

Evaluation of challenges for adoption of smart healthcare strategies

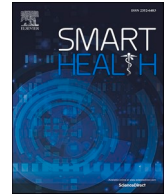
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Evaluation of challenges for adoption of smart healthcare strategies

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ABSTRACT

Smart healthcare strategies have been identified as a potential solution to address the growing challenges faced by the healthcare sector. The ability of smart healthcare strategies to improve efficiency, patient's outcomes and delivery of quality healthcare has motivated and committed governments and policy makers to invest in this innovation. However, uptake and usage of smart healthcare strategies has not been successful as anticipated, and this is due to a number of challenges faced by different stakeholders during the adoption of these strategies. The objective of this paper is to systematically check published literature to identify and compile a comprehensive list of challenges of adopting smart healthcare strategies. Knowledge of these potential challenges gives stakeholders awareness and better prospects of dealing with the challenges of adopting smart healthcare strategies. A systematic literature review was conducted. EBSCOhost, PubMed, Scopus and Science Direct were searched for full text, peer reviewed, English language articles that reported the challenges for successful adoption of smart healthcare management strategies. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines were used to select eligible articles. After the full screening, 26 articles that met the criteria were analysed and reported. Three main themes of challenges that affect the adoption of smart healthcare strategies have been identified based on technology-organisation-environment (TOE) framework. The findings of this study demonstrate that different TOE challenges affect smart health strategies adoption by healthcare sector. This study, therefore, proposes a differentiated approach to policies and practices to effectively scale up adoption of smart health and reduce failure rates of smart health projects. It is concluded that future research is needed in identifying key change management strategies to successfully manage the identified challenges to improve the prospects of successful adoption of smart healthcare strategies.

1. Introduction

The healthcare sector is faced with numerous challenges in delivering patient centred care. The often finance and resource limited healthcare providers are faced with mounting pressures to provide safe, high quality and effective healthcare services in the face of increased demand due to growing and aging populations. Adoption and use of smart healthcare management strategies enables

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healthcare providers to save on costs, increase patient access to healthcare services, improve communication and enhance data management. Aware of these benefits, governments, policy makers, healthcare providers and IT managers have expectations that smart healthcare management strategies are the answer to the insurmountable challenges experienced by the healthcare sector. While a lot of money has been invested in the adoption of smart healthcare management strategies, adoption rates of smart healthcare strategies is relatively low and strategies are still under-utilised (Sligo et al., 2017).

Smart or digital technology-enabled healthcare generally refers to a type of service plan that provides healthcare for people in any place, at any time and with electronic devices such as laptop, tablets, or smartphones (Quasim et al., 2021). The intelligent healthcare management system enables the patient to use medical assistance and services, such as emergency relief, diagnosis and monitoring at all times and all locations. The assessment of such a management system must be investigated in the context of innovative ideas like direct health care.

Developments of the IoT have led to continuous innovations in the healthcare sector (Yaqoob et al., 2021). However, adoption of smart healthcare strategies is complex and met with a number of challenges and shortcomings. This has caused a disconnection between the expected benefits and actual outcome of adopting smart healthcare strategies (De Grood et al., 2016). The adoption of smart healthcare strategies has not always been straightforward, consistent and has therefore laggard behind resulting in poor benefits being experienced and valuable resources being wasted. For example, telemedicine services must be reinforced using advanced ICT and will only become widespread when regulations are relaxed or eliminated (Lee & Lee, 2021). Moreover, that handling smart healthcare systems in a secure manner has become very challenging because the data is spread across various medical facilities. Most of existing healthcare systems are centralised that are vulnerable to single point of failures and information leakage due to the rise of cyber-security attacks. The leakage of patients' personal and critical information can lead to serious consequences. Also, the current medical systems fall short to provide transparency, trustful traceability, immutability, audit, privacy, and security (Yaqoob et al., 2021). In face of these challenges, it is also well known that diffusion of technology especially in healthcare is met by resistance from clinicians and sometimes abandoned in face of practical challenges (Porter et al., 2018).

Therefore, the purpose of this systematic literature review is to investigate and identify challenges that hinder the successful adoption of smart healthcare strategies within healthcare provider organisations. Identified challenges enable policy makers and healthcare leaders to understand and accurately evaluate potential challenges of adopting smart healthcare strategies ensuring proactive interventions are put in place to address these challenges as and when they arise thus improving the chances of successfully adopting smart healthcare strategies.

2. Methodology

A systematic review is used for this paper to review relevant literature guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement to answer the question: Why does the health sector fail to successfully adopt smart strategies to improve performance?

2.1. Literature search

Initial scoping was conducting by using the search terms ("smart health" OR "ehealth" OR "telehealth" OR "mhealth") AND ("adoption" OR "implementation") AND ("challenges" OR "barriers") to identify relevant electronic databases and journals to be used for the literature search. Following the initial scoping, electronic databases EBSCOhost, PubMed, Science Direct and Scopus were selected for this literature search. These databases were selected due to the reputation and variety of citations which cover the topic of this review. As different databases focus on different subject areas, inclusion topics were spread as shown in Table 1.

The key words used to search all 4 databases were designed to capture all-digital, mobile and advanced technology within healthcare settings: ("smart health*" OR "ehealth*" OR "electronic health*" OR "e-health*" OR "mHealth*" OR "m-health*" OR "mobile health*" OR "tele*" OR "Health Information System" OR "Health Information Technology" AND ("adoption" OR "implementation" OR "acceptance") AND ("challenges" OR "barriers" OR "disadvantages" OR "obstacles".)

During the extraction of articles, an advanced search tool was used to filter and limit articles to only identify the full text, peer reviewed, English language articles published between January 2015 and December 2021 (last 7 years). This is because technology is a fast paced, rapidly evolving field thereby important to avoid discussion of any out-dated technologies. Additionally, only full text articles were selected thereby excluding any conference abstracts, book chapters, blogs and health website contents.

Table 1
Criteria for topic inclusion.

EBSCOhost	PubMed	Scopus	Science Direct
Business source complete CINAHL, MEDLINE and PsycINFO databases Computer source	All topics included	Medicine Computer science Business and Management Health professionals	International Journal of Medical Informatics Health Policy and Technology International Journal of Information Management Telematics and Informatics

2.2. Article screening and selection

Identified articles were then screened for duplicate entries. Because several databases were used, there was a high possibility that some articles would have been published in more than one database. Once the duplicates were discarded, titles and abstracts were screened for eligibility. A full text review was then carried out for the remaining articles to identify the articles that met the pre-defined inclusion/exclusion criteria as shown in [Table 2](#).

