

# Digital health and self-management of chronic diseases in sub-Saharan Africa: A scoping review

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**Background:** With the rise of noncommunicable diseases (NCDs) in sub-Saharan Africa (SSA), the concept of digital self-management presents great opportunities for relieving some of the burdens healthcare systems face. However, for this to be realised, effective use of digital health in self-management and assessment is essential.

**Objective:** The objective of this scoping review was to identify social determinants and cognitive factors with potential influence on digital health use in self-management of chronic medical conditions associated with NCDs in SSA.

**Method:** The 5-stage scoping review framework was used to search, identify, and filter publications over a 10-year period from two major databases, Google Scholar and Pubmed. Based on the inclusion criteria, a total of 12 documents were chosen for analysis.

**Results:** Findings reveal that social determinants such as cultural values and societal practices demand a rethinking of how digital health for self-management of chronic diseases are designed and developed for use in SSA, whereas a cognitive factor such as self-efficacy is central in digital health use in self-management of chronic conditions, particularly in areas like adherence to medication, diet and exercise programmes.

**Conclusion:** Owing to the unique characteristics of digital health users in SSA, technologies and content (particularly those for self-management of chronic diseases) should be tailored to the diverse needs of the population. It is through this that the region can fully benefit from the potential of digital health use in self-management of chronic diseases associated with NCDs.

**Keywords:** digital health; self-management; sub-Saharan Africa; noncommunicable diseases; chronic medical conditions.

## Introduction

Sub-Saharan Africa (SSA) is experiencing a persistent rise in noncommunicable diseases (NCDs) that are chronic in nature, such as cardiovascular diseases, chronic respiratory diseases, cancers, autoimmune disorders and mental illnesses (Gouda et al. 2019; World Health Organization 2014a). Several studies have attributed this to the effects of rapid urbanisation in major cities (Amegah & Agyei-Mensah 2017; Katoto et al. 2019). The effects include lifestyle changes such as decreased physical activity, unhealthy diets and excessive substance consumption such as tobacco and alcohol abuse, all of which are associated with some chronic medical conditions (Hamid, Groot & Pavlova 2019; Haque et al. 2020). In addition, the degradation of environmental quality, including air, water and land pollution, is associated with a rise in NCDs (Amegah & Agyei-Mensah 2017; Katoto et al. 2019). Despite advances in NCD prevention, diagnosis, treatment and management, there is still a gap in redressing how lifestyle changes and environmental degradation contribute to the disease burden in SSA (Bigna & Noubiap 2019).

The treatment and management of NCDs in SSA place additional strain on the already overburdened primary healthcare systems (Gandarillas & Goswami 2018). As a result, most countries have developed strategies to promote healthy lifestyle choices, raise awareness of environmental risks and expand primary healthcare services (Tapela et al. 2019). In terms of primary care, there has been a paradigm shift toward a patient-centred approach rather than the disease-centred approach that had previously been the focus of healthcare systems in the region. A patient-centred approach to chronic disease management has grown in popularity because it is thought to improve health outcomes and quality of life (Poitras et al. 2018). This is because this approach allows healthcare services to be tailored to the needs of individual patients (Gandarillas & Goswami 2018). The patient-centred approach also promotes the idea of self-care or self-management, which can reduce the burden on healthcare systems.

Self-management is widely used in primary care and has gradually evolved into an important and critical component of chronic disease management and treatment (Talboom-Kamp et al. 2018). It is defined as the activities that an individual engages in to prevent and manage symptoms and treat chronic conditions (Schulman-Green et al. 2016). Self-management enables patients to not only define but also control their chronic health conditions (Cummings, Ellis & Turner 2017). Appropriate technologies are required to achieve the goals of a patient-centred approach to managing and treating chronic NCDs in SSA through self-management (Demaio et al. 2014). In a patient-centred healthcare approach, digital health then becomes an integral part of achieving desired health outcomes in the management of chronic NCDs (World Health Organization 2018). Digital health is frequently discussed under the umbrella term e-health, and m-health is defined as a concept that combines technology and healthcare. Digital health has been used to facilitate communication between patients and healthcare practitioners in the context of self-management.

