legislation and human-related constraints or a combination depending on the context under review.[22]

A literature review by Haque et al.[20] broadly discusses the challenges that impede eHealth implementation in developing countries. For example, inadequate data and ICT infrastructure pose a threat to the functionality of digital medical devices and applications in the sense that, record keeping, retrieval and sharing are fragmented and likely lead to errors and inaccuracies. Similarly, erratic or unavailable electricity supply in parts of both urban and rural settings may cause internet-enabled devices to be unavailable for seamless information management; damage to electronic devices because of a short-circuit and extra investments on alternate power sources. The human-related constraints highlighted include resistance to technology, limited digital literacy and perceptions attributed to the acceptance and use of health ICTs by patients and health care professionals.[21] Perceived insecurity of data privacy and confidentiality remain an ethical dilemma to DH implementations because of the proliferation of disinformation, mistrust and Artificial Intelligence (AI) biases, despite available legislations.[23]

If the challenges and associated united consequences highlighted earlier in the text are not addressed as a matter of urgency, they stand to continuously impede the successful implementation and accountability reporting of national DH strategies developed by SSA countries. The objective of this article was to conduct a literature analysis of peer-review literature to firstly, identify the reported extent to which national DH strategies are being implemented in SSA countries and secondly, recommend actions to address the constraints associated with the scarce reporting.

Methods

The goal of this review article was to recommend actions to address the current state of national DH strategies operationalisation in sub-Saharan Africa (SSA) countries. In the context of this article, operationalisation refers to translating the core components of a national DH strategy into observable or measurable outputs (leadership and governance, investments, stakeholder engagement, people centred approach, regulations, digital infrastructure, health workforce, interoperable digital applications and services) including implementation of health ICT interventions and their impacts on the health care systems. The authors were guided by Preferred Reporting Items for Systematic Reviews and Analyses (PRISMA) as recommended by Moher et al.[24] The PRISMA guideline enabled the authors to address the research question as follows: *What are the causal factors that contribute to scarce reporting of national Digital Health strategy implementation in SSA?* To identify the extent to which national DH strategies are being implemented, literature search, filtering of results and content analysis techniques were adopted.

Search strategy

For the literature search, the strategy was to query online databases of scholarly peer-reviewed publications using a string of keywords. Using Boolean operator in the advanced search, the string of keywords combined for the search are 'Digital Health' AND 'eHealth strategy' AND 'Sub-Saharan Africa'. Three online databases – Google scholar, PubMed and Scopus were selected because of their massive number of indexed publications, subject matter curation and to reduce duplication of queried results. The peer-reviewed publications mainly included journal articles, conference papers and book chapters. A period of 8 years (2015–2023) was considered for the search strategy, because it falls within the UN SDGs timeline. Subsequently, the results were filtered through a set of inclusion and exclusion criteria.

Inclusion and exclusion criteria

First of all, national DH strategy documents were not considered because the article focused on the extent to which their operationalisation is taking place and being reported in SSA countries through peer-reviewed scholarly studies. The inclusion criteria applied for the results to be considered as eligible are that: (1) publications must be written in English language because it is the authors' mode of learning; for participation in educational activities and the preferred means of expression; (2) timeline of publications is between 2015 and 2023; (3) publications relating to SSA countries; (4) studies with interventions implemented informed by the core components of the national DH strategies.

To further filter articles considered for eligibility, a set of exclusion criteria were applied as follows: (1) publications written in non-English language; (2) non-open access publications; (3) publications from outside of SSA context; (4) publications that do not specifically align the implementation of health ICTs to their national DH strategies; (5) publications on DH strategy or policy formulation or development. The choice of quantitative or qualitative or literature review methodologies did not influence eligibility as the rationale of the article was to examine how SSA countries are currently reporting operationalisation of their DH strategies.

