

A QUALITATIVE STUDY EXPLORING DIGITAL TRANSFORMATION IN THE SOUTH AFRICAN PUBLIC HEALTH SYSTEM

Declaration

I, Mathapelo Ntsimane declare that this research report is my own original work, I have followed the stipulated ethical practices for data collection by getting clearance from both Wits Ethics and Wits Medical Ethics. Where the work of others has been used, appropriate references have been made. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at Wits Business School. Submission of this report has only been for this degree and has not been examined in this school or any other university.

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Signed at Soweto

24 February 2025

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DEDICATION

I would like to dedicate this to my parents who have been nothing short of supportive, encouraging and believing in me every step of this journey. A special thanks to my mother for never ceasing to pray for me and being the glue that holds us together as a family, words are not enough to demonstrate what you mean to me, but I hope that this is a start. I love both dearly.

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ABSTRACT

INTRODUCTION: Digital transformation is the new era that ushers in the use of digital technologies to disrupt the traditional way of completing tasks in personal and workplace environments. This transformative process has affected every industry, with healthcare not being an exception.

PURPOSE: The purpose of this study was to explore the perceptions of healthcare professionals towards digital transformation to determine the following: the extent of digital transformation within one healthcare institution, as well as the benefits and barriers to the adoption of digital transformation.

METHOD: The study design was semi-structured interviews with healthcare professionals from one tertiary hospital in Gauteng. The study adopted a qualitative methodology. The data was analysed using thematic analysis and the theme codes were generated manually.

RESULTS: A total of 16 interviews were conducted and the standout points were that all the participants believed that digital transformation would benefit and help improve processes and operations within the institution. While digital transformation is believed to be beneficial, there is the problem of poor buy-in from the healthcare professionals as they are of the opinion that there are far more pertinent issues that need to be addressed before the focus can be on digitally transforming the public healthcare system.

CONCLUSION: The study was able to determine the extent of digital transformation in that currently there is work being done to interconnect public health institutions within Gauteng to reduce duplication and gear towards continuation of care. The main barriers identified towards successful digital transformation was the lack of financial resources, lack of proper network infrastructure and lack of adequate staff training – issues which, if properly addressed, could ensure that the pathway to transformation is easier.

CHAPTER 1: Introduction

1.1 Social context

The South African public health system has undergone multiple transformations. Dating back to colonial domination, apartheid dispossession and to the post-apartheid period, changes in healthcare policy have resulted in the system being riddled with challenges. Policies introduced in the post-apartheid era have allowed the system to be integrated into a comprehensive national service but inadequate implementation has led to failures (Coovadia et al, 2009). These challenges continue to mount as global healthcare delivery is transitioning towards Healthcare 4.0. This prompts a question: is the South African public healthcare system adequately prepared for another transformation?

Presently, healthcare in South Africa comprises of public and private institutions with 422 public hospitals and approximately 217 private hospitals (Dell & Khan, 2017); Stats SA, 2017). Recent statistics show a national population of over 64 million (Worldometer,2025) with 84% of the population utilising public healthcare services. This suggests that the workload is tremendous in these institutions and that proper operations and processes need to be in place to ensure that healthcare delivery is efficient and satisfactory. There are 5 categories of public hospitals: district, regional, tertiary, central and specialised. This paper focuses on tertiary hospitals which provide: a) specialist and sub-specialist services, b) intensive care services under the supervision of a specialist, c) training for healthcare practitioners, d) receive referrals from regional hospitals and e) have a bed count between 400-800 (Southern African Legal Information Institute, 2019).

1.2 Background

In industry, digital transformation is characterised by the use of digital technologies to create and modify business models, as well as transform organisational structures, stakeholder relationships and resources (Plekhanov et al,2023). It has facilitated industry disruptions through the introduction of technologies such as Artificial Intelligence (AI), Big Data, cloud computing and the Internet of Things (IoT). Digital transformation is understood in the context of the four preceding industrial revolutions, each of which have impacted the different aspects of society,

including healthcare delivery. This is evidenced in the transition of healthcare delivery from Healthcare 1.0 to Healthcare 4.0 (Jingshan L, 2021).

