Investigating the challenges, benefits, and applications of digital health in South Africa: A PRISMA process

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Abstract. Digital health technologies have the ability to enhance the quality of healthcare. The usage of digital technologies (digital gadgets and their related apps, platforms, and websites) has led to numerous claims in public health and medical research about an impending breakthrough in the health sector, preventative medicine, and public health. Nevertheless, it is crucial to take a more cynical stance when evaluating the effects and consequences of digital health. Moreover, digital health adoption in developing and developed countries has disclosed several advantages, challenges, and applications. Thus, this study aimed to investigate the challenges, benefits, and applications of digital health in South Africa. The methodology utilized in this study was a qualitative systematic review through the PRISMA process and made use of documents such as accredited academic journals, articles, and books to gather data. This study used a sequential sampling method, and data were collected until saturation was reached. For purposes of data analysis, the study used thematic analysis to discover themes from the gathered data. The findings of this study revealed barriers that impede digital health adoption in South Africa. These barriers include technical, supportive policies, skilled manpower, and many more. Furthermore, work is needed to explore how the adoption of digital health technologies will affect the work of individuals. It is recommended that end users be trained on how to use digital health systems and many other things.

Keywords: Digital health; E-health; Digital health technologies; Digital health benefits; Digital health challenges; Healthcare; South Africa.

1. Introduction

Many developing and developed nations have placed a greater priority on the utilization of technology to deliver health services [1]. Technology is now employed to deliver health services more effectively. Digital health services were introduced due to the use of technology in the healthcare sector [1]. Digital health technology could lead to new methods of understanding, practicing, and engaging with medicine, public health, and healthcare. The governments in developing nations are working to deploy these systems, while many developed countries have made significant expenditures in digital health systems [2-4]. According to numerous digital health and e-government policy documents, digital health is regarded as one of the tools in technology that are required to be used by health providers to ensure that everyone

has access to high-quality healthcare. Therefore, all the country's citizens will receive fair, inexpensive, and convenient services through digital health systems [3].

As a developing nation, South Africa is also hampered by issues, for instance, poverty and slow growth in the economy, which have prohibited the nation from meeting its development goals [5]. One of the objectives of the South African government is to provide its residents with the opportunity to have a high degree of healthcare services [6]. In contrast, the delivery of high-quality healthcare services of high-quality is exacerbated by barriers that include a shortage of healthcare infrastructure, expensive healthcare services, and a lack of qualified healthcare workers [7]. According to Furusa and Coleman [8], many developing nations are discovering that implementing digital health may be crucial in overcoming these difficulties after encountering comparable issues. The objectives of this research were to discover the benefits and challenges of adopting digital health and to discover the applications of digital health in South Africa by exploring existing literature.

The main aim of this study is to investigate the challenges of adopting digital health in South Africa.

1.1. Research objectives

a. To identify the challenges of adopting digital health in South Africa.
b. To discover the benefits of adopting digital health to the South African healthcare system.
c. To discover the applications of digital health in the South African healthcare sector.

1.2. Research questions

a. What are the challenges of adopting digital health in South Africa?
b. What are the benefits of adopting digital health to the South African healthcare system?
c. How is digital health being applied in the South African health sector?

The use of patient-centered healthcare systems is rising in popularity worldwide [9-11]. According to Hellberg and Johansson [11], over the past ten years, the health sector, information technology developers, and policymakers have all begun to pay more attention to patient-centered health information technology. According to Mburu and George [12], the South African government strived to deliver healthcare services of high quality to its citizens. Since the COVID-19 pandemic, there is a growing increase in digital health technologies in South Africa such as WhatsApp, chatbots, telemedicine, mobile health applications, artificial intelligence, robotics, and many more [13]. According to Sylva, et al. [14], strong "digital health strategies and policies" can make the adoption of digital health in South Africa easier. The primary objective of the South African eHealth Strategy 2020–2024 is to create "a well-functioning national health information system with the patient situated at the center." [15]. This is needed due to the fragmented, disorganized, and incompatible nature of the current information systems.

At various levels of care, a huge number of health institutions use information systems. The District Health Information System (DHIS), which has been in use since the middle of the 1990s, is the most widely used system at the primary healthcare level [15]. Employees at primary healthcare facilities compile statistical data from paper registers and send it to sub-district, district, provincial, and eventually national offices. Health institutions have used at least 15 different patient management or hospital information systems at the secondary and tertiary care levels [16].

Being one of the supportive systems in the health care system, digital health (d-health) is most likely to help address the challenges faced by health systems in developing countries [17]. Despite the well-known advantages of d-health, including improved data quality, decreased errors, and lower costs in the healthcare industry, most poor nations find it difficult to adopt d-health [18]. Hence, it is necessary to investigate the challenges of adopting digital health in South Africa.

To justify the problem, the use of digital health has significantly influenced the development of healthcare systems in the twenty-first century. Digital health has acquired attention in fields that include EHR, e-prescription, m-health, and many more [8]. Furthermore, paper-based systems are being progressively replaced by digital health. Many nations have hope that digital health technologies will help

reduce expenses and increase access to healthcare. Therefore, this causes digital health to become a reality in developing and developed nations and it shows enormous promise for enhancing healthcare access on a worldwide scale [19].