Analysis of results

Once the eligible peer-review literatures were identified, a content analysis procedure was adopted to map similarities between articles by focusing on how the core components of the country's DH strategy are operationalised as a strategic priority, type of DHI being implemented and their impact on the broader health care systems or extent of countrywide scale, if reported (see Table 1). This technique enabled the authors to identify the reported extent to which SSA countries are implementing their national DH strategy, core components that are not being reported and draw inference on the associated challenges.

Ethical considerations

This article does not contain any studies involving human participants performed by any of the authors. However, the research ethics committee of the institution was notified of the study for audit purposes. The next section presents a review of the findings. Ethical clearance to conduct this study was obtained from the University of South Africa, Graduate School of Business Leadership_RERC (Ref #: 2024_SBL_AC_003_FA- 2615).

Review findings

At the end of the literature search, the combination of keywords generated a total number (N = 208) on Google Scholar and Scopus (N = 11) between 2015 and 2023. The search query of PubMed database did not yield any relevant publication records (N = 0). Then, the lists of generated publications were sorted to remove duplicates. As a result, a total number (N = 210) of articles were screened. On applying the exclusion criteria, a total number (N = 203) of publications were discarded while (N = 7) satisfied the inclusion criteria.

The eligible publications explored how selected SSA countries have developed strategic priority areas and are progressing at implementing DHI as informed by their DH strategies. The commonly cited SSA countries include Ethiopia, Ghana, Kenya, Malawi, South Africa, Tanzania and Uganda.

It is not explicitly clear how the DH initiatives align to some of the strategic priority areas of different countries' national DH strategies because their impacts have not been extensively measured nor reported, hence the need for a structured means of reporting facilitated by the various Ministries or Departments of Health. In the included studies conducted in the SSA countries as mentioned in the review findings section, there is evident intention and efforts by governments through their Ministries of Health, to address their nation's health priority needs through the development of health ICT applications and underlying infrastructure. Some of the DHI are reported to have been implemented to scale, for example MomConnect in South Africa, mTrac in Uganda and a national health information system to capture routine health data for surveillance in Kenya. Figure 1 gives a summary of relevant studies and the core components of DH strategies that have been reported in different SSA countries.

The results from the literature search show that there are limited scholarly publications on the reporting of national DH strategies implementation, monitoring, evaluation and review in most SSA countries.[6,9] The limited or scarce reporting could be attributed to less involvement of academia in the implementation process, overly fragmented development of DHI by different actors independent of the DH strategies and pilotitis.[29]

TABLE 1: Summary of publications on national Digital Health strategy implementation in sub-Saharan Africa.