Healthcare 1.0 is the simple patient-clinician encounter where a consultation is conducted. The outcome is diagnosis, testing and the implementation of a treatment plan for the patient. Healthcare 2.0 is defined by the development of medical/ biotechnological devices that have played a critical role in imaging, monitoring and providing life support equipment (Li & Carayon, 2021). The development of information systems, electronic health records, the computerisation and digitisation of manual processes is a defining characteristic of Healthcare 3.0, which was introduced approximately a decade ago. The fourth and current revolution has been dominated by cyber-physical systems integrated with cloud computing, AI and the IoT. The desired effect of this integration is the creation of a smart and interconnected healthcare system. With the increasing use of automation, Big Data and IoT in healthcare 4.0, people engagement has become critical (Li & Carayon, 2021). The COVID-19 pandemic, for example, has been instrumental in the development of telehealth and remote care, according to Li and Carayon (2021). It is an example of the importance of technology adoption in healthcare as existing technological platforms were utilised to deliver healthcare virtually, maintaining continuity of care without risking exposure to patients (telemedicine) (Liu & Migeul-Cruz, 2022).

Li and Carayon (2021) argue that further research on the multitude of factors that influence Healthcare 4.0 is needed as this will inform how to adequately create a system that is interconnected and patient centred. Currently, there is a gap in research that examines the South African public healthcare system's transition from Healthcare 2.0 to Healthcare 4.0 and how it is implemented. The South African public healthcare is unique in that digitisation is approached differently at various levels (primary/secondary/tertiary), as well as provincially. This is largely because of spatial inequalities as some provinces are more urbanised/ industrialised while others are rural. Previous studies (Wright et al, 2017; Mbunge et al, 2022) have focused on the individual components (such as e-health records, telemedicine and the systems and devices that allow for its application) of the digital transitions in healthcare instead of combining all of them.

This study adopts the Technology-Organization-Environment (TOE) framework which investigates behavioural intentions and implementation of innovation at organisational level. It is superior to behavioural models as it reflects on the internal and external aspects i.e., technology,

environment and organisation. The technology aspect analyses the existing and new technologies relevant to the organisation, while the organisational aspect is based on the size, scope and resources that characterise the firm. The environment is the stage upon which the organisation performs its business (Nguyen et al, 2022). The framework can be used to understand how digitalisation is integrated into the South African healthcare system.

Another theory to consider is technology acceptance and how it has become a dominant aspect in learning management systems (Al-Nuaimi and Al-Emran 2021). Garcia-Perez et al (2022) indicate that a comprehensive understanding of digitising a healthcare system is not just the adoption of technologies, it is transformation of a system and ensuring that management strategies are in place that address audits geared at adaptive and transformative capabilities of healthcare organisations as well as issues such as cybersecurity.

1.3. Problem statement

Mhlanga (2023) highlights that the healthcare sector has been affected by digital transformation in the same way that other sectors of industry have. The use of technologies such as artificial intelligence will therefore have a pivotal role in long term care of patients. Mhlanga (2023) further recommends that there should be a focus on digital transformation in the healthcare industry of Africa.

The adoption of technology in healthcare delivery in South Africa has become imperative as more countries transition to Healthcare 4.0. to achieve cost-efficient, effective, and patient-centred healthcare systems. There are different tiers of the South African healthcare system that are primarily stuck in Healthcare 1.0 and 2.0. Should this problem go unaddressed, the South African public healthcare system will continue to lag behind the global community as well as the private healthcare system which is digitising at a faster rate. This will make the goal of accessible, efficient and effective healthcare less attainable in the public sector.

1.4. Research objectives

Research objective 1: To explore the extent of digital transformation in the South African public healthcare system.

Research objective 2: To identify barriers to the adoption of digital transformation in the South African public healthcare system.

Research objective 3: To identify the benefits of the adoption of digital transformation for the South African public healthcare system.

1.5. Significance of the study

The slow pace of regulation and other guidelines is a shared concern among health professionals, as observed by Wille and Nkomo at the Health Professions Council of South Africa (HPCSA) conference in 2019. The contribution of this study lies in understanding the extent of digital transformation within the South African healthcare system in order to facilitate successful transition to Healthcare 4.0. Given that implementation has been highlighted as the primary challenge, speaking to healthcare professionals will assist in identifying the specific obstacles to digital integration at organisational level.

1.6. Delimitations

1. This is an explorative study conducted through semi-structured interviews with healthcare professionals and administrators at one tertiary hospital in South Africa.
2. It would be interesting to explore digital transformation at the different levels of the South Africa public healthcare system, however, this would make the study too broad as each level has similar *and* different challenges.
3. The study does not include the private healthcare sector as it only serves approximately 20% of the population; it is also digitising at a faster rate than the public sector.