As shown in the PRISMA diagram in [Fig. 1](#), the search retrieved 10,393 articles and 25 additional records were identified from other sources. All 10,418 articles were screened for duplicates and 2674 duplicates were identified and excluded. Title and abstract screening was conducted on the remaining 7744 articles and 203 potentially eligible articles were selected for the next stage. A full-text review of the remaining 203 remaining articles was then conducted using inclusion and exclusion criteria described in the earlier article screening and selection section and a total of 26 articles were identified as eligible and therefore analysed for this systematic review. However, the types of papers selected in terms of research methods was not differentiated as this is a limitation of this work.

2.3. Limitations

Relying on a systematic review as a search strategy involves the risk that valuable published sources and articles are excluded because of being deemed as out of the scope strategy. For example, only publicly available databases and full text available articles were searched and reviewed. Additionally, conference materials were also excluded from this review, but some good materials are published in conferences. This potentially omitted valuable published materials which may have been vital to this study.

3. Findings

After reviewing relevant literature, three main smart healthcare adoption challenges were mapped into technology-organisation-environment (TOE) framework which is described in [Tornatzky and Fleischer \(1990\)](#), process of technological innovation. The TOE framework has been used in multiple studies with significant degree of reliability and predictability of adoption ([Govindarajulu & Lippert, 2002](#); [Racherla & Hu, 2008](#); and [Lian et al., 2014](#)). TOE is free from restrictions on business and organisation's size ([Chen, Phan, & Reutens, 2010](#)). Hence, it offers a complete image of the user's adoption of technology, its execution, and the expected obstacles. All identified challenges are mapped under technology, organisation, and environment themes as illustrated in [Table 3](#).

3.1. Technological challenges

3.1.1. Privacy and security issues

Various literature identify privacy and security as a major challenge in the adoption of any technological strategies especially smart healthcare strategies. Smart healthcare involves the transmission of personal and sensitive patient data over the internet ([Ameri et al., 2020](#); [Poudel & Nissen, 2016](#)). The healthcare system deals with a lot of sensitive data such as HIV tests information and patients may feel uncomfortable sharing such medical data through the use of smart healthcare strategies that in the past have been exposed to privacy and security issues. It is a common fear that hackers can intercept information and use it unlawfully. This results in resistance by patients to consent to healthcare providers and clinicians to use and transmit data using smart healthcare strategies. [Melchiorre et al. \(2018\)](#) document that a smart health adoption programme in Germany faced challenges due to lack of trust in data safety.

Additionally, [Paaske et al. \(2017\)](#) note that inappropriate collection, intentional misuse and unauthorised access of patient data poses serious smart healthcare strategies adoption concerns. This is supported by [De Grood et al. \(2016\)](#) and [Gagnon et al. \(2016\)](#) who concur that privacy and security concerns arise due to poor security measures being put in place therefore permitting security vulnerabilities to be exposed and exploited. Even with good security measures, [Borries et al. \(2019\)](#) and [Mileski et al. \(2017\)](#) added that security and privacy issues also arise as a result of end users (both patients and clinicians) failing to adhere to rules and regulations of using smart technologies such as sharing passwords.

Without adequate security measures and adherence with security rules and regulations, patients' personal data maybe stolen and used to commit fraud and other crimes and infringe patients' privacy. When this happens healthcare providers are charged hefty penalties and fines. The threat of hefty fines is massive enough to deter healthcare providers from adopting smart healthcare management strategies.

Table 2

Article inclusion and exclusion criteria.

	Inclusion	Exclusion
Location	USA, Europe, Canada and Australia	All other geographical locations
Research methods	All research designs thus, qualitative, quantitative and mixed methods	
Setting	Healthcare setting e.g. hospital, doctors' surgery, local clinics etc.	Non-healthcare setting
Types of studies	Articles from the perspective of a patient, healthcare professional and IT professionals in a health-related roles	Studies purely focussed on technology infrastructure and applications for example Internet of Things
Data collection timing	Data collection carried out between January 2015 and December 2021	Data collection carried out before January 2015

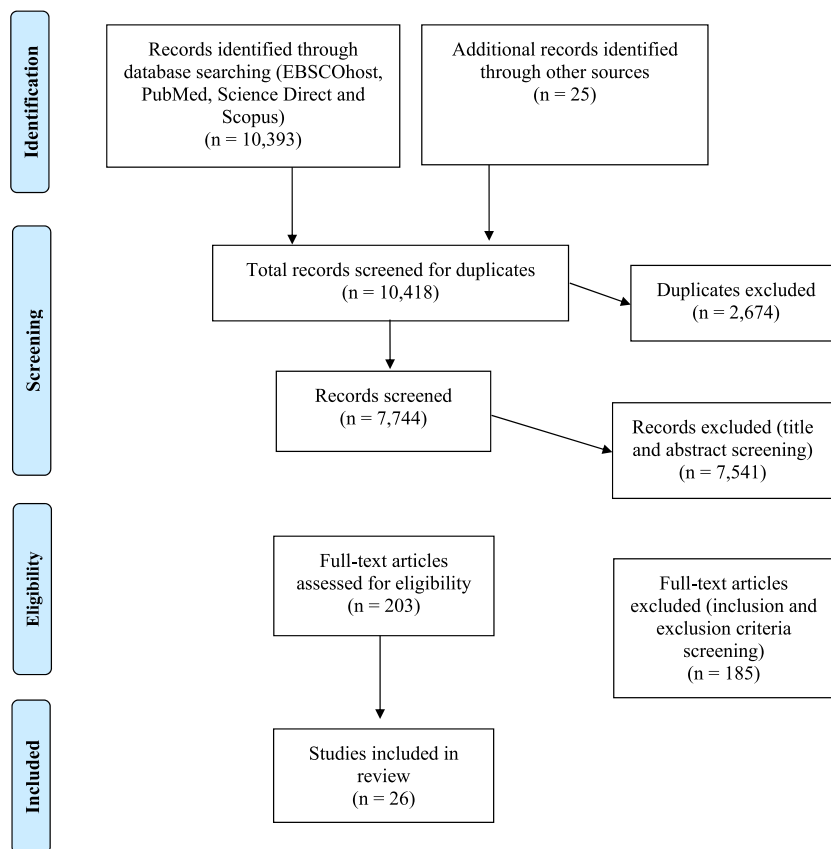


Fig. 1. PRISMA article screening process.

3.1.2. Data governance and ethical concerns

According to a study carried out by [Gagnon et al. \(2016\)](#) another challenge that affects the successful adoption of smart healthcare strategies is that of poor data governance. The authors define data governance as the ownership, control and management of information. Ethical and legal issues relating to who should own and is therefore responsible for patient information gathered and used in smart healthcare strategies is a barrier in the successful adoption of smart healthcare strategies. The social relationship of smart medical care could be complicated, since one person's information might be obtained by many people and manufacturers without their approval, which would cause many ethical problems. [Gagnon et al. \(2016\)](#) further explain that lack of legislation and regulation in relation to data governance has caused slow uptake of smart healthcare strategies in Canada. This is maintained by [Melchiorre et al. \(2018\)](#) who point out that though many countries in Europe have national legislation to protect privacy of electronic data, there is still lack of dedicated legislative frameworks relating to smart healthcare data. This lack of legislative frameworks, ethical and legal issues of data ownership has resulted in healthcare providers being put off adopting smart healthcare strategies as data governance issues remain unresolved. Personal medical information would provide a valuable and important personal asset. The disclosure of this information could impact the user that could be discriminated within the society. The inappropriate use of information could also violate the ethical bottom line.