Title, author and year	Aim and/or objective	Context	Findings on DH interventions informed by DH strategies	Core component of DH strategy	Constraints highlighted with DH strategy operationalisation
1. A mobile health model supporting Ethiopia's eHealth strategy[25]	To explore the development of a scalable mHealth model that aligns with the national eHealth strategy to address cervical cancer screening	Ethiopia	• The Ethiopian Federal Ministry of Health has set up a multidisciplinary research, development and evaluation centre and invested in telecommunication infrastructure to support the deployment of mHealth initiatives to facilitate health education and digital media messages; cervical cancer screening and collating population health surveillance data.	• It could be inferred that the Ethiopian government has prioritised governance, investments, people centred approach, digital infrastructure and scaling up of digital applications and services.	Expensive costs of funding; Inadequate Digital Health literacy and related human resource challenges; the lack of infrastructure to enable near real-time monitoring and collection of accurate public health data to make decisions on surveillance and response.
2. Assessing the feasibility of eHealth and mHealth: a systematic review and analysis of initiatives implemented in Kenya[26]	To offer a situational analysis of eHealth initiatives being implemented in Kenya	Kenya	• While there are a host of Digital Health initiatives being implemented across the public and private health institutions, there is scarce reporting on how they satisfy the national Digital Health strategy and meet health objectives.	The Kenyan national eHealth strategy outlines five strategic priority areas according to country needs to address the high cost of care, demand for quality care and shortage of skilled health care professionals. The focus areas include investments, people centred approach, digital infrastructure, health workforce, interoperable digital applications and services.	A lack of coordination by way of registry containing all Digital Health initiatives or pilot projects and how they contribute to strengthening the Kenyan health care system. This is attributed to the level of Digital Divide and unequal implementation of DH initiatives in urban and rural or marginalised areas of Kenya.
3. Re-visiting national eHealth strategies in the IoT and Big Data Era[23]	To examine how national eHealth strategies have considered the new realities of fourth industrial technology and digital services	Kenya, Tanzania, Uganda, Ghana, and South Africa	• The authors propose that national eHealth strategies consider adjust their strategic priorities to consider the role of fourth industrial revolution technologies such as Big Data, IoT.	• All core components were discussed in relation to how national eHealth strategies should be amended to accommodate Fourth Industrial Revolution (4IR) technologies.	Lack of capacity and inadequate consideration for the digital skills necessary to include advanced technologies for the health care system.
4. Why national eHealth strategies matter – An exploratory study of eHealth strategies of African countries[9]	To demonstrate the importance of health IT strategies in the deployment of eHealth initiatives being in an evolving paradigm being shaped by Industry 4.0 technologies	African countries – Kenya, Uganda, Tanzania, Ghana, and South Africa	• Kenya has established eHealth standards and adoption of an open-source web-based District Health Information Systems (DHIS) version 2 for data aggregation across district and national levels. • As of 2013, Uganda has scaled up mTrac, a mHealth platform for health surveillance data. • Tanzania has implemented Open Medical Record System (OpenMRS), an open-source software to manage HIV and AIDS initiatives. • Ghana has developed CommCare, a smartphone intervention to support pregnant women and nursing mothers towards reducing maternal and infant mortality rates. • South Africa has implemented health information systems including MomConnect for maternal and infant health promotion.	• The evident theme in all the countries reviewed is that the national eHealth strategies are focused on implementing a national electronic record system where routine data can be collected, managed and used for informed decision-making. • The study advocates for the targets of national DH strategies to be measured.	Lack of appropriate coordination to ensure standardisation of Digital Health implementation. An additional constraint is the limited contextual frameworks that include governance, privacy and security of data in the health care systems.
5. Assessing strategic priority factors in eHealth policies of four African countries[11]	To assess BETTEReHealth strategic priority factors based on the eHealth policies from four African countries	Ethiopia, Ghana & Malawi	• The government of Ethiopia has invested to scale up internet connectivity and building capacity to make use of digital data for evidence-based decisions. However, the extent of the return on investment in the strategic areas still needs to be reported. • The strategic priority areas for the government of Ghana are regulating health data, infrastructure, and digital application investments. • In Malawi, the government priority areas include investment in digital health care systems and internet infrastructure to address interoperability issues.	• The similar core components that have been considered by these countries include, investments, digital infrastructure development, capacity building and eHealth standards or guideline through policy formulation.	• Public policy factors such as insufficient national-level legislature, how often policies should be reviewed to align with technology advancements and health objectives; technical and human resources including infrastructure (lack of interoperability and poorly coordinated implementation and integration of DH technologies) and poor digital skills respectively.
6. eHealth policy framework in low and lower middle-income countries: A PRISMA systematic review and analysis[27]	To propose an eHealth policy framework for developing countries	Low and lower middle-income countries	• The authors highlight that the correlation between human – user-centredness, technical – interoperability, legislation and innovation factors influence the formulation of eHealth policy framework.	• There is a need for contextual Digital Health policies that incorporate the core components of Digital Health strategies, if implementation is to be successful.	
7. Tanzania's and Germany's Digital Health strategies and their consistency with the World Health Organization's global strategy on Digital Health 2020 – 2025: Comparative policy analysis[28]	To assess the alignment of the two countries' Digital Health strategies with the WHO's global strategy on Digital Health	Tanzania	• The Tanzania federal ministry of health is focused on the expansion of investments in health ICTs including 4IR technologies such as AI and the use of data for surveillance to improve the citizens' quality of life.	• The areas of priorities that urgently need to be addressed were highlighted in Tanzania's Digital Health strategy 2019 – 2024. Four of the areas being operationalised are implementation of Digital Health applications, people centred services enabled by Digital Health, knowledge collaboration and transfer and Digital Health governance.	A lack of consideration for the rapid technology advancements and the skills or capacity to serve the contextual needs of the health care system. Also, there is currently no platform or framework to feed back on the efficacy or performance of implemented Digital Health tools.