1.7. Assumptions

The following assumptions have been made regarding this study:

1. The participants will answer all the questions.
2. As the interview will be anonymised, participants will answer questions honestly and appropriately.
3. The participants in particular the healthcare professionals will have a limited understanding of digital transformation and fear of it being adopted within the public healthcare system.
4. As the research is being conducted at an academic, tertiary hospital easy accessibility to variety of healthcare professionals and administrators is guaranteed.

CHAPTER 2: Literature review

2.1. The WHO perspective on global digital health strategy

Throughout the 2000s, the World Health Organisation (WHO) has influenced the global trajectory of healthcare systems by providing digital strategies that can be employed to better health information systems and improve healthcare for patients. In 2005, WHO defined eHealth as the use of Information and Communication Technologies (ICTs) in health to do research, educate students, treat patients, track diseases and monitor public health (Masilela et al, 2013). eHealth is expected to help with the flow of information, support the delivery of health services and aid in the management of health systems.

Over time, WHO has developed a global strategy on digital health that has been influenced by digital innovations such as IoT, AI, Big data analytics, blockchain technology, smart wearables and other platforms. Adoption of these technologies is expected to address the issue of universal health coverage (UHC) (WHO, 2021). Informed by this objective, the South African Health Department has published the National Digital Strategy for the period of 2019-2024 (NDoH, 2020). South Africa started developing its own eHealth strategy in 2010 when a National eHealth Steering Committee created the 16th draft version of the strategy. The challenge with the draft was that it was resource-intensive, difficult to implement and would cost billions (Masilela et al, 2013). It was recommended that the health sector should invest in resources that address all the priority areas identified in the strategy, as well as acquire human capital with the ability and technical expertise to provide strategic leadership (Masilela et al, 2013).

2.2. A brief overview of the South African National Digital Strategy

The mainstay principle for this digital strategy is to achieve better health for all South Africans using digital technologies that enable a person-centred approach. At the end of this digital strategy period (2019-2024), the Department of Health hopes to have achieved nine strategic interventions which are briefly outlined in Appendix 1. At its core, the National Digital Strategy aims to improve the health status of all South African citizens, create a tech-savvy people who embrace existing

and new technological interventions, create the opportunity for active involvement from both government and citizens to work collaboratively in developing a digital health ecosystem that is successful and addresses existing obstacles (NDoH, 2020).

2.3. Types of eHealth platforms being used in South African public healthcare system

A technological innovation that has generated excitement is the use of mobile devices to deliver health services (commonly referred to as mobile health or mHealth). South Africa can accommodate the use of mHealth as there is high mobile phone penetration, a well-developed ICT industry, a record of small-scale initiatives that have successfully implemented mHealth and government support for eHealth. However, the obstacles are scaling up mHealth and deriving evidence that indicates its effectiveness in health services delivery (Leon et al, 2012). A successful initiative that demonstrates the benefit of digital transformation and the use of mHealth is *MomConnect* which was established in 2014 by the Department of Health (Pillay & Motsoaledi, 2018).

Cline and Luiz's (2013) study demonstrate the impact that ICTs have on South African facilities (focusing on two tertiary hospitals). The significant findings are the positive impact that automation has had on cost and strategic value on public sector hospitals, as evidenced by positive patient experience, hospital staff workflow improvement and improvement in overall morale in the workplace. While there are many demands on the public sector such as resource allocation, access to healthcare and efficient management of patient encounters, the research suggests that use of ICTS can help alleviate these challenges (Cline & Luiz, 2013).

2.4. Use of electronic health records (EHRs) and the barriers affecting them

A key feature of digital health is electronic health record (EHR) systems that need to be implemented to register and track patients as they visit different health facilities. Several barriers affect the implementation of EHRs which are broadly categorised into three main areas: technical, social and environmental. These are further broken-down to include: the absence of supporting

infrastructure, lack of user training and commitment, political influence, lack of framework for implementation, and legislation and regulation (Katurura & Cillers, 2018).

Katurura and Cillers (2018) suggest investment in alternative infrastructures that can facilitate EHRs through the following: a) use of incentives to attract and retain information and communication technology experts in the field of health, b) engagement and participation of all stakeholders in the developmental process of eHealth, c) appropriate legislation and frameworks and d) government to create budgets that have capacity for eHealth programmes.