Patients in this case send and receive personalised health-related information related to their chronic condition (Roess 2017). Telemedicine is commonly used in the provision of primary healthcare services in the SSA context, particularly when patients have limited access to healthcare facilities. As a result, digital health has enormous potential to improve health outcomes and the overall quality of life for patients living with chronic diseases (Morton et al. 2017). Chronic disease treatment support, patient tracking, education and awareness are all supported by digital health initiatives.

## Research problem and question

Several challenges affect digital health adoption and use in SSA, as they do in many other parts of the world. These include, but are not limited to, low levels of digital literacy and skills, a consistent supply of electricity, issues with Internet connectivity and high data costs, ethical and privacy concerns, and scepticism about digital health (Braithwaite & Okhaku 2020). While the focus of these challenges has been on communicable or infectious diseases, chronic illness associated with NCDs has received less attention. As a result, it is not surprising that there is a paucity of literature on the use of digital health in the self-management of chronic medical conditions associated with NCDs, particularly in the SSA context.

The research question that underpins this study is as follows: how do social determinants and cognitive factors influence the adoption and effective use of digital health technologies in the self-management of chronic medical conditions associated with NCDs in SSA?

## Literature review

This section of the article provides a review of the existing literature on chronic disease management in SSA, as well as the use of digital health technologies in chronic disease self-management in SSA.

## Chronic disease management in sub-Saharan Africa

Healthcare systems in SSA struggle with the burden of both NCDs and communicable diseases. For many years, the emphasis has been on communicable and infectious disease prevention and management, such as malaria, cholera, HIV and AIDS, and tuberculosis (TB). However, with the continued rise of NCDs, there has been a rapid shift in chronic illness prevention and management to combat the scourge of NCD-related premature deaths (Kraef et al. 2020; Kushitor & Boatema 2018). Greater parts of SSA have NCD prevention and management measures in place, such as increased taxes on alcohol and tobacco products, promotion of nutrition programmes and protection from tobacco smoke exposure (Juma et al. 2018).

However, efforts to put such measures in place are hampered by a number of obstacles. Randall and Ghebre (2016), for example, highlight challenges such as infrastructure and human capacity gaps exacerbated by financial constraints that impede cancer care management. Likewise, Van Gemert et al. (2018) conducted research on chronic obstructive pulmonary disease in three East African countries. They cite a lack of a national protocol for assessment and management as well as inadequate healthcare infrastructure as barriers to optimal NCD management and prevention. The consequences of such historical challenges continue to exacerbate disparities in most healthcare systems and efforts to manage NCDs.

Notwithstanding the challenges, some countries have developed other innovative solutions to address the rising demand for chronic illness care associated with NCDs. Integrating chronic illness care with existing communicable and infectious disease management models is one of the solutions (Ame 2020). Chronic disease management models, for example, have been integrated with existing primary care models for infectious and communicable diseases in South Africa. This is intended to help the public healthcare system deal with the burden of treating and managing NCDs (Wroe et al. 2015). Similarly, decentralised integrated chronic care clinics were established in rural areas of Malawi, where patients could receive chronic illness care in addition to other general healthcare services (Wroe et al. 2015).

## Application of digital health technologies in chronic disease self-management in sub-Saharan Africa

Extant literature shows widespread adoption and use of digital health technologies to enhance the provision of healthcare services in SSA (Odekunle, Odekunle & Shankar 2017; Olu et al. 2019; Sandström et al. 2016). The increase in the use of digital health is due to the proliferation of smartphones and other mobile devices in areas of self-assessment and management. Digital health is commonly used in areas such as seeking health-related information for the improvement of lifestyle habits such as diet, sleeping patterns, exercise and so forth. This has been attributed to the advancements in mobile telecommunication infrastructure in

SSA that have bolstered connectivity and enabled m-health to become ubiquitous (Hampshire et al. 2021). It is based on this that Holst et al. (2020) refer to SSA as an emergent breeding ground for digital health initiatives.