In many nations, access to healthcare is seen as one of the most fundamental rights of its residents. In South Africa, the current Constitution, which was enacted in 1996, guarantees everyone's right to health [20]. South Africa has a long history of providing healthcare. The health system has been significantly impacted by socioeconomic realities over the years, notably since the institutionalization of apartheid in the 1940s. Over the course of its lengthy history, the country's health system's government has been disorganized and divided, and its resources have been poorly managed. As a result, the system became extremely unjust, costly, and ineffective [21].

Additionally, South Africa is currently facing various challenges in the healthcare industry such as privacy and access, infrastructure, scalability, and management to name a few. According to Thulare, et al. [17], poor system utilization, particularly poorly designed healthcare information systems lead to challenges in communicating with patients and more time and energy invested by healthcare personnel in capturing the essential health information for medical records. According to Najem, et al. [22], these health information systems can combine the information about the patient and improve patterns of interaction across different wards in hospitals and healthcare workers, resulting in systems being effective and enabling them to deliver high-quality medical services. Nonetheless, those systems that hold delicate and private data should be safeguarded to preserve data integrity.

Digital health systems should be introduced in all healthcare facilities so that the extracted data can be stored digitally [17]. As explained by Katurura and Cilliers [7], more than half of South African healthcare sectors are still utilizing a paper-based file system to capture the personal information of the patients, and those files are kept in a room where anything such as file loss can occur. We are in the fourth industrial revolution (4IR); however, the healthcare industry is behind since it is still using the traditional paper-based system to store data about patients. Based on the lack of full integration of digital health (d-health) in the South African healthcare system, more academic research is needed to understand the challenges in adopting d-health in South Africa. Therefore, this study aims to identify challenges affecting the adoption of digital health in South Africa.

2. Research method

This study utilized systematic review as a qualitative research methodology through Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) in understanding the challenges of adopting digital health in South Africa. The PRISMA assisted the researchers to gain knowledge more specifically about digital health technologies, their benefits, applications, and challenges that citizens face with regard to adopting digital health technologies. Researchers like [22], Trifu, et al. [23], Gundogan, et al. [24] and Moher, et al. [25] continue to use PRISMA to report and understand existing literature through its four-phase process. The four-phase Liberati, et al. [26] as shown in Table 2 were applied in the study to understand the research objectives. As a systematic review study, the results, information, or data were obtained from different well-known academic databases such as Embase, Scopus, Epistemonikos, Google Scholar, and many more. It means that the study was based on secondary data in applying document review and secondary ideas from other researchers.

As explained by Asiamah, et al. [27], it is of paramount essential for a researcher to select a target population when gathering the data. According to Casteel and Bridier [28], the target population refers to “the specific, conceptually bounded group of potential participants to whom the researcher may have access that represents the nature of the population of interest”. The target population for this study is the technology associated with accredited publications and articles, which specifically addresses digital health, challenges faced, and applications of digital health. The two main types of sampling methods are probability and non-probability sampling [29]. This research employs non-probability sampling. Non-probability sampling draws the sample utilizing a non-randomized method [30]. Different types of non-

probability sampling methods are sequential sampling, convenience sampling, purposive sampling, quota sampling, and snowball sampling [30].

The sequential sampling method was employed in this study to select the subjects of the research. "Sequential sampling is similar to purposive sampling with one difference: instead of trying to discover as many cases as possible while taking into account time, resources, and costs, sequential sampling involves collecting cases until the amount of new information or variety of cases is filled." [31]. This implies that "data should be collected until saturation is reached." [31] as applied in the study.

Inclusion and exclusion criteria. The employment sample size for this research is the journals, articles, and papers that focused on the challenges of adopting digital health until saturation is reached. According to Bhardwaj [32], sampling refers to a procedure used to choose a sample from an individual or an enormous group of a population for a specific kind of research purpose. Accredited academic material online and printed, and cited documents about digital health were used until a conclusion was reached. Table 1 provides the inclusion and exclusion criteria for the sourced materials.

Table 1. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Articles that are written in English	Non-English Articles
Articles published from 2017 to date	Articles published in the 1990s
Accredited academic journals, articles, and books	Non-accredited journals
Focus more on the South African context	Not directly linked to the South African context

2.1. Recruitment of necessary documents

This study utilizes document review as a method of collecting data. In order to search for the documents, the digital health and the challenges of digital health adoption in South Africa are searched. This study employed keywords such as "digital health challenges", "e-health", "e-health barriers", "adoption of digital health in South Africa", and many more to have relevant documents about the challenges encountered in adopting digital health. The study used relevant documents within the South African context on the above-mentioned academic databases. Moreover, it employed documents that were written in English within the past five years, from 2017. The recruited sources are analyzed using Atlas.Ti.