2.5. Impact of COVID-19 pandemic on data security in South Africa

During the COVID-19 pandemic, the South African government created a contact tracing database to ensure public health, however, this raised the question of constitutionally legislated protections on privacy. The research conducted by Cachalia and Klaaren (2022) recommends that there is a need for policymakers to review legislation on cybersecurity and develop regulations that promote open data initiatives that allow for the re-use of public sector information without infringing on the Protection of Personal Information Act (POPIA) (Cachalia & Klaaren, 2022).

A systematic review conducted by Stoumpos et al (2022) analysed changes that are occurring within the healthcare industry as a result of digital transformation. In total they reviewed 5847 articles, however only 287 met their inclusion criteria. These articles included information on the acceptance and importance of e-health, telemedicine and security issues and were articles published from across the globe. If the researchers had limited the scope to Africa and in particular South Africa the researchers would have had far less literature to review, thus supporting the relevance of conducting this study.

CHAPTER 3: Methodology

3.1. Research design

This is a qualitative study aimed at determining the extent of digital transformation within the South African public healthcare system. Although there is growing research on this topic, only a few studies have examined healthcare providers' understandings and perceptions of digital transformation – particularly those working in tertiary public hospitals. A qualitative approach will provide a deeper understanding of digital transformation in the context of the South African public healthcare system.

3.2. Data collection methods

Primary data will be collected using an anonymised semi-structured interview guide. A semi-structured interview is a conversation-based interview. It allows both the researcher and the participants to have an open-ended conversation about the topic under examination. The interview guide will be sent to participants prior to the interview to allow them to familiarise themselves with the questions but it will not be used as a script. In-person and online interviews will be the two options that the participants will have. Online interviews help eliminate logistical problems - Iyanna et al (2022) utilised a similar data collection process in their study on *Digital Transformation of healthcare sector: What is impending adoption and continued usage of technology-driven innovations by end-users*. The purpose of the study was to identify perceived barriers and other inhibiting factors to individuals' adoption and use of e-health innovations.

3.3. Population and sample

The sample population consists of healthcare professionals and administrators at a tertiary-level hospital in South Africa. This tertiary hospital was chosen as it has a variety of health disciplines allowing for the pool of healthcare professionals to be larger than at other lower-level institutions. As tertiary-level institutions receive referrals from all other hospitals, it is important to explore the digital technologies that have been adopted within this type of hospital system.

The study uses purposive sampling as healthcare professionals and administrators work within the hospital ecosystem. This is similar to the methodological approach adopted by Iyanna et al (2022) in a study addressing digital transformation in the health sector. The participants were chosen based on their employment at the hospital, as management and administrators who interact with the different health systems available in hospitals (*see* Iyanna et al, 2022).

3.3.1 Sample Size

Researchers have varying opinions on what constitutes the correct sample size in qualitative research before saturation of the data occurs. Mason (2010) suggests that the mean sample size for qualitative research interviews is 31, while Dworkin's (2012) study recommends that the minimum sample size is 25-30 participants taking part in interviews. While the opinion on how many participants are required to reach saturation may vary among researchers, the defining point for saturation is when the researcher keeps hearing the same responses from different participants during interviews (Guest et al, 2006) or when no new codes can be generated when the data is being analysed (Urquhart, 2013). Other researchers have observed in their studies that saturation was achieved at 10 interviews and further went to conduct two more interviews as confirmation that saturation had indeed been achieved (Jassim & Whitford, 2014). For the purposes of this study, and based on the above stated recommendations of saturation, the targeted sample size is 20 participants.

3.3.2. Research instrument

DeJonkchree and Vaughan (2019) illustrate that semi-structured interviews are commonly used in qualitative research and allow for an open dialogue between the researcher and participant(s). The study also provides a method for creating an interview guide that aims to initiate the interview, answer the research questions (core questions), and construct follow-up questions that provide details about the core questions based on participants' responses.

A semi-formal interview guide will be used to conduct the study as it will guide the researcher and participants but conversation is intended to flow freely instead of being scripted. The questions will follow a similar approach to that of the DeJonkchree and Vaughan's (2019) study.