The wide spectrum of potential benefits of digital health use includes reducing long-distance travel, enhancing personalised care, disease surveillance and management, and so forth (Bempong et al. 2019; Roess 2017). Owing to the advancement of mobile telecommunication infrastructure, SSA is also witnessing a proliferation of digital healthcare applications. Countries like Kenya, Benin, Uganda and South Africa have seen widespread use of healthcare applications such as Hello-Doctor, ChanjoPlus, M-Tiba, mTrac and GoMedical (Ajifowoke 2021). Furthermore, mobile-enabled device features such as short-messaging services (SMSs), text messaging and instant messaging have largely contributed to improving communication between patients and their physicians, as well as among healthcare professionals. Noninvasive treatment techniques and physical activity monitoring are examples of m-health applications in personal healthcare management.

Maternal and neonatal health are two other areas where m-health is being used in SSA, to monitor and educate pregnant women before and after childbirth (Mulani et al. 2020). Table 1 showcases the common chronic diseases and the associated digital health technologies used to self-manage SSA.

## Methods

To achieve the primary objectives of this scoping review, the methodological approach undertaken was guided by Arksey and O'Malley's (2005) outlined methods. The authors state that the general purpose of a scoping review is to identify and map the available evidence in literature on a given topic under investigation, using a 5-stage scoping review framework. In stage 1, research question(s) or objectives including key elements that are the focus of the investigation are identified. Stage 2 involves the identification of relevant studies in literature that relate to the research objectives or question(s) on the topic under investigation. Stage 3 involves the selection of relevant and appropriate studies. In stage 4, the retrieved data is charted, and later in Stage 5, it is summarised and reported to provide meaningful understanding on the topic or issue(s) under investigation. Following the 5-stage scoping review framework, research objectives and questions that underpin this study are outlined in the introductory section. For stages 2–4, the researchers applied the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-Scr) as a guideline (see Figure 1). In the next subsections, the processes of stages 2–4 is outlined.

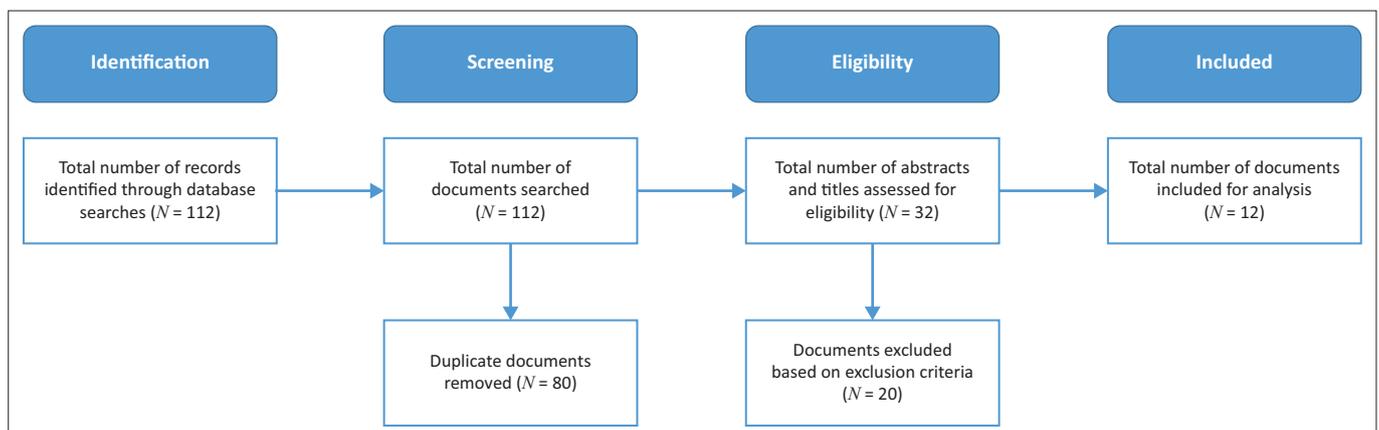
## Types of sources

All studies that had qualitative, quantitative, and mixed methods empirical design were included in this scoping review. Systematic literature reviews and other reviews were also considered and retrieved. Only literature published in