Any relevant article documents must be checked for completeness, which entails determining how specific or all-inclusive the data is [33]. Therefore, it is important not to consider the information as "accurate, necessarily precise, or a comprehensive description of events that have occurred" when reading articles [33]. The researchers, therefore, undertake the subsequent 8-step approach (Figure 1) to validate the inclusion and exclusion criteria for the application of PRISMA:

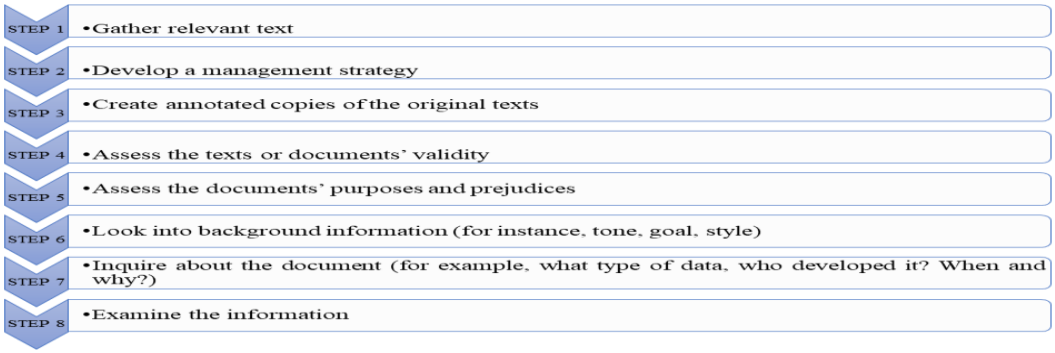

Figure 1. Steps of the planning process

Step 1: overview of the study towards identifying and gathering relevant documents across databases and sources in a systematic searches, step 2: defining a clear systematic plan to enable screening and

including criteria's for the relevant studies and questions, step 3: it highlights important documents with transparent inclusion and exclusion parameters, step 4 looks into the verification of sources in evaluating the relevancy, accuracy and quality of documents align to the topic, step 5 focus on assessing the relevant documents specific topics bearing in mind the some potential bias (for example, authors perspectives) to ensure objectivity and reliability of the sources included.

Step 6 it covers background information examination to understand the goal, tone and style of the existing studies in alignment with the topic for accuracy and consistency, step 7 it seeks to deeply inquire about identified documents by spotting the type, the data source, the authors (who developed it), the publication year and the objective, and step 8 involves with the examining the characteristics of the studies included and the findings to ensure alignment and relevant with the topic and the systematic review.

2.2. Structure of the objectives

The main purpose of the structure is to further describe in detail the researcher's approach toward tackling the objectives of the study, as well as what the researcher wants to accomplish. The research objectives are listed below:

Objectives 1 and 2: Identify the benefits and challenges of adopting digital health in the South African healthcare system. The researcher will collect the relevant documents from credible sources such as PubMed, Embase, Google Scholar, Epistemonikos, and Science Direct, to name a few. The researcher will be able to get relevant data and create themes with appropriate search tags.

Objective 3: Identify the applications of digital health in South Africa's health sector. The researcher will search for how digital health is being applied in the health sector. Themes and quotes will be created with the hope that they will interlink since there will be a connection between the themes and their quotations, which will assist the researchers with the utilization of ATLAS.ti.

2.3. Document review analytic process

Mohajan [34] defines document analysis as a sort of qualitative research in which the researcher examines the documents to provide a problem evaluation, a voice, and a meaning. Document analysis is employed by researchers for a variety of purposes. Beginning with the fact that documents are useful resources and manageable, document review is an effective method of data collection [35]. Documents and texts are widely utilized and come in many different formats, making them reliable and practical data sources. When compared to conducting one's study, obtaining and reading papers is typically significantly expensive and less time-consuming [36]. Documents are reliable data sources that may be studied and re-examined without being influenced by the researcher's perspective or methodology [33].

Thematic analysis was employed to reach the findings of the research. According to Nowell, et al. [37], thematic analysis refers to the process of "identifying, evaluating and reporting themes within the data". Vaismoradi, et al. [38] stated that it refers to a descriptive strategy that narrows the data to be flexible, enabling researchers to combine numerous data techniques. It is widely used because so many research issues and themes may be addressed by utilizing this method of data analysis [39].

Keywords like "South Africa digital health", "digital health benefits", "digital health advantages", "digital health pros", "digital health challenges", "digital health disadvantages", "digital health barriers", "digital health cons" and "digital health obstacles" were utilized to conduct data searches for the study.

The researchers searched about 167 articles from different databases. After eliminating 95 papers from electronic databases due to duplications, 39 articles due to not meeting the protocol title, and 10 articles that were not full-text articles (inclusion and exclusion criteria), the researcher was left with 23 articles for analysis. Only a small number of newspapers were suitable for the study, but they fell short of providing adequate answers to the research questions. Figure 2 depicts the article flowchart using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) article reporting criteria. According to Kayesa and Shung-King [40] and Liberati, et al. [26] PRISMA provides a four-phase process, such as identification, screening, and eligibility, and is included in document analysis as

applied in the study. From the 23 included articles, the analysis and findings of the study were drawn in response to the three main research objectives and questions. Each of the articles (documents) assisted the researchers in addressing every research objective/question through thematic analysis.