3.4. Procedure for data collection

- After ethics approval of the study, an email was sent to the respective hospital heads requesting permission for employees to partake in the study, these were followed up with telephonic contact.
- An email/ WhatsApp message/ physical copy with an introduction and explanation of the study along with the researcher's details was provided and distributed to participants in the study. Consent was obtained from participants who participated both online and in person.
- The interview guide was made available to all participants via email and WhatsApp message based on what was convenient for the participants.
- Participants were given the option of either an in-person interview or an online interview (via teams).
- Participants were asked for permission for the interviews to be recorded as the researcher needed to listen to the interviews for transcription and analysis at a later stage.
- The only identifiers that were used for each of the participants was the position that they hold and which department they are based in.
- The interviews were conducted approximately over a 2-month period.
- The method for distribution of the study documents needed to be adjusted to include WhatsApp and physical copies as the participants didn't have work email addresses and it was more convenient for the participants to either get a hard copy that they could read during in-person interviews or the information to be sent via WhatsApp.

3.5. Data analysis and interpretation

Shibambu and Ngoepe (2025) followed a similar research design as this study and utilised thematic analysis on their study regarding service delivery through digital transformation in the public sector. An article was published in the *Journal of Physiotherapy* which expressed how qualitative research was gaining popularity within health research with thematic analysis being the favourable choice for data analysis, as it allows for easy collection of data and one of the ways to code the data is using the frequency of ideas expressed by participants, Ayre and McCaffery (2022).

Thematic analysis of the data was done as it allows for the recognition of patterns within the data and the grouping of recurring themes that arose from the data. The researcher analysed the responses from the interviews on a fortnightly basis and identified emerging themes as interviews were conducted. At the end of the allocated timeframe for the interviews, the researcher re-evaluated all the data available. This helped refine the findings and accurately define the emerging themes. These are discussed further in the findings section of this paper.

3.6. Limitations to study

The study focussed on one tertiary-level hospital within the South African public health system due to time constraints and the exclusion of participants from the private healthcare sector. As this study is qualitative the absence of quantitative data limits generalisation.

3.7. Ethical considerations

- The purpose of the study was explained to all participants and they were requested to sign an online or in-person consent form.
- The anonymity of the participants has been upheld by the researcher. In other words, participants are referred to as nurses, doctors, administrators, etc. in the findings.
- Research permission letters were completed in line with the university requirements.
- The name of the organisation has not been included in the final report, which refers to the ‘hospital/ institution’.
- The researcher has signed the plagiarism declaration form and provided the Turnitin report to show that no plagiarism has taken place.

3.8. Quality assurance

Quality assurance was assessed by using four parameters: transferability, dependability, credibility and confirmability which occurred once the data collection and analysis was completed for this study by the researcher. These parameters were described in an article that explored these concepts,

considering them as trustworthiness pillars which are assessed through prolonged engagement, thorough documentation, allowing for reliability, legitimacy and accuracy of the findings (Ahmed, 2024).

After the data was analysed, quality assurance was assessed using the following parameters:

- Transferability – the study process and findings have been well-detailed with explanations provided for the themes that have been generated. The study can be applied not just to one tier of the public healthcare system (tertiary), but it can be replicated even at primary and secondary level as well as being conducted with different healthcare professionals like the allied staff and management. This study could also translate to private healthcare system in South Africa.
- Dependability – this was determined by the researcher by following the methodology and data collection processes as indicated above and re-checking of work regularly by the researcher and supervisor.
- Credibility – the research was conducted over a two- month period with small gaps as per the convenience of the participants. Thus the researcher wasn't inundated with information at once and could relisten to the recordings to observe the findings. Participants that were interviewed provided shared experiences and perceptions. This suggested saturation aided in the researcher having confidence in the truthfulness of the results.
- Confirmability – was determined through the manual generation of the theme codes. These codes were derived from similar ideas or concepts (frequency of ideas) that the participants had expressed from the interview process. For example, all the participants expressed that they had never used or heard of *MomConnect* which is a question that didn't require a code. In the question 'what do you perceive to be challenges/ barriers regarding digital transformation?' the following ideas were expressed and recurred: lack of financial resources, poor network infrastructure, cybersecurity measures that were required to protect data, lack of equipment and adequate staff skills. The same method was used for all questions and codes were done alphabetically and numerically: e.g., A1 for the first question, B1 for the second question and so forth.
- After the data was interpreted, a conceptual framework was developed as per the literature recommendation by: Creswell and Creswell (2018) suggesting that the use of theory in

qualitative studies is varied and can be used as an endpoint i.e., the theory/conceptual model will be developed at the end of the study once data collection has occurred. It will be based on the themes that arise from the data.