For instance, Artificial intelligence (AI) and machine learning solutions are transforming the way healthcare is being delivered. However, to the ethical questions that comes with advancements in AI, some opinions are that AI cannot be trusted since it does not possess any emotive states and cannot be held responsible for its actions. The development of AI will form more of a reliance and it is recommended that AI should be referred to as being able to be relied upon, not trusted, and the onus should be on organisations using AI, and those who created it and whether they themselves are trustworthy. The concern is just how much responsibility is given to AI to make key health related decisions, and the conflict between AI-decision and human decisions. It may get to a point where individual rights may be overlooked and it may lead to humans struggling to maintain control over AI machines and an ethical boundary must be investigated and used. It is suggested to try and mitigate the negative impacts as much as possible, the government should provide training on AI to reduce the initial barrier between the public and AI. In addition, AI technology and its creators need to be held liable for any actions they should be held accountable for.

3.1.3. Interoperability issues

Advanced medical services are comprised of several stakeholders such as doctors, patients, clinical and research centres. Multiple

Table 3
Key challenges for adopting smart healthcare strategies.

Challenge theme	Related challenges	Sources	Description
Technological challenges	<ul style="list-style-type: none"> - Privacy and security issues - Data governance and ethical concerns - Interoperability issues - Lack of data terminology and standards - Poor data quality - Functional and non-functional system issues - Costs 	<p>Alami et al. (2017) Ameri et al. (2020) De Grood et al. (2016) Eden et al. (2016) Gagnon et al. (2016) Kapadia et al. (2015) Kooij et al. (2018) Kruse et al. (2015) Mansour et al. (2021) Mileski et al. (2017) Melchiorre et al. (2018) Paaske et al. (2017) Poudel and Nissen (2016) Pradhan et al. (2021) Tian et al. (2019) Treisman et al. (2016) Yaqoob et al. (2021) Zadvinskis et al. (2018)</p>	These are challenges that affect the adoption of new technology within an organisation
Organisational challenges	<ul style="list-style-type: none"> - Disrupted workflows and reduced productivity - Change culture - Organisational readiness - Organisational size - Organisational structure - Lack of management support and poor leadership - Lack of knowledge - Poor communication and engagement - Poor planning - Rigid policies and procedures 	<p>Alami et al. (2017) Ameri et al. (2020) De Grood et al. (2016) Eden et al. (2016) Faber et al. (2017) Feng et al. (2019) Kapadia et al. (2015) Kooij et al. (2018) Kruse et al. (2018b) Lee and Lee (2021) Nguyen et al. (2015) Mileski et al. (2017) Paaske et al. (2017) Papa et al. (2020) Poudel and Nissen (2016) Razmak et al. (2018) Sligo et al. (2017) Tian et al. (2019) Zadvinskis et al. (2018)</p>	These are challenges that are faced at an organisational level by organisations adopting smart healthcare strategies
Environment challenges	<ul style="list-style-type: none"> - End user behaviour - Resistance to change - Poor computer skills - Lack of training and support 	<p>Alami et al. (2017) De Grood et al. (2016) Feng et al. (2019) Gagnon et al. (2016) Kapadia et al. (2015) Kooij et al. (2018) Kruse et al. (2015) Nguyen et al. (2015) Melchiorre et al. (2018) Mileski et al. (2017) Paaske et al. (2017) Razmak et al. (2018) Tian et al. (2019) Yaqoob et al. (2021)</p>	These are challenges faced by end users who after or are affected by the adoption of smart healthcare strategies.

dimensions should be considered such as disease preventive measures and observation, prognosis and treatment, clinical management, health decision-making, and medical studies. For instance, mobile internet, Cloud Computing (CC), big data, 5G systems, micro-electronics, and AI, along with smart biotechnology are assumed to be the milestones of modern healthcare (Mansour et al., 2021). A major driver in the adoption of smart healthcare strategies is the ability of data to be shared amongst different healthcare providers and different clinicians. However, different providers and clinicians are noted to be using different smart healthcare software and hardware systems that is not standardised causing interoperability issues and making transfer and sharing of data a headache (Paaske et al., 2017).

Healthcare providers have different budgets and varying levels of resources to commit to technological advancements. This results in different technology maturity levels amongst healthcare providers. Difference in maturity levels of software and hardware systems is the main cause for interoperability issues (Kapadia et al. 2015).

Additionally, De Grood et al. (2016) explain that a remarkable challenge of smart healthcare strategies adoption is the incompatibility of the smart healthcare strategies with already existing systems. This is a major challenge because the new smart healthcare strategies cannot communicate with the other legacy systems already used by the same healthcare provider organisation making it difficult for clinicians to consolidate workflows (Alami et al., 2017; Gagnon et al., 2016; Lim et al., 2018). This is evidenced

by a study carried out by [Melchiorre et al. \(2018\)](#) who reveal that the successful adoption of smart healthcare in Finland was hampered by incompatible health and social care systems. Furthermore, the authors also reveal that in another study in Denmark, interoperability issues emerged between different IT recording systems in hospitals making it difficult for healthcare providers and clinicians to exchange patient data.

This incompatibility and interoperability issues has negatively affected workflows and massively affected provision of care to patients thereby resulting in healthcare providers refraining from adopting smart healthcare strategies. Fear of loss of productivity and being inability to provide care results has seen healthcare providers prefer to continue working on legacy systems than adopt smart healthcare strategies that may hinder data transfer and disrupt workflows.

3.1.4. Lack of data and terminology standards

[Eden et al. \(2016\)](#) explain that lack of data and terminology standards greatly affects the adoption of smart healthcare strategies. Some providers or clinicians prefer more information whilst others prefer lesser information to avoid having to scroll down several pages to complete a task. This difference in preference and lack of standards to govern the how much data is collected and stored is a challenge in the adoption of smart healthcare strategies. Additionally, inconsistent classification and terminology of data has resulted in inconsistencies and confusion that end users find less useful and time consuming. Thus, causing end users to decide not to adopt and use smart healthcare strategies.