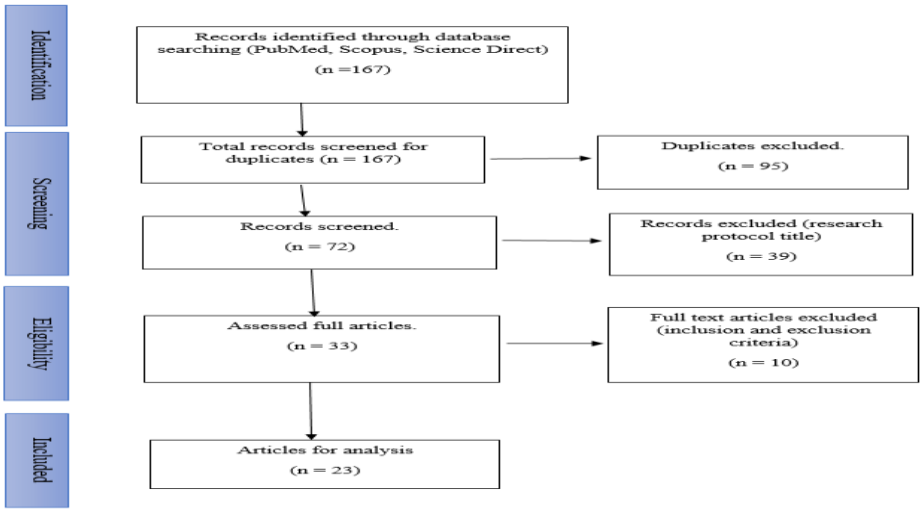

Figure 2. PRISMA flow chart

The research articles that were subjected to thematic analysis revealed categories and themes within them. Data that had the same meaning were grouped into several categories. Categories such as "technical challenges', "lack of supportive policies", "skilled manpower", "data and information", "funding", "enhancement" and "applications" were derived from the collected data, thus answering "investigation of the challenges of adoption of digital health in South Africa" research topic as well as the sub-questions.

3. Analysis and findings

3.1. Qualitative thematic analysis summary

For a comprehensive and nuanced analysis of the results, both qualitative and quantitative data were collected on the number of authors expressing a particular view. The following is a summary of a selection of subjects that were identified as essential during the thematic analysis and that obtained a high level of saturation. The literature review data is divided into the following categories and themes concerning their research questions, starting with the main question/objectives, followed by the sub-questions.

3.2. What are the challenges of adopting digital health?

According to the analysis of literature on the adoption of digital health, there are a number of reasons why developed and developing countries are adopting digital health at such a slow rate. Nonetheless, this study's analysis of the literature found that there are more difficulties that South Africa is facing currently. With all that being said, Table 2 and Figure 3 present all the themes or code summaries of the results that answer the above question.

Table 2. Digital health adoption challenges

Category	Themes	Frequency
Technical	Poor connection	4
	Lack of ICT infrastructure	6
	Interoperability issues	5

Category	Themes	Frequency
	Lack of electricity	10
Supportive policies	Strict policies and rules	6
Skilled Manpower	Reluctance to adopt	20
	Lack of computer literacy	7
	Inadequate training	10
	Shortage of staff	14
Funding	Costs	8
Data and Information	Privacy and security	15
	Poor data quality	4

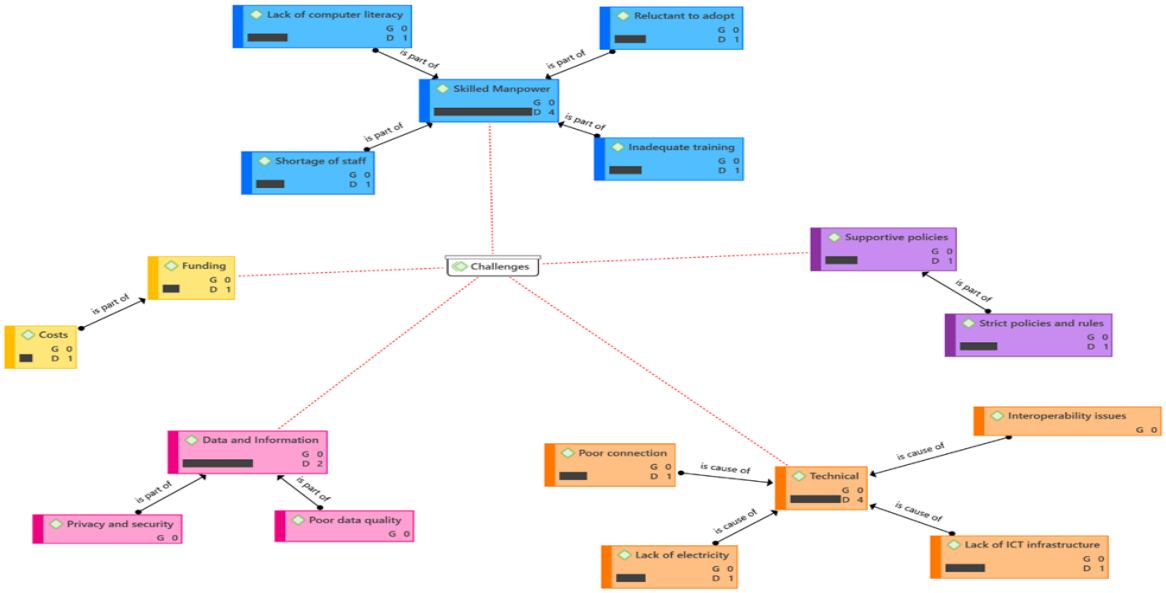

Figure 3. Digital health challenges

Challenges of digital health adoption involve poor connection, lack of infrastructure, interoperability issues, lack of electricity, network overload, strict policies and rules, reluctance to adopt, lack of digital literacy, shortage of staff, inadequate training, costs, privacy, security, and poor data quality. The results are summarized in Table 2 and Figure 3 as challenges of digital health were grouped into five groups, namely: technical, supportive policies, skilled manpower, funding, and data and information. Reluctance to adopt has the highest frequency among them all, and poor connection and poor data quality have the least frequency.