CHAPTER 4: Findings and Discussion

4.1. Demographics

Interviews were conducted with the staff from the hospital. To be included in the study the participants had to be current employees. Twenty-three people were approached who had expressed interest to participate in the study, a total of seventeen staff members went on to sign the informed consent documents and 16 completed the interview process. Only one participant who had signed the informed consent did not proceed with the interview despite numerous attempts to make further contact.

The table below provides a description of the three groups of staff that were interviewed for the study.

Table1: Sample description

Demographics	Group A	Group B	Group C
Role at the hospital	Patient administrators	Nursing staff	Doctors
Qualifications	• All the of participants interviewed in this group have at least 5 years of work experience and working at the Hospital. • Most of them (4/6) started their careers with the institution as interns and have proceeded to have permanent posts at the institution.	• 2 Enrolled nurses with a certificate in nursing • 1 Professional nurse specialised in trauma.	• 2 Interns with MBChB degrees and one has a BSc degree as well. They are from the Department of Obstetrics and Gynaecology. • 5 registrars in Department of Radiology – all have MBChB degrees, and one

			has two masters degrees.
Range of years of experience	• 1-32 years • The person with the least experience was the intern and the person with most experience has been with the institution for 32 years.	• 5-10 years • One of nurses has both private and public health experience.	• 1-16 years • The two interns were in their 12-month working as doctors at the time of interviewing.
Total number of participants	6	3	7

Most of the staff consented to audio recordings and four did not sign the audio consent form. Their answers were written by the investigator on the interview guide.

The questions from the interview guide were used to answer the three objectives that the study proposed and the themes were derived from the participants' responses. As the responses repeated themselves, a tally was done to determine when the question had reached saturation. For the questions asked in this study similar responses generally reached saturation between 2-6 participants.

4.2. The extent of digital transformation in the South African public healthcare system

The first set of questions in the interview guide were directed at answering the first objective. The first theme that was derived in relation to this objective is: *a broad definition for digital transformation*.

Digital transformation is defined by the participants as the shift from paper-based resources to digital resources. It allows for efficient time management as processes that were once time consuming can be completed in less time. It enables capturing of patients' personal details which can be shared across public health institutions in the province, whereas in the past each institution

would have their own records. It enables the optimisation of resources, accessibility and reliability of records and digital technologies can be used in patient management.

The second theme is that of the perceptions of healthcare professionals towards digital technologies and their use in the public healthcare system.

When analysing the understandings and uses of digital technologies among the participants, in particular the use of AI, IoT and Big Data, the majority of participants gave adequate responses to this question. Only a few did not understand the question and required clarification. This indicates that healthcare professionals are aware of these technologies and, more importantly, how they can effectively be used in the healthcare system to improve efficiencies, as well as patient care. Use of the digital technologies is well understood by the administrative staff and doctors. The nursing group was less familiar with the extent to which these technologies can help the system beyond patient care.

The third theme is the impact that adoption of digital tools has on workplace efficiencies.

The digital tools that all the participants knew of are smartphone apps, wearable devices, staff communication software, electronic health records and e-booking systems. The doctors also knew of online tools to diagnose conditions. They were all familiar with these as some are being used in the institution; others are used by the staff for personal reasons. The participants all believe that these digital tools are effective in improving daily functions – the e-booking system in particular has had a positive effect on how the system runs. However, they suggested that it can be improved by all departments having an e-booking system. This would ensure that the patients are not subjected to moving around in the large hospital but instead the patient administrators would complete all bookings for the patients based on the doctor's orders. In this regard, all the participants believed the adaption of digital tools would enhance efficiency within the public healthcare system.

Based on the participants' responses, it is critical to establish the staff's understanding of the technologies/ tools and how they perceive their contribution to making the working environment productive and effective when discussing and planning the integration of digital tools/ technologies in the workplace. This substantiates why the TOE framework is important when digitising in the workplace. It foregrounds what is the available technology at the workplace. Externally, it

highlights how the institution has created an environment where technology can be used for daily processes; how the staff defines what constitutes digital transformation in the workplace; what the staff understands about the use of digital technologies specifically in the workplace; and how the staff perceive the impact that the adoption of digital technologies and tools would have on workplace efficiency.