3.1.5. Poor data quality

Although the adoption and use of smart healthcare strategies enable data to be collected, stored and transmitted efficiently and effectively, it is also noted that adoption of smart healthcare strategies result in poor data quality. The amount of data is too complicated and too large, which leads to difficulties in data sharing and communication ([Tian et al., 2019](#)). There are also problems with compatibility between different platforms and devices. Additionally, more people are living with multiple illnesses therefore receive treatment and care from multiple healthcare providers and clinicians. This results in fragmented and incomplete clinical records in any one given healthcare provider or clinician. This fragmentation of data is caused by a number of reasons which include limited coverage of healthcare providers that use smart healthcare strategies therefore unable to share this data ([Eden et al., 2016](#)). Additionally, some patients refuse to consent to medical records being transferred to other healthcare providers or clinicians using smart healthcare strategies due to privacy and security concerns therefore resulting in data fragmentation. Additionally, one of the major issues in secure data sharing is data fragmentation ([Pradhan et al., 2021](#)). Data fragmentation may lead to a gap in information across healthcare providers, who are associated with a single patient. Insufficient information may hamper the treatment process. Blockchain technology is used to solve the problem of data fragmentation and helps the healthcare centres to establish a connection among the data repositories that are present in the network. Furthermore, poor patient matching process and slow and confusing smart healthcare strategies has seen resistance from clinicians to adopt smart healthcare strategies ([Eden et al., 2016](#)). This resistance means clinicians refrain from adopting smart healthcare strategies which results in incomplete or fragmented patient medical records.

Moreover, the main concern while designing an IoT device is maintaining the quality-of-service matrices that include privacy of information sharing, security, cost, reliability, and availability ([Pradhan et al., 2021](#)). [Melchiorre et al. \(2018\)](#) add that in a smart health adoption project in Netherlands, limited computer skills of users especially patents during self-management resulted in missing or inaccurate readings which led to in poor levels of data quality. [Borries et al. \(2019\)](#) and [Mileski et al. \(2017\)](#) further explained that missing, inaccurate and inconsistent data is also caused by patients forgetting to record readings whilst self-monitoring. Additionally, [Lim et al. \(2018\)](#) in agreement with [Gagnon et al. \(2016\)](#) that lack of comprehension and understanding of healthcare information by patients may cause misinterpretation of data, provoke incorrect data entry or information overload. Modified, incomplete or falsified data greatly reduces the credibility of patient provided data. [Kapadia et al. \(2015\)](#) concurs and adds that missing data, incomplete and inaccurate data limits the clinicians' full assessment of patients' health, and this inconsistent communication, documentation and processes plays a role in the clinicians' decision not to adopt smart healthcare strategies.

Due to the increasing number of evolving apps and wearables available, patients can choice any app or wearable to self-monitor and manage health conditions. This means there is a risk that patients may choice to use an app that is not listed or regarded as credible or wearable that is not regarded as a medical device by healthcare authorities and regulators. This means valuable data collected by such apps or wearables cannot used as evidence by clinicians during assessments, reviews or in research thereby resulting in incomplete, fragmented and subsequently poor data quality ([Lukaschek et al., 2019](#); [Treisman et al., 2016](#)).

Adoption of smart healthcare strategies encourages collection of more data than when manual data collection is used. This exposes both clinicians and patients to the risk of information overload which may decrease the quality of information used by clinicians. [De Grood et al. \(2016\)](#) explain that inability of effectively synthesize and address large volumes of data which may result in clinicians missing important information that is needed to make accurate decision in the treatment of patients.

3.1.6. Functional and non-functional system issues

These are challenges that can affect the actual use of smart healthcare technology. [Mileski et al. \(2017\)](#) stated that some smart healthcare technologies are complex to use. This means clinicians refrain from using the systems or may partially use the systems resulting in clinicians experiencing lesser benefits that initially expected. This is supported by a study carried out by [De Grood et al. \(2016\)](#) which reveals that clinicians are of the opinion that although smart healthcare strategies have a lot of good features, the systems are difficult to use due to the complicated nature of how the smart healthcare strategies are designed. The authors go further to explain that most clinicians thought these strategies where not "user-friendly" and "counterintuitive" which leads to slow up take of smart healthcare strategies.

In addition to system usability issues, [Zadvinskis et al. \(2018\)](#) also identified system functionality and non-functional issues as a major challenge that affects the adoption of smart healthcare strategies by clinicians. The authors identified issues which include lengthy time needed to login, scanning issues, increased numbers of program updates, shutdowns whilst completing tasks and power losses. [Alami et al. \(2017\)](#) add low storage space and low speed of transmission as to hindrances to successful adoption of smart healthcare strategies. Users are negatively affected by these issues and therefore perceive adoption of smart healthcare strategies as a failure and waste of valuable productive time hence refrain from the adoption and use of smart healthcare strategies.

Another challenge that affects the adoption of smart healthcare strategies is that of digital divide ([Gagnon et al., 2016](#); [Lim et al., 2018](#)). Digital divide can be defined as the limited access to a computer or the internet by a user. Although most households now have a computer or an electronic device to use, there are still some without such electronic devices for example some household of the elderly people and households in rural areas. This then influences healthcare providers that serve these population. The healthcare providers view the adopt smart healthcare strategies as ineffective and non-beneficiary since the people the organisation serves do not have access to electronic devices or the internet and therefore will not use smart healthcare strategies.

3.1.7. Costs

Adoption of any cutting age technological solution is associated with high costs. There are a number of cost associated with the adoption of smart healthcare strategies and these include infrastructure, hardware and software purchase costs, implementation costs and ongoing maintenance costs. Some technologies related to smart healthcare are still in the experimental stages and require a large amount of funding to be maintained and upgraded ([Tian et al., 2019](#)). Moreover, [Kruse et al. \(2015\)](#) and [Mileski et al. \(2017\)](#) point out that high initial adoption cost discourages most healthcare providers from adopting smart healthcare management strategies. Lack of funds hinders healthcare providers from taking the first step of adopting smart healthcare which is purchasing the expensive required hardware and software. Money is a major problem especially in healthcare where most governments do not allocate large budgets or provide incentives to provide money for the much needed financial support ([Gagnon et al., 2016](#); [Lim et al., 2018](#)).

This same sentiment is echoed by [Paaske et al. \(2017\)](#) who state that technology costs are high especially where more complex capabilities are needed for example a complete Radio Frequency Identification (RFID) system requires tags, readers, printers, middleware and infrastructure that cost millions of dollars. Although some technologies such as RFID tags are reusable, these technologies can also be easily lost causing unexpected costs to the providers. Additionally, [Ameri et al. \(2020\)](#) in agreement with [Poudel and Nissen \(2016\)](#) and [Kooij et al. \(2018\)](#) that some smart healthcare technologies require high speed digital connections and sophisticated equipment such as Integrated Service Digital Network (ISDN) which is relatedly expensive to purchase and is limited in some cases for example in rural areas.