**TABLE 1:** Common chronic medical conditions and associated digital health technologies in sub-Saharan Africa.

Nature of chronic medical conditions	Digital health that supports chronic medical conditions	Impact of digital health usage on chronic medical conditions
Diabetes	Medical mobile applications (apps); SMS; digital glucose monitor; sensors	Assists to monitor blood sugars and related vital signs; prompts patient to adjust lifestyle behaviours such as physical activities, glucose regulation and sleep adequacy
Cardiovascular problems	Fitness tracking apps; portable handheld digital electrocardiogram (ECG) monitors	Cost effective: reduces visits to the hospital; aids convenience and comfort
Cancer	Smartphone medical apps, wearables, sensors	Assists to monitor comorbidities in concerned patients; monitors recovery or remission of cancerous cells in the body
Mental ailments such as anxiety, stress and depression	Telemedicine, smart watches, smartphone medical apps	Enables remote consultation; improves mobility; monitors stress symptoms
Dementia and Alzheimer's	Portable digital health devices; digital hearing aids, wearables	Noninvasive method to assist and monitor the elderly in real time; promotes and sustains independent living (Ambient assisted-living [AAL]) and associated attributes

SMS, short-messaging service.



**FIGURE 1:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses steps followed in identifying documents.

English from 2012 to 2022 were considered in the scoping review. The 10-year timeline was chosen because there has been an exponential increase in global awareness, design and implementation of digital health technologies for chronic medical disease self-management and monitoring in the last 10 years. Table 2 shows the inclusion and exclusion criteria that were applied in the selection of relevant and appropriate literature.

## Search strategy

The search strategy aimed at finding peer-reviewed articles and was conducted on two academic databases, namely Google Scholar and PubMed. The following search keywords were used: 'self-management' OR 'self-care' AND 'chronic medical conditions' AND 'digital health' OR 'mobile health' OR 'wearable technology' AND 'SSA'. The types of studies considered for inclusion in the scoping review included all qualitative, quantitative, random trials and mixed methods studies. In addition, only articles published from 2012 to 2022 were considered. The retrieved articles were screened over two rounds for the study's selection. In the first round, the researchers reviewed the title and abstracts according to the inclusion and exclusion criteria listed in Table 2. In the second round of the review, the full text of the selected articles were screened to determine if they met the outlined criteria and to delete duplicates.

## Charting and extracting data

In this stage, the full-text articles that met the inclusion criteria are further reviewed using the Arksey and O'Malley (2005) descriptive-analytical narrative method. This method involves synthesising and interpreting the data by sifting through and sorting the extracted material (data) according to the key objectives or researcher question(s) on the topic under investigation. This required the application of a thematic analysis framework. The data extracted included the names of authors, the year of publication, aim of the study, location or context of study and main findings.

## Summarising and reporting results

After data from the included articles were extracted and charted, the descriptive data were analysed using the

thematic analysis technique. The extracted data were summarised, and the findings were organised into two broad themes: social determinants and cognitive factors that influence the use of digital health in the self-management of chronic medical conditions.

## Results

After the second round of the search strategy, a total of 112 articles exploring the adoption and use of digital health technologies in the self-management of chronic medical conditions in SSA were initially identified. Following an iterative process of manual screening for duplications, a total of 80 articles were removed, leaving a total of 32 articles eligible for review. Of the 32 articles, 20 were excluded based on the exclusion criteria (Table 2). A total of 12 articles that met the inclusion criteria were included in the final review, which largely focused on digital health technology use in self-management of chronic medical conditions associated with NCDs in SSA. These articles were then analysed using the descriptive-analytical narrative method.