DH, Digital Health; PRISMA, Preferred Reporting Items for Systematic Reviews and Analyses; WHO, World Health Organization; ICT, information and communication technology; IoT, Internet of Things.

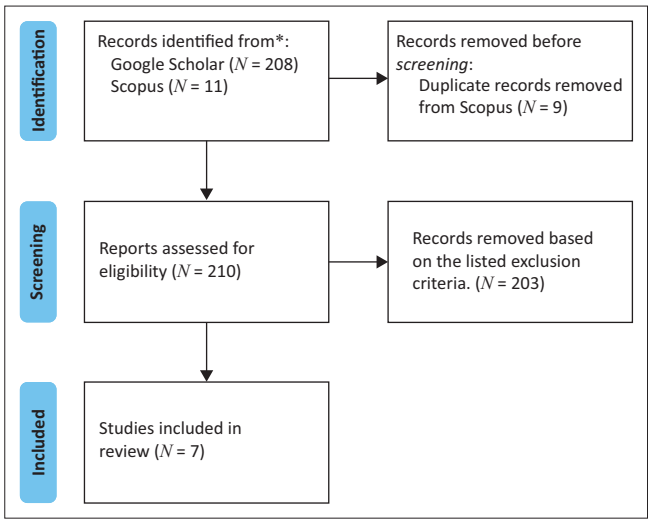

FIGURE 1: Search strategy and identification of eligible publications.

Implications and recommendations

Results from the literature review show that several DH initiatives are being developed as informed by operationalising national DH strategies. Thus, it is argued that development, implementation and assessment of these strategies enable the progress and maturity levels of DH applications.[9] However, the limited and scarce reporting of DH strategy implementation is confirmed in the few available publications, because of complexity of health care systems.[14] The significance of reporting DH implementation is to capture and evaluate the evidence of challenges experienced during pilot tests and successful projects.[30] Embedding a mechanism for new knowledge creation, such as a structured process for DH strategy implementation reporting, is critical in active ongoing efforts to developing practical solutions for complex societal problems.[17] The current situation requires a stronger partnership and collaboration between relevant stakeholders in the health care systems of SSA countries.[6] The relevant stakeholders and their roles should be identified and engaged so that the different goals of DH strategies are met, recorded and its impact evaluated accordingly.

Subsequently, countries in SSA that have reportedly operationalised their national DH strategy are few compared to the total number that have any form of strategy, plan or framework. The countries have either adopted the nine core components of the WHO global strategy for DH or contextualised their own priority areas. For example, the most common core components as strategic priority areas are investments and infrastructure.[9,11] Also, some of the governments have established technical agencies to coordinate and enable collaboration to implement DH focused on priority areas. On collaboration, Wickson et al.[15] suggest a broader view of interaction that is inclusive of affected persons and their experiences – what they refer to as the integration of epistemologies towards generating new knowledge. The infusion of disciplines that takes place during collaboration offers novel opportunities for stakeholders to identify performance indicators, data points and resources needed to monitor, assess and report DH strategy implementation and associated benefit measurements to SSA health care systems.

An adaptive methodology that transcends the multidisciplinary boundaries is most ideal to address the limited to no reporting on the collaborative roles of stakeholders, the available resources concerning skills and digital knowledge required to operationalise priority areas of national DH strategies. To address this, the authors propose a stakeholder mapping, analysis and engagement methodology inclusive of cross-sectional scientific disciplines and non-scientific stakeholders.[31] Such a participatory engagement enables identifying intersections of roles; conflicting interest management, equitable participation and the development of action points that include practical solutions on how implemented DH strategies should be monitored, assessed and reported within peculiar contexts.[32] In essence, leadership, human capacity and resources are the critical elements to successful implementation of national DH strategies and reporting of milestones.[33]