Costs absorbed in the adoption of smart healthcare strategies also include operational, maintenance and training costs which are ongoing even after the initial adoption has been completed. [Alami et al. \(2017\)](#) state that in the case that funding for adopting smart healthcare strategies is provided, the funding is often limited and provisional and cover only the initial start-up costs without consideration of other costs such as maintenance, sustainability or training costs. [Kruse et al. \(2015\)](#) and [Kruse et al. \(2017\)](#) support that with further funding must be available to ensure follow-up and ongoing costs for training which facilitates users' acceptance of smart healthcare capabilities. Lack of adequate funding negatively affects the amount of first line support, maintenance and training provided to end users. These high ongoing costs often deter healthcare providers who have an already stretched budget from adopting smart healthcare strategies.

3.2. Organisational challenges

3.2.1. Disrupted workflows and reduced productivity

Adoption of any new technology comes with disruptions before, during and post adoption. This is particularly true for the adoption of smart healthcare strategies. A lot of time is required before adoption to train end users to gain the required competency levels to use the new systems. This training demands time away from clinical tasks which reduces organisational productivity. Furthermore, [Borries et al. \(2019\)](#) and [Mileski et al. \(2017\)](#) added that it takes a considerable amount of time to complete roll-out of smart healthcare strategies across an organisation which means productivity will be low whilst adoption takes place.

Additionally, disruptions of usual workflows and processes are experienced as the new smart healthcare strategies are being integrated into the organisation's processes. This change and disruption, which takes a lot of time reduces overall healthcare provider organisation's productivity ([De Groot et al., 2016](#); [Kruse et al., 2018b](#); [Papa et al., 2020](#)).

Post adoption, productivity is also reduced while end users get used to using systems and experience other initial difficulties associated with the new strategies and possible changes with workflows. [Kruse et al. \(2018b\)](#) and [Paaske et al. \(2017\)](#) agree that during the early stages of adopting smart healthcare strategies, healthcare provider organisations may face system failures such as loss or disruption of data which hinders smooth flow of workflow processes thereby reducing productivity. [Nguyen et al. \(2015\)](#) also note that adoption of smart healthcare strategies improve communications but on the downside this improved communication increases workload for clinicians which in turn reduces productivity. The authors note that in a study carried out in 2010, results showed a massive increase in the number of disruptions from three messages to ten alert messages a day post adoption of smart healthcare strategies within a medical team. This goes to show that availability of rapid alerts causes alert fatigue through information overload which many clinicians regard as disruptive, increases workload and reduces productivity.

The process of adopting smart healthcare strategies sometimes has hidden inefficiencies to workflow for example disruptive login, separate logins and password portals and too many clicks. [Nguyen et al. \(2015\)](#) note that clinicians are required to constantly log into systems to check for information therefore in case of an emergency, smart healthcare technologies are viewed as slowing down

clinicians from bring up and viewing documentation and completing tasks. These inefficiencies coupled up with difficulties in to get privileges to access and exchange information results in failure to adopt smart healthcare strategies (Eden et al., 2016; Kooij et al., 2018 and Zadvinskis et al., 2018).

Furthermore, the use of for example mobile devices during consultations impacts on the attentiveness of clinicians. Clinicians are preoccupied with fiddling and consulting smart healthcare systems which is viewed as reducing engagement between clinicians and patients and disrupting primary clinical tasks (Kapadia et al., 2015). This is reinforced by Nguyen et al. (2015) who express that clinician reported that the use of smart healthcare strategies results in lesser face to face interaction with patients and other clinicians thereby reducing meaningful interactions. This is viewed as a massive challenge in healthcare which places importance in positive face to face engagement to effectively diagnosis and treat patients. Therefore, this results in clinicians opting not to adopt smart healthcare strategies as these changes usual work processes.

3.2.2. Change culture

According to Razmak et al. (2018) change culture refers to the degree of willingness by the healthcare provider organisation to support, show positive affect and openness to change decision making to incorporate the change. Change culture plays an important role in the successful adoption of smart healthcare strategies.

In a study about smart healthcare strategies adoption in Netherlands hospitals, Kooij et al. (2018) revealed that the innovation-averse culture in hospitals is a major challenge in the adoption of smart healthcare strategies. The major reason for this culture in the health sector is because of the many conflicting key stakeholders who all need their opinions to be heard and taken into account. This unavoidably slows down or completely stops the adoption process if one of the stakeholder groups feels unaccommodated. Additionally, adoption of smart healthcare strategies affects major healthcare provider processes which are often ambiguous and difficult to adjust (Kooij et al., 2018). This leads changes in tasks and new responsibilities for staff. Change of established tasks or new responsibilities often rattles end users and this leads to resistance to the change and therefore promotes an innovation-averse culture within healthcare provider organisations.

Furthermore, the healthcare sector deals with the most important aspects of life. In the past such changes were related to mistakes and errors which may result in catastrophic consequences and in healthcare this may result in loss of life. This negative past experience has inevitably caused some healthcare providers and healthcare professionals to be conservative when it comes to change therefore unknowingly exerting a change averse organisational culture which is a major challenge in the adoption of smart healthcare strategies (Kooij et al., 2018).

3.2.3. Organisational readiness

Faber et al. (2017) define organisation readiness as the availability of the required resources for the successful adoption of smart healthcare strategies. Unavailability of mandatory resources mean the healthcare provider organisation that is adopting smart healthcare strategies is not ready to do so hence a challenge in the successful adoption of smart healthcare strategies. The required resources needed in the successful adoption of smart healthcare strategies include IT infrastructure, IT governance and security resources, expert IT human resources and financial resources. Lack of such important resources adversely affect the adoption of smart healthcare strategies (Papa et al., 2020).

A major resource that can halt the adoption of smart healthcare strategies is that of lack of finances (Faber et al., 2017). All resources needed to adopt smart healthcare strategies need money to cover costs to install, run and maintain smart healthcare strategies. Money is also needed for paying extra human resources. Zadvinskis et al. (2018) reveal that during adoption, healthcare providers must schedule in an increased number of clinicians because clinicians will take longer to complete routine tasks as a result of using new smart healthcare strategies. Besides the availability of money to pay for extra clinicians, healthcare provider organisations face an enormous challenge of shortages of clinicians within the sector. This means even if the money is available to pay for extra clinicians there are no available clinicians to support the safe adoption of smart healthcare strategies.

Additionally, another common challenge identified in current literature is the lack of IT human resources which provide skills, knowledge and support to successfully adopt smart healthcare strategies. IT expertise is essential not only during adoption of smart healthcare strategies but also to ensure continuity of services once the strategies have been implemented (Kooij et al., 2018). The authors go on to explain that in a study carried out in Netherlands, IT expertise was identified as lacking in hospitals. Acquiring such expertise was made difficult by the fact that hospital budgets are often too small to attract suitable IT specialist personnel.

Lack of technological resources such as IT infrastructure, hardware, network signal is a major hindrance in the successful adoption of smart healthcare strategies (Nguyen et al., 2015). Furthermore, technological issues are caused by other factors such as buildings and locations of healthcare provider organisations. Paaske et al. (2017) note that in a study carried out in 2010 it was apparent that technical issues were experienced due to hospital building ceiling heights and there were areas in the building where network connectivity was an issue. This is still true even today as some hospitals buildings infrastructure affect hardware connections and network connectivity which are fundamental in the usage of smart healthcare strategies. Challenges such as these therefore seriously hamper the successful adoption of smart healthcare strategies.