Theme four: Platform coverage at public health institutions.

The application *MomConnect* was established in 2014. Yet, a decade later, all the participants who are based at the tertiary hospital had not heard of it. While there is extensive work being done creating platforms that can be used by healthcare practitioners, an existing concern is how the current platform(s) are being consumed by healthcare practitioners, to what extent the platforms are used by patients and which areas in the province are utilising this platform i.e., primary, secondary or tertiary care. The other important factor that needs to be considered is the relevance of the platform at the different tiers of public health institutions.

4.3. Barriers to the adoption of digital technologies in South Africa's public healthcare system

Theme one: Poor distribution of government information

This theme was derived from questions 3-5 of the interview which inquired if the participants had read the South African National Digital Strategy and what their opinions were on the document. One out the sixteen participants had attempted to read the National Digital Strategy. The reason for this was because it was one of questions for this study but, prior to this, the participant was not aware that such a document existed. This is a sentiment that was shared by the rest of the participants. The document in question is generated by South African National Department of Health. There have been two cycles of the National Digital Strategy, the last one being the 2019-2024 edition. The strategy outlines the goals that the department has regarding disruptions in the healthcare industry due to digital technologies and tools. This document is readily available on the internet if one searches for it, however, almost all the participants had not heard of it or come across it or even thought to search for it. One of the participants made a comment questioning why the department had not taken any initiative to introduce and explain the document to staff as it

usually does this when introducing new policies e.g., Batho Pele Principles. If they were to do this, it is expected that the staff would have a clear picture of the goals that need to be achieved.

Theme two: Disconnect between health management and staff

The above-mentioned theme indicates that there is poor communication between those who are writing and creating policies and those who must implement them at the ground level. The responses suggest that management and staff are not aligned. One of the resounding concerns that staff voiced out is that there is no discussion when systems are introduced; there is also the expectation that staff will just adopt and adapt to the changes seamlessly. In some cases management has not communicated with staff to find out whether the changes are necessary or beneficial, what concerns the staff have regarding the changes, and what effect the changes will have on their daily activities.

This raised a sub-theme of monitoring and evaluation: what are the systems/ processes in place that ensure that adequate monitoring and evaluation is being done when new systems and processes are introduced? Who is responsible to ensure that that this gets done? How often should the monitoring be happening? And when does engagement with staff happen during this process? Once issues have been raised, how are solutions provided to the staff? If this disconnect is allowed to continue, it will lead to a disengaged workforce and the goals that need to be achieved by digitally transforming the system will not be realised.

Theme three: Unsuccessful implementation of the digital systems

Questions 11 and 12, which were on the successful implementation of eHealth systems at the institution, aided in the development of this theme. The adoption of eHealth platforms was the least successful in the hospital.

There are different types of eHealth systems that have been used at the hospital. RIS is the radiology information system, a specialised software that manages workflow within the radiological department and integrates administrative and clinical data (Candelis, 2022). PACS is a picture archiving and communication system which replaced use of traditional films in radiology (Strickland, 2000). Medicom is a computerised patient information system which has been used in the institution from 2011/2012. However, in 2020 the system experienced multiple failures and, as

of 23 January 2022, is no longer operational. The system failure was at both the levels of software and hardware as the equipment was no longer under warranty (Mokgethi, 2022).

The Medicom, RIS and PACS were brought from vendors as a package by the Department of Health, but each vendor uses a different type of architecture for these systems. Currently SAP is the software that is being used at the institution. The responses that were provided leaned towards unsuccessful implementation of the eHealth systems. There were different opinions on which systems – past or present – had been well implemented. Some of the participants believed that the previous system that had Medicom/RIS/PACS was better than the current platform that is being used.

The standout advantage according to the participants regarding the new SAP system is that patients do not need to be entered twice on the system. Once they enter the Casualty Department and their information is recorded, if they need to go to the Radiology Department they can be easily found on the system. Previously, they would have to recapture on RIS. While this may be an advantage, the disadvantage is that when the system is offline the patients can't have radiological procedures done as they do not have an existing patient file in the system. With the previous system this could be bypassed by entering patient details using RIS which could function offline.