3.3. What are the benefits of digital health?

Table 3 and Figure 4 show the summary of the results of the above research question.

Table 3. Digital health benefits

Category	Themes	Frequency
Enhancement	Doctor-patient connection	8
	Monitoring health status	9
	Efficiency	6

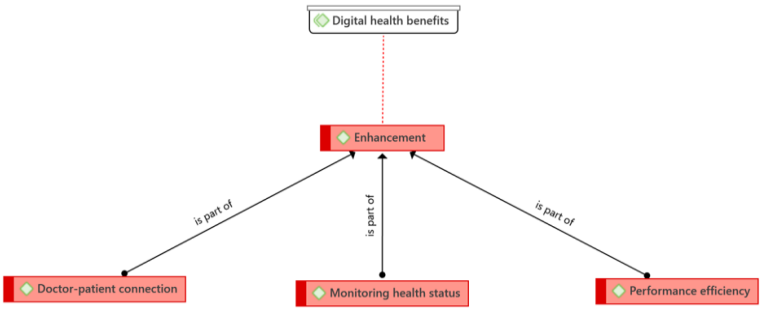

Figure 4. Digital health benefits

The benefits of digital health adoption include the doctor-patient connection and monitoring health status. Table 3 and Figure 4 summarize the results. Monitoring health status has a higher frequency, followed by the doctor-patient connection, then lastly performance efficiency.

3.4. How is digital health being applied in the South African health sector?

Table 4 and Figure 5 summarize the results of the above question.

Table 4. Digital health applications

Category	Themes	Frequency
Applications	Electronic Health Record (HER)	8
	Health Information Systems (HIS)	7
	Telemedicine	6
	Mobile Health (m-health)	10
	Electronic prescription (e-prescription)	3

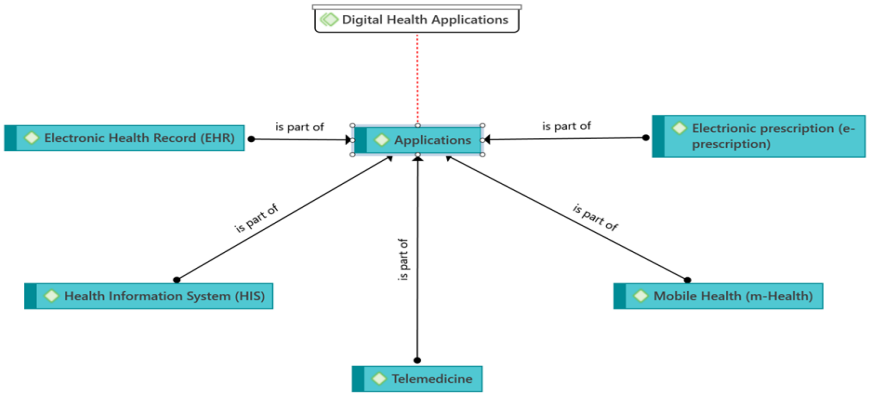

Figure 5. Digital health applications

The applications of digital health encompass Electronic Health Record (EHR), Health Information Systems (HIS), Mobile Health (m-health), telemedicine, and e-prescription. The results are summarized in Table 4 and Figure 5. The aforementioned were grouped into a single group, namely: Applications. M-health has a higher frequency, followed by Electronic Health Record, followed by Health Information Systems, then telemedicine, then lastly e-prescription.

4. Discussions

The following section explains the themes in detail. The discussions followed the sequence of the research objectives.

4.1. Digital health challenges

The following provides the challenges in adopting digital health in South Africa.

4.1.1. Technical challenges

The study revealed that poor connection, lack of ICT infrastructure, interoperability issues, and lack of electricity are the technical challenges that negatively impact digital health adoption.

- **Poor connection:** The results of the study showed that poor connection is one of the technical factors that hurt the adoption of digital health. According to Mbunge, et al. [13], digital health demands an internet connection in order to facilitate remote healthcare delivery and consultations using digital health technologies like telemedicine and mobile health. Mbunge, et al. [13] added that the use of digital health is impaired in some regions of South Africa by a poor internet connection.
- **Lack of ICT infrastructure:** In order to increase the healthcare quality delivered to all the residents, the healthcare sector is one of the paramount industries that need to leverage information and communication technology [8]. ICT infrastructure and diverse technologies are particularly important to the implementation of digital health. This study discovered a shortage of ICT infrastructure supporting digital health. According to Furusa and Coleman [8], there are insufficient digital health technologies available in a handful of hospitals in South Africa. The ICT tools that are currently available are designed for administrative and purchasing tasks.
- **Interoperability issues:** Clinicians, patients, clinical facilities, and research facilities are just a few of the involved parties in medical services. According to Renukappa, et al. [41], it is important to take into account a number of factors, including illness prevention strategies, prognosis, observation of diseases, and many more. Data sharing between various health professionals and patients is a key factor in the adoption of digital health technologies. Renukappa, et al. [41], state that it has been observed that various doctors and providers utilize a variety of digital health software and hardware that is not recognized, leading to interoperability problems and making the transfer and exchange of data very challenging.