3.2.4. Organisational size

Organisational size is interlinked with availability of resources as mentioned in organisational readiness above. Faber et al. (2017) note that unlike larger healthcare providers, smaller healthcare providers possess lesser slack in resources such as small budgets and fewer personnel. This means that smaller healthcare provider organisations are unable to provide smart healthcare adoption projects with the much-needed finance, human and technical resources which are all essential in the adoption of smart healthcare strategies.

This lack of resources restricts smaller healthcare providers from adopting smart healthcare strategies due to lack of sufficient resources to experiment and customise the emerging smart healthcare technologies during the early stages of adoption and pay for maintenance costs after adoption.

3.2.5. Organisational structure

Faber et al. (2017) explain that organisational structure plays a key role in the adoption of smart healthcare strategies. Organisational structure defines who makes decisions in the organisation. The authors revealed that an organisational structure that promotes centralised top management decision making negatively affects the adoption of smart healthcare strategies as it eliminates innovation and responsibility of end users who will use the smart healthcare strategies on a daily basis. This limitation may result in wrong decision making from top management such as selecting smart healthcare strategies that do not support or align with current workflows because of failure to include end users with the relevant knowledge or experience needed when making such decisions. Thus, misalignment of smart healthcare strategies and existent workflows which is a cause of end user resistance. Therefore, a centralised top management organisational structure leads to end user resistance which is a main challenge in the successful adoption of smart healthcare strategies.

Healthcare provider organisational structures are dynamic and non-linear. Kooj et al. (2018) identify that healthcare provider organisations often have numerous departments and each department usually has its own policies, management and prioritising approach different from other departments. This is sustained by Sligo et al. (2017) who mention that healthcare provider organisations are mostly multi-professional organisations with dual hierarchical structures involving managers and clinicians. The authors go further to explain that unlike managers, clinicians often have high degree of autonomy and decentralised decision making. This makes the organisational structure complicated with numerous levels and may sometimes include other several linked organisations with different funding and priorities. Such complexity causes complications such as multi-stakeholder perspectives, tensions between obligations and power asymmetry which slows down or even results in failure to start the process of adopting smart healthcare because of failure to reach some form of agreement, get a decision made or action taken.

3.2.6. Lack of management support and poor leadership

The literature highlighted that investigating the integration of new smart healthcare programmes into existing clinicians' workflows, it was concluded that supportive organisation structures, solid support groups, effective training, availability of policy level sponsors and extension of procedures were all important tools to successful integration of new smart healthcare systems into the usual workflow (Ameri et al., 2020; Poudel & Nissen, 2016). All these tools are provided by supportive organisation leadership. Additionally, management usually possess the knowledge and understanding of the complex healthcare operational processes which is required to successful deliver such major transformational change (Razmak et al., 2018). Thus, healthcare provider organisations without or with poor management support will find adoption of smart healthcare strategies challenging.

Management usually has the power and autonomy to provide required resources and without this management support, smart healthcare adoption initiatives are likely to suffer from lack of resources (Alami et al., 2017; Razmak et al., 2018). Additionally, poor leadership adversely affects sensitive human resources support needed during the unsettling period of change. Poor organisational leadership means lack of compassion to support the distressed end users going through the change which will lead to resistance or even staff leaving the organisation. Additionally, Faber et al. (2017) note that poor leadership results in poor communication and reinforcement of values through an articulate vision which plays a crucial role in influencing the acceptance of smart health strategies by end users.

Furthermore, healthcare provider leaders with poor leadership skills are risk averse, slow to integrate changes, less supportive of innovative ideas from end users who are not in a position of leadership and reluctant to invest in the adoption of smart healthcare strategies which are all catalysts of failure to adopt smart healthcare strategies (Sligo et al., 2017).

3.2.7. Lack of knowledge

The findings of Feng et al. (2019) indicate that the vast majority of smart medical services in the current market are as one of the functions of smart city software. Therefore, the interface for smart medical design machine is too simple, and therefore it is not very humane for users.

Kapadia et al. (2015) reveal that two managerial groups, one from a rural location and another from a regional location where compared and it was noted that the rural group which had limited knowledge, technical skills and less experience in health IT tended not to consider the potential benefits of smart healthcare strategies. This goes to show that lack of knowledge and understanding of smart healthcare strategies leads to insufficient meaningful change drives therefore reduces the likelihood smart healthcare adoption.

In a study carried out by Zadvinskis et al. (2018), lack of knowledge in healthcare provider organisations resulted in increased workflows and added requirements for clinicians. This was due to lack of knowledge of existing workflow and how this could be integrated with the new smart healthcare strategies. This lack of knowledge further affected decision making resulting in failure to retire old unnecessary requirements and advocate for new smart healthcare features.

3.2.8. Poor communication and engagement

Communication and engagement are important during any change exercise to ensure buy-in. When communication and engagement are poor there is a threat that the change will not be smooth and may fail. Alami et al. (2017) carried out a study that revealed that during an exercise to adopt smart healthcare strategies, clinicians felt that the process was done from a top-down approach without clinicians being consulted and engaged this resulted in the clinicians refusing to adopt and use the smart healthcare strategies. The

authors also note that a top-down approach to change limits innovation and creativity which uncovers new practises essential to the successful adoption of smart healthcare strategies.

In another study carried out by [Kapadia et al. \(2015\)](#), it was revealed that top management which was in charge of initiating the adoption of a smart healthcare strategy failed to involve lower-level staff which resulted in purchasing of a smart healthcare system that did not meet the user requirements and was therefore not utilised in the healthcare provider organisation. This is supported by [Zadvinskis et al. \(2018\)](#) who note that clinicians were faced with using smart healthcare strategies that were too general and do not meet workflow requirements. This is caused by failure to engage with clinicians or end users who are knowledgeable of the workflow processes. In the end healthcare provider organisation fail to realise expected benefits hindering the successful adoption of smart healthcare strategies. In light of this, [Sligo et al. \(2017\)](#) document that engagement and communication must also be from bottom-up i. e. from end users to management as a means of sharing knowledge and feedback on how the adoption process is taking place which builds on a learning culture and reflective monitoring which are important in the successful adoption of smart healthcare strategies.

3.2.9. Poor planning

A challenge of successful adoption smart healthcare strategies is that of poor planning. Like any other endeavour to implement a change within an organisation, it is important to ensure the change strategy aligns with overall organisational vision and goals. Some healthcare providers organisations adopting smart healthcare fail to properly plan the adoption which leads to misalignment with organisational goals and vision ([Borries et al., 2019](#); [Mileski et al., 2017](#); [Sligo et al., 2017](#)). The authors go further to explain that failure to align IT initiatives with organisational goals only causing confusion and misunderstanding. Additionally, poor planning can result in unrealistic adoption timeframes or scheduling the change during busy or peak times which is catastrophic as the organisation is unable to facilitate the successful adoption of smart healthcare management strategies at the selected time ([Sligo et al., 2017](#)).