## Study characteristics

The selected articles consisted of studies focusing on digital technology use in self-management of chronic medical conditions associated with NCDs in SSA. Of the 12 selected articles, the majority focused on the use of digital health in self-management of diabetes ( $n = 5$ ). Other remaining articles focused on, hypertension ( $n = 1$ ), heart conditions ( $n = 2$ ), cancer care ( $n = 1$ ) and other NCDs ( $n = 3$ ). In the majority of the studies, the intervention used in self-management of the chronic medical condition was SMSes via mobile phones ( $n = 9$ ) and telephone calls ( $n = 1$ ); the rest of the studies looked at general use of Information and communication Technologies (ICTs) ( $n = 2$ ). Data from the studies were collected using qualitative methods ( $n = 3$ ), quantitative methods ( $n = 3$ ), realist and systematic review ( $n = 2$ ), pilot study ( $n = 1$ ) and randomised trial ( $n = 3$ ). Data collection methods of the included studies varied, with some studies addressing national populations while others collected data at specific healthcare facilities, the community level or individual groups. Table 3 presents a summary description of the selected studies on digital health use in self-management of chronic medical conditions associated with NCDs in various countries in SSA.

## Discussions

The primary objective of this scoping review was to identify the social determinants and cognitive factors that have potential influence on the effective use of digital health in the self-management of chronic medical conditions associated with NCDs in SSA. Several *social determinants* and *cognitive factors* were identified through the analysis of the selected articles and are discussed in this section.

Several *social determinants* are identified in the reviewed articles. Cultural values and societal practices, accessibility, affordability, awareness, language and connectivity were

**TABLE 2:** Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> <li>All articles must be written in English</li> <li>Peer-reviewed journal articles</li> <li>Articles focused on at least one chronic disease (i.e. cardiovascular disease, chronic respiratory diseases, cancers, autoimmune disorders and mental illness, etc.)</li> <li>Articles of studies on self-management of chronic medical conditions in SSA countries</li> <li>Digital health, m-health, e-health used for self-management of chronic medical conditions</li> <li>Articles that focus on social determinants and/or cognitive factors that influence digital health</li> </ul>	<ul style="list-style-type: none"> <li>Articles written in other languages</li> <li>Articles on studies undertaken outside the SSA region</li> <li>Theses, books and non-open access publications</li> <li>Articles not focused on the use of digital health interventions for self-management of chronic diseases associated with NCDs in SSA</li> </ul>

NCD, noncommunicable diseases; SSA, sub-Saharan Africa.

**TABLE 3:** A summary description of the selected articles on digital health use in the self-management of chronic medical conditions associated with non-communicable diseases in sub-Saharan Africa.