The study revealed that this lack of compatibility and interoperability has had a significant detrimental impact on workflows, which has prevented healthcare professionals from adopting digital health. Mbunge, et al. [13] add that a noteworthy barrier to the implementation of digital health initiatives is the incompatibility of systems currently in place. Furthermore, this presents a significant barrier since medical practitioners find it challenging to combine workflows due to new digital health technologies that cannot interact with other existing systems that are currently in use within the healthcare sector [13].

- **Lack of electricity:** The findings of the study showed that a lack of electricity posed another difficulty for the adoption of digital health. According to Muinga, et al. [42], in certain instances, the hospitals had some areas linked to a power source, such as generators, due to electrical power outages or load shedding, while other areas did not. Moreover, there were prolonged patient lines in certain facilities because there were unclear instructions on how to enter data in the event of a power outage [19].

4.1.2. Supportive policies

The findings of the study revealed that strict policies and rules under the supportive policy category are the factors that negatively affect digital health adoption in South Africa.

- **Strict policies and rules:** There is still much potential for improvement, and numerous barriers are currently developing due to the rise of new technology and issues [43]. Renukappa, et al. [41], stated that the absence of macro-direction and programme guidelines in digital health results in confusing development goals and resource waste. Additionally, healthcare sectors should make advances in assuring data integrity because there are no consistent standards in the organizations. The study's findings showed that there is a lack of strict policies and rules in the healthcare industry. According to Renukappa, et al. [41], the majority of present healthcare policies, practices, and laws do not encourage the adoption of digital health technologies.

From the researcher's perspective, it is necessary to change these policies and rules because they were developed in the past to support the manual and paper-based healthcare system. It is challenging to

increase security and make digital health technologies operate with current workflows without these modifications. Muinga, et al. [42], state that even though it can take years to obtain the necessary authorization, as modifying healthcare legislation and standards is arduous. Moreover, healthcare organizations are discouraged from implementing digital health technologies due to this tiresome and time-consuming approach.

4.1.3. Skilled manpower

The study's findings showed that skilled manpower challenges that affect the adoption of digital health are: reluctance to adopt, lack of computer literacy, inadequate training, and shortage of staff.

- **Reluctance to adopt:** The implementation of digital healthcare technologies jeopardizes the end users' control over procedures based on their unique knowledge and skills, for instance, by developing a diagnosis before professionals meet patients, and, due to the perceived bias, clinicians may be reluctant to adopt digital health technologies [19]. In other situations, the implementation of digital healthcare techniques results in users having more inquiries, phone calls, and a high number of appointments, particularly in the initial stage of adoption, which clinicians perceive as increasing their workload [41].

The study revealed that there is a significant amount of opposition to digital health being implemented in the healthcare industry. The use of technology may significantly alter how people connect and operate. Nonetheless, if the staff does not like the modification, they will probably reject it [8]. Additionally, Renukappa, et al. [41] and Khan [19] state that users' resistance to utilizing digital health technologies is the result of their aversion to change and their lack of knowledge about the advantages these initiatives offer, due to a lack of communication by top management to engage with the end users.

- **Lack of computer literacy:** The results of the study showed that a lack of computer literacy among users is a frequent barrier to the adoption of digital health initiatives. According to Namatovu and Magumba [44], a lack of computer literacy makes it difficult to execute tasks, which makes the new digital health technologies more annoying, useless, and ineffective. Thus, resistance to them arises.

This is substantiated by Renukappa, et al. [41], who claim that people's choice to adopt digital health technologies is influenced by their educational and technical background. Digital health technologies are more likely to be utilized in daily life by individuals with higher levels of education and technical competency than those with lower levels of both. Furthermore, Namatovu and Magumba [44] added that the adoption of digital health technologies by users is significantly impacted by fears and a phobia of utilizing smart devices.

- **Inadequate training:** The implementation of digital health technologies by users is exacerbated, as was already indicated above, by a lack of computer literacy and skills. As a result, users who are not proficient in implementing digital health technologies must receive training in order to obtain the necessary abilities [41]. The study revealed that there is a great lack of training amongst users about digital health technologies in the healthcare sector.

From the researcher's point of view, users should receive adequate training so that they can be able to utilize digital health technologies. Nonetheless, Razmak, et al. [45], discovered that training requirements must be adapted to the user's skills and knowledge. Therefore, rather than being generalized to everybody, training should be tailored to the user's abilities, knowledge, and job position. If users are not properly trained, digital health technologies may be used incorrectly, or users may completely refrain from utilizing new tactics [46].