3.2.10. Rigid policies and procedures

With the emergence of new technologies and new problems, there is still considerable room for development, and many challenges are now emerging ([Tian et al., 2019](#)). For instance, the authors stated that smart healthcare lacks macro guidance and programmatic documents, which leads to unclear development goals and ultimately a waste of resources. Furthermore, medical institutions, lack uniform standards among different regions and different organisations, and improvements are needed in ensuring data integrity.

Most of the current policies, procedures and regulations in healthcare are not supportive of smart healthcare adoption ([Ameri et al., 2020](#); [Poudel & Nissen, 2016](#)). These policies and regulations set in the past were designed to cater for the manual and paper-based healthcare hence these regulations and policies need changing. Without these changes, it is difficult to improve security and enable integration of smart healthcare with existing workflows. However, changing regulations and policies in healthcare is tedious and may take years to get the required authorisation. This tedious and time-consuming process is challenging enough to put off healthcare provider organisations from adopting smart healthcare strategies ([Nguyen et al., 2015](#)).

3.3. Environment challenges

3.3.1. End user behaviour

End users are key stakeholders in the adoption of smart healthcare management strategies therefore it is important to understand the potential behaviours displayed by end users as this can either hinder acceptance and buy-in of smart healthcare strategies. End user behaviour is categorised into perceived usefulness and perceived ease of use. [Tian et al. \(2019\)](#) highlighted that from a patient's perspective, smart healthcare lacks relevant legal norms, and there are risks with regard to personal information and privacy breaches. Some users even have difficulty using the technology.

[Razmak et al. \(2018\)](#) define perceived usefulness as the degree to which an end user considers that using an innovative system will improve his/her performance. Thus, the end user's intention to adopt smart healthcare strategies depends on how useful the user perceives the strategies are. [Kapadia et al. \(2015\)](#) reveals that in adoption of smart healthcare strategies resulted in increased time by clinicians to document patient information because the clinicians recorded the information on paper first before entering the information on the smart healthcare system. The initial paper documentation was because the interface of the smart healthcare system did not match the clinicians' documentation practises. This misalignment led to frustrations and a negative perception of smart healthcare strategies' usefulness.

[Kruse et al. \(2015\)](#) and [Kruse et al. \(2017\)](#) added that lack of usefulness may be a result of poor adoption which in turn fails to deliver the expected benefits. If clinicians are not convinced with the positive impact of smart healthcare strategies in the clinicians' daily tasks, adoption of smart healthcare strategies is bound to remain limited. Moreover, [Kapadia et al. \(2015\)](#) explain that some end users are reluctant to adopt to smart healthcare strategies due to lack of reliability for example false alarms caused by dictation and monitoring tools. Once the accuracy of smart healthcare strategies becomes questionable some clinicians perceive the strategies as useless and therefore reluctant to adopt these strategies.

[Razmak et al. \(2018\)](#) define ease of use as the degree to which an end user deems the use of smart healthcare strategies as free of effort. Thus, end users are more inclined to adopt and use smart healthcare strategies that work in a way that makes tasks easier for them. The authors go further to explain that perceived ease of use as been identified in numerous literature as a predictor to end user behaviour towards the adoption and use of smart healthcare strategies. User interfaces play an important role in the acceptance of technology and most end users are reluctant to adopt smart healthcare strategies due to poor layout of information, poor design of systems, poor reliability and use of technical jargon ([Gagnon et al., 2016](#); [Kapadia et al., 2015](#); [Lim et al., 2018](#); [Paaske et al., 2017](#)). If any of these factors exist, this makes the smart healthcare strategies complicated to use.

Additionally, negative past experiences with other smart healthcare strategies may also affect end users' perception to use smart healthcare strategies. If an end user had previously found smart healthcare strategies difficult to use or not useful, this negatively affects the user's perception of smart healthcare strategies and therefore most likely to refrain from using the new strategies (Kapadia et al., 2015).

Moreover, Feng et al. (2019) also criticised the absence of adequate effective information for patients on hospital official websites. The authors noted that currently, many hospitals, including large hospitals, leave little information for patients on their official websites, and the most of this information is about hospitals while other effective information is not complete.

3.3.2. Resistance to change

Introduction of smart healthcare strategies threatens end users' control over processes or procedures of their individual knowledge and expertise for example by formulating diagnosis before the clinicians meets the patients and this potential bias results in clinicians unwilling to adopt smart healthcare strategies (De Grood et al., 2016; Kooij et al., 2018). In other instances, the introduction of smart healthcare strategies means users experience more questions, more phone calls and increased appointments especially in the early adoption stages which clinicians view as increased workload.

Additionally, Alami et al. (2017) note that a benefit of adopting of smart healthcare strategies means a gain in clinical time, which users often perceive as smart healthcare strategies taking the users' job and may result in the users being laid off and therefore results in resistance to accept smart healthcare strategies. Kruse et al. (2015) and Kruse et al. (2017) added that refusal to use of smart healthcare by end users is because of fear of change and lack of understanding of the benefits such initiatives bring due to poor communication and engagement of end users by top management.

3.3.3. Poor computer skills

Melchiorre et al. (2018) stated that lack of computer skills amongst end users is a common challenge in the adoption of smart healthcare strategies. Lack of computer skills means one struggles to complete task therefore finds the new smart systems frustrating, unhelpful, and unusable and therefore a cause of resistance. This is supported by Kapadia et al. (2015) who state that a person's educational and/or technical knowledge determines the decision to adopt smart healthcare strategies. People with higher levels of education and technological proficiency incline to using smart healthcare strategies in their daily lives more than those with lower education and technological levels. Razmak et al. (2018) add that poor computer skills result in smart device anxiety, fear and phobia which greatly affects the adoption of smart healthcare strategies by end users.

3.3.4. Poor training and support

As mentioned above poor computer skills and knowledge poses a challenge in the adoption of smart healthcare strategies by end users. Therefore, end users with poor knowledge or skills of using smart healthcare strategies require training to acquire the new skill to become competent in using the new strategies. However, too often umbrella training is provided to all end users but a study by De Grood et al. (2016) found out that training needs must be tailored to the end user's knowledge and capabilities. Thus, training must be aligned to the end users' skills, knowledge and job role rather than be general for everyone. Failure tailor training leads to wrong use of smart healthcare systems or end users completely abstain from using the new strategies. However, due to tight budgets that healthcare organisations operate on, it is difficult to tailor training to the specific individual as it costs a lot of money and may require more training time which is scarce hence that umbrella training for all.