Leadership in DH requires both political will and commitment as well as the technical knowledge required to manage the complexities associated with the development and implementation of health ICT interventions.[34] Therefore, countries in SSA should inaugurate DH champions with knowledge in advanced digital technologies such as AI and Big Data analytics (BDA) in health-related fields to lead transdisciplinary teams to establish, monitor, evaluate and maintain DH projects through their life cycle, to prevent pilotitis.[29] In this way, implicit knowledge on DH strategy and projects implementation is adequately curated towards strengthening health care systems to meet SDG 3 in SSA countries.

Knowledge and capacity development are essential to ensure that all core components of national DH strategies are actively being engaged to optimise the benefits of health ICTs.[35] Currently, it is not clear if or how other core components of national DH strategies have contributed to the extent of implementation. Therefore, it is imperative that SSA countries establish agencies mandated to carry out research and curate knowledge relevant to operationalising the core components of national DH strategies towards monitoring implementation, measuring performance and identifying outcomes. Such agencies will include actors and relationships based on the Quadruple Helix model of government–university–civil society–industry.[32] Drawing from the tenets of transdisciplinary approaches towards innovatively addressing complex societal problems as argued by Butt and Dimitrijevic,[31] Levesque et al.[17] and Wickson et al.,[15] the authors developed Figure 2.

Without adequate resources such as financial investments, ICT infrastructure and the cross-functional collaboration of experienced human capacities, it remains difficult for SSA countries to determine and institutionalise requirements for the successful implementation of DH strategies as well as