- **Shortage of staff:** The study revealed that there is a high level of shortage of staff in the healthcare sector. Zajac, et al. [47] and Razu, et al. [48] substantiated that there are insufficient professionals in this management and environment, and the healthcare industry is lacking such professionals. According to the researcher's perspective, as mentioned above, training should be equipped to enhance the skills and abilities of workers. Qureshi, et al. [49] suggest that in order to also address

this problem, using mobiles and other telemedicine gadgets to connect knowledgeable resources with people is an effective way.

4.1.4. Funding

Costs were revealed as a factor that also affects digital health adoption in this study.

- **Costs:** The adoption of digital health technologies entails a lot of expenses, such as infrastructure, software and hardware purchases, implementation expenditures, and continuing maintenance expenses [19]. The findings of the study revealed that costs are a significant issue with regard to the adoption of digital health. According to Mitchell and Kan [50], any cutting-edge technologies come at a great cost in order to be adopted. Moreover, some digital health technologies are in the testing stage and need significant money to be managed and enhanced. Muinga, et al. [42], note that the majority of healthcare providers are deterred from adopting digital health technologies due to the increased initial costs of adoption.

4.1.5. Data and information

The results of the study showed privacy and security, and poor data quality as the factors that negatively affected digital health adoption.

- **Privacy and security:** The study's findings disclosed that privacy and security are the major concerns in the healthcare sector. "Patients may feel profoundly uncomfortable disclosing their medical information when utilizing digital health technologies that have previously been exposed to privacy and security issues because the healthcare system works with a lot of sensitive data, such as information from HIV tests." [41]. According to the researcher's point of view, the possibility of information being intercepted by hackers and being used improperly is a prevalent concern. Because of this, patients are less willing to provide permission for healthcare professionals to share information utilizing digital health technologies [13].
- **Poor data quality:** The results of the study disclosed that poor data quality is also a barrier to digital health adoption. Even though the implementation and employment of digital health technologies make it possible for data to be gathered in an effective manner, it also highlighted that these technologies lead to low-quality data, and there are issues with sharing data and interaction, since there is too much complex data [41].

4.2. Digital health benefits

Researchers have identified some advantages and benefits of digital health [51, 52]. Digital health saves time; for instance, instead of going to the hospital and waiting in long queues for consultations and check-ups, this can all be done digitally over a tablet or personal computer [51, 53]. The study recorded enhancement as the main benefit of digital health.

4.2.1. Enhancement

The study revealed the doctor-patient connection, monitoring health status, and efficiency as the benefits of digital health.

- **Doctor-patient connection:** Participation in digital health by healthcare practitioners builds the practitioner-patient connection by increasing and enhancing communication with patients. In addition, Digital health promotes patients to be more active in their self-care and self-management, hence enhancing patient adherence to treatment regimens [8].

Downing, et al. [54] also observed that digital health can promote healthcare providers' productivity by making it easier to collect, store, and manage patient data, as well as by alleviating administrative burdens. Moreover, digital health may aid in the reduction of medically unnecessary ill effects by continual education and management of healthcare practitioners' adherence to best practices.

- **Monitoring health status:** It is claimed that digital health can improve people's access to healthcare practitioners, their ability to monitor their health state, and the speed at which they can

discuss and diagnose medical issues [55]. The results of the study suggest that digital health should be employed in the healthcare sector. According to Evans [56], the implementation of digital health may save doctors and patients money and time since patients no longer need to travel long distances to receive healthcare services. Moreover, the use of digital health might let poor rural hospitals exchange human resources and equipment with hospitals that are well-equipped [57].

- **Performance efficiency:** Enhancing performance efficiency is one of the goals of digital health technologies in the healthcare sector. Safi, et al. [58] state that enhanced efficiency is the primary driver behind the utilization of digital health technologies. The effectiveness of digital health technologies has also been validated, attesting to the significant time-saving they provided throughout the search for information [58, 59]. It also provides effective communication and patient outcomes [60] and clinical management [61].

According to Evans [56], digital health technologies make it simple to quickly and easily retrieve recorded information by pushing a button and using phrases. Moreover, the usage of digital health technologies has become more reliable, which has reduced the time it takes to coordinate information for patients with complex diseases [56].

4.3. Data and applications

This research question/objective aimed to discover the utilization of digital health in South Africa. The utilization of digital health is essential for treating and assisting patients with a variety of disorders. Digital technology, for example, can enhance the treatment, supervision, and quality of life of individuals with various diseases, but doing so will necessitate continuous comments and suggestions from researchers, medical practitioners, and digital specialists [62]. The study found that digital health is applied in South Africa as Electronic Health Record (EHR), Health Information Systems (HIS), Telemedicine, Mobile health (m-health), and electronic prescription (e-prescription).

- **Electronic Health Record (EHR):** The study findings revealed that electronic health records make it possible to share patient data between treatment settings, with the additional benefit of providing healthcare professionals access to the most recent data for making choices about the health outcomes of the patient [46]. EHR systems enable the collection, storage, and distribution of both personal and medical data about a patient [7].

Compared to paper-based systems, EHR systems are safer, more accessible, storable, maintainable, and shareable [63, 64]. Kruse, et al. [65] stated that the benefits of EHR include improved process standardization and the ability to recover information very quickly. Moreover, according to [66], utilizing electronic health records increases accessibility to medical information, thus enhancing the effectiveness of healthcare services.