Additionally, training times must be selected carefully taking into consideration that training provided too early may result in end users forgetting the acquired skills due to the long-time lapse before using the system. Training too close to the adoption time may also result in end users being forced to use the system before they feel comfortable to do so. Thus, it is important that training time is carefully scheduled. De Grood et al. (2016) suggest that follow-up training sessions and first line one-on-one or on demand support is provided during real life situations and in early stages of adoption as failure to provide these may result in failure to successfully adopt smart healthcare strategies. The authors further explain that end users working within smaller healthcare provider organisations struggle to adopt smart healthcare strategies due to limited availability of first line or one-one support because of the limited resources that smaller healthcare organisations have at their disposal. Kapadia et al. (2015) concludes that as a result of lack of training and support, end users fail to maximise full functionality of smart healthcare systems and take more time to input and retrieve required information therefore revert back to paper and manual processes hence failing to benefit from adoption of smart healthcare strategies.

4. Discussion

Based on the identified 26 articles that meet the requirements of this systematic review, 21 key smart healthcare adoption challenges were identified and discussed. The 21 challenges are divided into three main themes based on TOE framework. Organisational challenge's theme is the most prevalent theme with 10 challenges linked to it as compared to technological theme which contains seven challenges and environment theme with only four challenges. Additionally, organisational challenges were discussed in more articles i.e., 19 articles compared to any other theme. Technological themes are discussed in 18 articles and environment challenges were discussed in 14 articles. The frequency of occurrence does not necessarily mean the theme with the highest frequency is the most important, but it assists healthcare leaders and policy makers to understand the most widespread theme. This helps to prioritise counter measures based on the challenges that are likely to arise and maximise allocation of resources which are often limited within healthcare.

The organisational theme includes challenges such as change culture, organisational readiness, lack of management support and

poor leadership, poor planning, organisational structure and poor communication and engagement is the most common theme with challenges cited in most literature as key success factors for most change initiatives. These challenges affect and run through pre-adoption, adoption and post adoption stages and therefore through the entire adoption life cycle. Therefore, if challenges within this theme are poor managed it is most certain that the initiative will fail, and large investments lost. These challenges are within the remit of healthcare leaders to deal with and with suitable change management strategies in place within a healthcare provider organisation these challenges can be resolved and managed.

The second most common theme is the technological theme which constitutes of privacy and security issues, interoperability issues, lack of data technology and standards, costs and data governance and ethical concerns challenges. This theme is a collection of challenges related to the adoption of technology and usage of data within healthcare. Challenges from this theme mainly affect the pre-adoption and adoption stages of the adoption life cycle. These challenges are mainly within the remit of policy makers and with suitable policies and regulations being put in place earlier in the adoption process, challenges are be addressed earlier in the adoption process.

The last but also important theme is the environment theme. This theme mainly focuses on one of the most important stakeholder group in the adoption of smart healthcare management strategies. End users are the people who will use the new system on a daily basis and whose daily work is greatly affected by the adoption of smart healthcare management strategies. Without the buy-in and full acceptance of this stakeholder group, adoption of smart healthcare strategies is almost guaranteed to fail. These challenges affect all three stages of the adoption life cycle. Although just four challenges i.e., end user behaviour, resistance to change, poor computer skills and lack of training and support are listed in this theme, failure to address these challenges can be catastrophic and therefore just as important as the other two themes. Therefore, it is important that management are fully aware of these challenges and related strategies are put in place to deal with these challenges as they arise.

5. Conclusions and recommendations

Smart healthcare strategies have been identified as a solution to the challenges that the healthcare sector is currently faced with. However, adoption of smart healthcare strategies has not been easy with a number of failures still being recorded. The current study reveals that achieving smart healthcare transformation means change for the health sector, and that such a process of change depends on the ability of stakeholders and individual healthcare providers and patients to manage and work with new knowledge. Smart health in the rest of the world has been challenging and a number of failures are still being recorded. Having investigated on current literature, three main themes emerged of challenges faced by healthcare provider organisations. The three challenges themes identified are technological, organisational and environment challenges with several other related challenges associated with each theme. The findings of this study demonstrate that different TOE challenges affect smart health strategies adoption by healthcare sector. The study, therefore, proposes a differentiated approach to policies and practices to effectively scale up adoption of smart health and reduce failure rates of smart health projects. The study results can help inform smart healthcare providers and policymakers regarding the key challenges impacting smart health adoption, guiding them into making educated decisions to foster this adoption and harness the potential benefits.

It has been noted that the adoption of smart healthcare strategies is a complex process that is not just technologically challenging but affects organisations and individual end users affected by the change. Therefore, it is paramount to understand of how technological, organisational and environment challenges are intertwined to determine and prepare how these challenges can be addressed when they surface to improve the chances of resolving these challenges and successfully adopting smart healthcare strategies. Although adoption of smart healthcare strategies is complex and numerous challenges prevail, if adoption is effectively managed using appropriate change management strategies healthcare provider organisations can successfully adopt smart healthcare strategies and benefit from the opportunities provided by these strategies. Therefore, future work must concentrate on change strategies that can be engaged to facilitate successful adoption of smart healthcare management strategies.

It is about change management enabled by technologies to help increase the efficiency and effectiveness of service delivery and the benefits to patients and clinicians. Therefore, it suggests that government's needs to create a robust healthcare digital infrastructure that includes connectivity, safe data storage and consented access to health data and data sharing. Also, it is necessary to address the urban and rural divide of skilled healthcare workforce and digital infrastructure. Furthermore, there is a need to establish a robust governance framework to support change management and a culture of digital transformation, including clarity over data ownership, cyber security, patient consent and patient education. The scarcity of knowledge and expertise associated with digital transformation is, and will continue to be, a huge challenge for many healthcare staff to recommend digital services and products to patients and service users. Therefore, training and education related to the digital literacy will help leaders, managers and change agents to understand better how to craft and recommend digital services and products to patients and service users.

Given that the research reported in this paper is based on review of literature, the results presented here are only tentative and of limited value for the purpose of generalisation. Therefore, additional research is therefore called for, to further explore the complex mix of key challenges which healthcare sector face in achieving digital mission. Although this study contributes to the understanding of the challenges for adoption of smart health, some limitations must be acknowledged. This review may not have included relevant studies that were not indexed in the searched databases, written in a language other than English. Moreover, this analysis only considered published studies, and no further contacts were made with the papers' authors to obtain extra information or to validate our thematic analysis. Consequently, it is possible that other smart health adoption challenges might have been missed. Future studies could include studies in exploring the relationships and connections between different challenges for adopting smart healthcare strategies. As indicated by [Dedrick and West \(2003\)](#), TOE framework is only a scientific classification for classifying variables and it

doesn't represent the integrated theoretical framework or well-established theory, therefore, there is a need for a robust framework to examine technology adoption in healthcare sector organisations.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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