Title of study	Author, study year	Country or region	Intervention	Nature of chronic medical conditions	Objective and methodology of study	Outcome(s)
1. The mobile phone as a tool in improving cancer care in Nigeria	Odigie et al. (2012)	Nigeria	Mobile phones	Cancer	<b>Method:</b> Quantitative study <b>Objective(s):</b> To investigate the use of mobile phones as a tool for improving cancer care in a low-resource setting	Patients who made use of mobile phones to contact clinicians adhered to appointments better than those who were not in contact with their clinicians
2. Diabetes Buddies: Peer support through a mobile phone buddy system	Rotheram-Borus et al. (2012)	South Africa	Mobile phones	Diabetes	<b>Method:</b> Pilot program <b>Objective(s):</b> To test the feasibility and acceptability of a mobile phone-based peer support intervention among women in resource-poor settings to self-manage their diabetes	Cost of mobile phones has an impact on its use Reliable technology infrastructure is required to sustain phone to support mobile phone buddy system
3. Mobile phone text messages to support treatment adherence in adults with high blood pressure (SMS Text Adherence Support [STAR]) a single-blind, randomized trial	Bobrow et al. (2016)	South Africa	SMS texts (mobile phones)	Hypertension (high blood pressure)	<b>Method:</b> A single-blind, three-arm, randomised trial <b>Objective(s):</b> To assess the effect of automated treatment adherence support delivered via mobile phone short-message system (SMS) text messages on blood pressure	The primary outcome of the study indicated a small reduction in systolic blood pressure control compared with usual care at 12 months
4. The effect of text message support on diabetes self-management in developing countries—A randomised trial	Olmen et al. (2017)	Developing countries (Democratic Republic of Congo)	Text messaging	Diabetes	<b>Method:</b> A randomised trial <b>Objective(s):</b> Implement a mobile phone intervention in existing diabetes programmes in three low- and middle-income countries	Text messages did not show additional effect on diabetes control among the participants in the trial
5. Applicability of structured telephone monitoring to follow up heart failure patients discharged from Muhimbili National Hospital, Tanzania	Mmbali and Chillo (2017)	Tanzania	Telephones	Heart Failure	<b>Method:</b> Quantitative analysis <b>Objective(s):</b> To determine the applicability of structured telephone monitoring of heart failure patients	Accessibility of mobile technology and the high cost of heart failure management influenced use of telephone monitoring in heart failure patients
6. A realist review of mobile phone-based health interventions for non-communicable disease management in sub-Saharan Africa	Opoku, Stephani and Quentin (2017)	Sub-Saharan Africa	Mobile phones	NCDs	<b>Method:</b> A realist review <b>Objective(s):</b> To understand how, why, for whom and in what circumstances m-health interventions contribute to improved treatment and care for patients with NCDs	Contextual factors such as needs and enabling resources influenced the perceptions of patients and healthcare providers on the ease of use and usefulness of the m-health intervention Positive attitude as well as common language of communication played a major role in mobile phone use
7. Factors motivating the adoption of self-healthcare monitoring mobile applications by the South African youth	Ndayizigamiye, Soni and Jere (2018)	South Africa	Mobile applications	NCDs	<b>Method:</b> Qualitative analysis <b>Objective(s):</b> To investigate factors that could influence the use of self-healthcare monitoring mobile applications by South African youth	Findings suggest factors such as awareness, performance expectancy, affordability, privacy and economic influenced ICT tools use
8. Challenges for the adoption of ICT for diabetes self-management in South Africa	Petersen et al. (2020)	South Africa	ICTs	Diabetes	<b>Method:</b> Qualitative analysis <b>Objective(s):</b> To identify the challenges and barriers for the adoption of ICT tools for diabetes self-management	Findings suggest factors such as sociocultural and cognitive factors such as the lack of electronic skills and self-awareness are inhibitors of ICT tools use in self-management among diabetic patients
9. E-health literacy and associated factors among chronic patients in a low-income country: a cross-sectional survey	Shifferaw et al. (2020)	Ethiopia	Mobile Internet use	Chronic conditions	<b>Method:</b> A cross-sectional survey <b>Objective(s):</b> To assess e-health literacy levels and associated factors among Internet user chronic patients in north-west Ethiopia	Participants with higher education were more likely to possess e-health literacy skills Awareness of the availability of online resources and having a positive attitude towards online resources
10. Digital messaging to support control for type 2 diabetes (STAR2D): a multicentre randomised controlled trial	Farmer et al. (2021)	South Africa and Malawi	Mobile phone messaging	Diabetes	<b>Method:</b> Randomised trial <b>Objective(s):</b> To test the effectiveness of sending brief, automated SMSs in improving outcomes in adults with type 2 diabetes	Participants reported many challenges to adherence despite finding messages acceptable and useful
11. Process evaluation of a brief messaging intervention to improve diabetes treatment adherence in sub-Saharan Africa	Leon et al. (2021)	Malawi and South Africa	Brief messaging intervention SMSes	Diabetes	<b>Method:</b> Qualitative research design <b>Objective(s):</b> Testing the effectiveness of brief text messaging for improving clinical outcomes and medication adherence	Acceptability and usefulness of the brief messages and positive behavioural changes associated to text reminders
12. Patient-facing m-health application improves self-care and symptoms of heart failure in Uganda	Schwartz et al. (2022)	Uganda	M-health application (Medly Uganda)	Heart failure	<b>Method:</b> Prospective study <b>Objective(s):</b> Evaluating the clinical effectiveness of Medly Uganda	Self-care in heart failure index improved among the patients using the m-health application