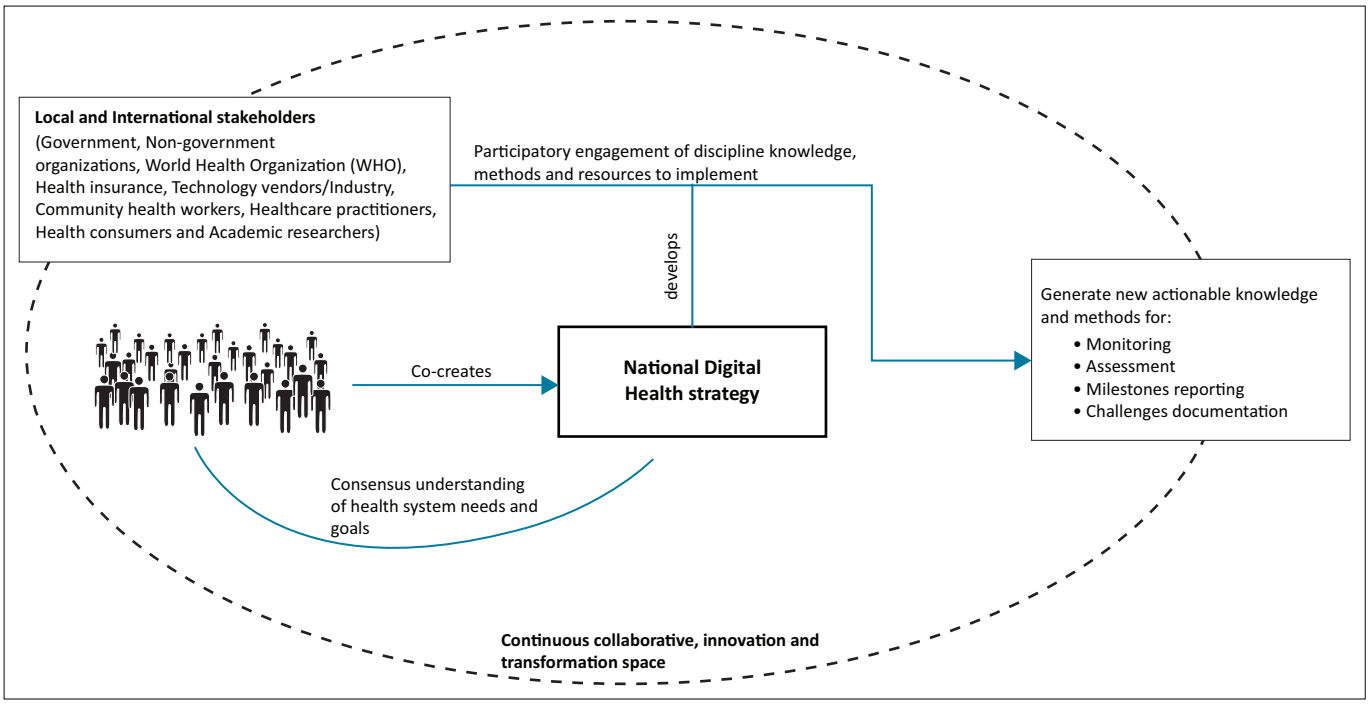

FIGURE 2: Transdisciplinary approach to reporting national Digital Health strategy implementation.

generating knowledge and capacity to report, monitor and assess milestones. It is for these reasons that Mengiste et al.[27] argued for formulation of DH policies to address complexities of eHealth implementation.

Conclusion

The rationale for the article was to identify the extent to which countries in sub-Saharan Africa (SSA) are (or are not) reporting implementation of their national DH strategies, towards realising UN SDG 3 – 'Good health and well-being'. However, it remains unclear how the DH interventions align to in-country strategic priority areas of their DH strategies because countrywide impacts are not being extensively measured nor reported (actionable knowledge), hence the need for a structured means of reporting facilitated by the Ministries or Departments of Health. To address the complexity of reporting national DH strategy implementation, cross-functional collaborations between academic researchers and health institutions or the related industry and government through their Ministries or Department of Health, and an adaptive methodology to assess DHIs towards new knowledge co-creation could potentially redress the existing gap. Therefore, capacity building; implicit knowledge sharing and resources are critical enabling (or inhibiting) factors to implementing national DH strategies in SSA. Three limitations of this article are the unintended omission of relevant articles published in closed access journals; not considering studies from non-English or French speaking SSA countries and exclusion of non-scholarly publications such as WHO and national Ministries of Health review reports on DH strategies.

In SSA countries such as Ghana, Kenya, Malawi, Uganda, where national DH strategies have been developed, there is a need to monitor, evaluate and report milestones using the WHO DH toolkit as established by Njoroge et al.[26] and checklist developed by Franck et al.[30] A structured means of monitoring and reporting would assist the relevant government authorities to be accountable in efficient resource allocation; that investments are intentionally directed to scale pilot studies to nationwide implementation of DH to strengthen health care systems and to identify weaknesses where more efforts are required through partnerships and collaborations. Contextualising DH leadership on principles of transformation, engaged scholarship and sustainability should be prioritised to ensure that appropriate capacity is being developed across health government authorities, health workers and academia to share knowledge and skills, with the aim to optimise the benefits of technology applications within the health sector. To capture a more holistic evidence of other contexts within SSA, there is a need to investigate how Francophone countries are operationalising, transforming, monitoring and reporting their national DH strategies.

For future studies, countries that lack reporting mechanisms to assess the extent to which their national DH strategies are being operationalised should consider strategic partnerships with countries like South Africa, who have in the past reviewed implementation of their eHealth strategy 2012–2016 and revised into National Digital Health strategy 2019–2024. The strategic partnerships could be in the form of co-development or knowledge sharing collaboration between academia, policy makers, community health workers, health care professionals, allied health workers, health-related software industry vendors and governments. Further, countries in SSA should identify sources to collect Big Data on implementation of DH strategies through Internet of Things (IoT) then employ BDA to report, identify trends and forecast prescriptive actions on the core components that are lagging in intended outcomes.

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Competing interests

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Authors' contributions

O.O.O. and N.B.W.M. conceptualised the idea of the manuscript. O.O.O. was responsible for articulating the research problem, conducting the search strategy, analysis of the eligible articles and writing the first draft of the manuscript, while N.B.W.M. proofread and offered critical review before final draft submission.

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