- **Health Information Systems (HIS):** According to Jagadeeswari, et al. [67], Health Information Systems (HIS) is a "complete and integrated information system intended to handle all hospital operations, including medical, administrative, financial, and clinical elements". Patient demographics and financial transactions are included in both the previous and most recent versions of Health Information Systems. However, from the researcher's point of view, the most current one serves as the primary point of data input for practically all hospital transactions, despite the fact that it is not well known and is thus used appropriately. For instance, HIS is presently used for "patient registration, admissions and order capture, financial reporting, and many more" [19].

Observations from the study by Kilsdonk, et al. [68] indicate that the advantages of utilizing HIS include simplified and enhanced monitoring of supplies, inventory, and medications, improved turnaround time for hospital tasks that previously relied on paper-based slips and registers, and enhanced policy compliance and audit controls. The ability to monitor and assess the daily workflow of clinical services across all hospital divisions from a single place may enable healthcare workers to make more educated choices while using HIS.

- **Telemedicine:** The study's findings indicate that telemedicine in the context of digital health can be as straightforward as a phone conversation between two doctors or as complex as combining satellite technology and video conferencing tools to perform an in-person consultation [12]. While in pre-recorded telemedicine, information is summarized and transmitted to the recipient for a later reaction, real-time telemedicine allows users to converse and accept medical data almost instantly and with minimal interruptions [69]. Telemedicine has become increasingly popular as a result of the development of mobile computing and the Internet [70]. According to Petersen, et al. [71], telemedicine has revolutionized the delivery of health services since it permits the coverage of areas where providing healthcare to residents is difficult owing to their remoteness.
- **Mobile health (m-health):** M-health is one area of technological progress in the healthcare industry that is attracting more attention globally. Kruse, et al. [65] describe m-health as "an umbrella term encompassing the usage of mobile communications and multimedia technologies for health-related purposes within health care delivery and public health systems". This definition of m-Health, which initially appeared in 2003, has now been expanded to include public healthcare [72]. M-health has expanded significantly as a result of the extensive use of mobile connection infrastructure in middle-income and low-income nations [73]. According to El-Kassem, et al. [74], despite the fact that m-health is still in its infancy, it has already had a significant impact on healthcare systems by proving that it can bring medical care to remote areas and encourage a change toward patient-centered care.
- **Electronic prescription (e-prescription):** The study revealed that e-prescription is one of the applications of digital health. According to Voutsidou [75], the implementation and use of electronic programs in the area of pharmacy legislation, for instance, the medication list and the electronic prescription, is vital to the rational admission of the offered services, providing suitable and more cost-effective care while also minimizing costs. According to the researcher's point of view, the adoption of e-prescriptions will make things a lot easier for patients as they will be able to get prescriptions from their medical practitioners digitally.

5. Recommendations

The following recommendations are made based on the results of the research:

- The researcher suggests that the government should be involved in the use of digital health technologies and equip medical practitioners with digital gadgets so that they can start to adopt the use of digital health systems.
- Policymakers and the government should collaborate to enhance policies and rules that will enhance the implementation of digital health.
- The government should provide hospitals and clinics with sufficient ICT infrastructure and offer training to staff to improve their effectiveness.
- Technology standards that solve difficulties with privacy and security concerns, and interoperability issues may increase adoption and use.

6. Future work

The nature of technology is changing rapidly, and there might be new factors that affect the utilization of digital health technologies. In the future, studies similar to this one may combine both qualitative and quantitative methods to examine the challenges of adopting digital health. In doing the same research, different sampling methods besides the sequential sampling method may be employed. Additionally, future researchers should investigate how the adoption of digital health technologies will affect the work of individuals.

7. Conclusion

Digital health technologies are progressively taking the place of conventional healthcare delivery methods (traditional methods). Governments, medical personnel, and research organizations in the health industry in both developed and developing nations have taken cognizance of the necessity to adopt digital health. Several governments have launched initiatives to encourage the adoption of digital health at different levels of healthcare facilities. Nonetheless, South African medical facilities are just beginning to explore the digital health concept. The application of digital health has not received enough attention. According to Zhou, et al. [76], healthcare workers only occasionally or never employ digital health despite the collaboration of governments and donors in order to roll out digital health.

Digital health is very poor and in an unacceptable condition in public healthcare facilities. Digital health technologies mostly target a small number of core hospitals while ignoring smaller hospitals. As a result, its development at public hospitals can really be considered emergent. This makes it imperative that policies are put in place to encourage the adoption of digital health by public healthcare organizations.

This study has identified the elements affecting the adoption of digital health in South Africa. The research demonstrates that a variety of factors affect how well digital health systems operate. These encompass, among other things, limited funding, lack of digital literacy, policy, and legislation, shortage of trained staff, and slow adoption of technology. Moreover, the results also show that medical practitioners working in hospitals encounter the same difficulties in the adoption of digital health systems. If these aspects are considered, there is a higher chance that digital health will be adopted in South Africa. Conversely, South Africa would keep falling behind when it comes to the adoption of digital health systems.

8. References

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