SMS, short-messaging service; NCD, noncommunicable diseases.

among the topics covered. In this review, social determinants are defined as conditions or circumstances that have a significant impact on an individual. As a result, social determinants are a critical factor in the effective use of digital health in the self-management of chronic medical conditions associated with NCDs in the SSA context. Beliefs, rules, norms, behaviours and procedures that guide an individual's cultural values and social practices are all part of culture. Hofstede (2001) suggests that an individual's cultural values shape their pattern of thinking and behaviour. When it comes to culture, SSA is without a doubt one of the most diverse regions in the world. As a result, it is a factor that cannot be ignored in the region when it comes to digital health adoption and use. Cultural values, it is argued, have an impact on an individual's understanding and perception of health-related issues, as well as how they act in response to those issues (Petersen et al. 2020). In their study, Sagaro, Battineni and Amenta (2020) suggest that in parts of Ethiopia, women do not have the right to make healthcare-related decisions due to cultural beliefs and practices. This includes using e-health services on their own without permission. This is an example of how culture influences digital health use in the self-management of chronic medical conditions in SSA.

Another social determinant identified in SSA was the presence of several vernacular languages and unique modes of communication. Language and communication methods have been identified as potential barriers to effective digital health use in SSA (Opoku et al. 2017). Language disparities and communication methods, according to Corcoran (2013), have an impact on the effective use of digital health in the self-management of chronic medical conditions, particularly when it comes to accessing and understanding health-related information. The vast majority of digital health applications and tools used in the SSA context are designed and developed in the developed world. As a result, the majority of digital health tools are not customised to meet the needs and communication methods of the local language or dialect, potentially excluding those who do not understand the language used in digital health applications and tools (Coleman et al. 2020).

Other social determinants mentioned in relation to digital self-management of chronic medical conditions associated with NCDs include ethical concerns about data privacy and consent, the digital divide, health and digital literacy. All of these factors have a significant impact on how digital health applications and tools are used. For example, users and potential users who are concerned about the security of their health data may reject the use of digital health technology in self-management. This situation is exacerbated by the fact that digital devices are commonly shared among family members in most parts of SSA. Ndayizigamiye et al. (2018) highlight the lack of awareness of digital applications and tools as one of the social determinants that influenced the use of digital health.

Another determinant of digital self-management in the SSA context is connectivity. It is perceived as more than just the

ability of individuals (patients), healthcare practitioners and facilities to connect via digital networks in this context. It is also regarded as having adequate physical infrastructure resources, such as digital network infrastructure, roads and a reliable power supply to power digital devices and mobile network infrastructure (Mmbali & Chillo 2017). Strong connectivity promotes mobile network coverage, which is critical in the self-management of chronic medical conditions through the use of digital technologies. Sagaro et al. (2020) suggest that the majority of people living in remote areas with limited access to technology infrastructure are less likely to adopt and then use digital self-management for chronic medical conditions.

Affordability is yet another social determinant identified. Healthcare systems implement and prescribe digital self-management initiatives, but patients are often not provided access to the necessary digital infrastructure resources, such as digital devices and internet access. Affordability includes the cost of mobile data, digital health apps, Internet use and the cost of acquiring smartphone devices that can use health apps. Individuals in the majority of SSA do not have access to mobile devices capable of supporting digital health applications or the Internet. This becomes a barrier to using digital technologies to self-manage chronic medical conditions (Ndayizigamiye et al. 2018). Table 4 provides a description of sampled articles on social determinants that influence digital health use in the self-management of chronic medical conditions associated with NCDs in SSA.

The authors of this scoping review contend that the identified social determinants necessitate a rethinking of how digital health technologies for the self-management of chronic medical conditions are designed and developed for use in the SSA context. For example, Crawford and Serhal (2020) argued that the quality and effectiveness of digital self-care management will suffer if technologies are not experienced as culturally safe by their users. Therefore, designing culturally and linguistically appropriate digital health technologies for self-management of chronic medical conditions in SSA should be prioritised. In addition, connectivity and affordability play a critical role in the effective use of digital health technologies in the self-management of chronic medical conditions in SSA.

The second part of the objective of the study was to identify *cognitive factors*. These are factors considered characteristic of an individual that affect their ability to effectively make use of digital health in self-management of chronic medical conditions. Danili and Reid (2006) suggest factors such as reasoning, attention and memory span as part of cognitivism. These are characteristics that are fundamental in self-management of chronic medical conditions that may have impaired an individual's cognitivism. As a result, a patient may not effectively use digital health in self-management. Other important cognitive factors include self-efficacy, self-awareness and usability that influence digital health technologies in self-management of chronic

**TABLE 4:** Studies on social determinants of digital health use in self-management of chronic medical conditions.

Number	Title of journal or conference paper	Author details	Chronic medical condition	Outcome(s) related to social determinants
1.	Process evaluation of a brief messaging intervention to improve diabetes treatment adherence in sub-Saharan Africa	Leon et al. (2021)	Diabetes	The complex context and need for self-management and health service support
2.	Challenges for the adoption of ICT for diabetes self-management in South Africa	Petersen et al. (2020)	Diabetes	Sociocultural, economic factors influenced ICT tools use
3.	Factors motivating the adoption of self-healthcare monitoring mobile applications by the South African youth	Ndayizigamiye et al. (2018)	NCDs	Awareness, performance expectancy, affordability and privacy
4.	Applicability of structured telephone monitoring to follow up heart failure patients discharged from Muhimbili National Hospital, Tanzania	Mmbali and Chillo (2017)	Heart failure	Accessibility of mobile technology and the high cost of care
5.	A realist review of mobile phone-based health interventions for noncommunicable disease management in sub-Saharan Africa	Opoku et al. (2017)	NCDs	Contextual factors such as needs and enabling resources influenced the perception of patients A positive attitude, language of communication

ICT, Internet and communication technology; NCDs, noncommunicable diseases.

medical conditions (Opoku, Stephani and Quentin (2017) Petersen et al. 2020).

## Conclusion

Digital self-management of chronic medical conditions is an emerging alternative approach to NCDs' management in SSA. Given the uniqueness of the SSA context, digital self-management of chronic medical conditions associated with NCDs cannot be devoid of sociocultural, economic and cognitive factors such as self-efficacy that pose potential barriers to effective digital health use. Careful consideration should therefore be given to these factors if the region is to realise the benefits of digital health for improved health outcomes for individuals living with chronic medical conditions associated with NCDs.

The outcomes of this scoping review may be of interest to several individuals in government, academia, industry and policymakers in SSA. There is a great need for adequate digital infrastructural resources as well as enabling policies that favour digital health initiatives that are attuned to the sociocultural and cognitive needs of the population in the SSA context. The adoption of and subsequent effective use of digital health in the self-management of chronic medical conditions associated with NCDs in SSA can only be of value to the population if there is an enabling environment. Owing to the limited studies conducted in the SSA context on digital health use in self-management of chronic medical conditions associated with NCDs, there is room for empirical studies to be done in greater parts of the region.

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### Competing interests

The authors have declared that no competing interest exist.

### Authors' contributions

M.A. and O.O. contributed equally to the conceptualisation and writing of the manuscript. The introduction and method section were written by M.A. while O.O. wrote the background literature section. The results section was jointly written by M.A. and O.O. The discussion section was written by M.A.

## Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

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## Data availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

## Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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