Participants mentioned that when new systems are introduced there is no adequate induction for the staff that enables them to acclimatise. Because the training that is provided is not sufficient, when problems occur it takes long for them to be resolved. The staff admits that many of them do not have technical skills that are required for navigation of the digital systems. They are of the opinion that training staff adequately on digital systems is one of the crucial elements for digital transformation to occur.

Theme four: Lack of resources and infrastructure affecting digital transformation in the public health system

This theme is based on the answers to question 9: what challenges/ barriers do you perceive may occur as the healthcare system digitally transforms?

Public health in South Africa has been marred with the issue of inadequate resource availability at healthcare institutions. Based on participants' responses, there is still more work that needs to be done to overcome this challenge. Specific to this paper, lack of resources was defined as per the

responses provided, namely: poor network infrastructure, loadshedding/ load reduction that occurs due to electricity generation issues with Eskom, an inadequate number of computers available in the departments where participants work, lack of training material and poor integration of the new system that has been introduced.

The poor network infrastructure was an issue across the board from all the participants and is considered the biggest challenge that the institution is faced with. While digitising is a good idea, if this issue is not addressed there is no point in trying to digitise. The participants noted that when the system shuts down some processes can be switched to paper-based processes but others cannot. The catching-up that is done manually or the transfer of work from the paper-based to the digital system isn't always done well. At present Eskom issues have been minimised, however they are still present and they do affect public hospitals. Participants feel that the Eskom crisis negatively impacts the goal of digitising as tools required to digitise rely on electricity. It makes it difficult to use the internet when the hospital is on back-up generation – this slows processes and lengthens waiting times for the end users (patients). The sentiment among participants is that beyond the issues that are specific to this study, lack of resources runs deep in the public health system. Some of the resources that are lacking are: equipment that the clinicians need to use, basic medication and maintenance of existing infrastructure and equipment and, a lack of funds to aid in improving health institutions. As a result, the participants feel that digitally transforming the system will take very long because resolving these other issues has to be prioritised. These are necessary to ensure that patients receive the help that they have come to healthcare institutions for.

Regarding the lack of training material: one of the issues was that the training that was provided for the new system was attended by only some of the staff members – the rest had to be trained by word of mouth. One of the traditions in healthcare training is: 'you see one, you do one and you teach one'. This may work for some of the techniques that staff are trained on but for a digital system that has complexities it would be useful for training material to be available for those who didn't attend the training. This can complement what is transferred by word of mouth. It would also be a helpful refresher tool that is readily available for everyone to use. The availability of the tools of trade, such as computers, is also an issue as accessing patient diagnostic reports like blood results or imaging results can be delayed. With the blood results doctors are able to use their phones

to see the results, however, with the new PACS system they are unable to do so. This requires that they go to the Radiology Department to get the reports or see the images.

A sub-theme that was identified was: the role that the individual's age plays in desiring transformation in the workplace. The participants did not disclose their ages for this study; however, they all expressed the opinion that the older staff members are resistant to change and that adopting digital tools for them is usually very challenging. They are digital migrants with little or no computer literacy and are not familiar with digital platforms, while the younger generation (digital natives) are more receptive and eager to have digital processes and systems in place to conduct daily work activities.

Theme five: Concerns regarding job security and the fear of being rendered redundant.

During the interviews one of the questions required the participants to express their concerns regarding the adoption of digital tools. Half of the participants didn't express any concerns and felt that digital transformation will lead to positive outcomes, whilst the other half expressed concerns regarding job security. The one example provided was that of filing clerks: now that more processes are being digitised, patient files will eventually no longer be required and once that happens there will no longer be a need to have filing clerks as physical files will be obsolete. This begs the question, what will happen to the staff in those posts? Will their jobs become redundant resulting in retrenchment? This effect may continue to trickle to other jobs within the hospital – even the doctors are at risk as improving AI capabilities will lead to diagnosticians not being necessary. The machines would be able to generate immediate reports, eliminating human error and the element of fatigue.

Theme six: Concerns regarding data safety, cybersecurity measures and ethical policies on the storage of patient data

Participants raised concern over the measures that would be implemented to ensure that patient data is well protected. This included questions about the plan that is in place to ensure that the system doesn't suffer a security breach. For example, in 2023 the National Health Laboratory Service (NHLS) system suffered a cyberattack which affected service delivery; clinicians had no access to patient results and the staff at the NHLS were also unable to conduct their daily

operations. Processes had to be reverted to manual operation. The attack was launched by cyberterrorists using disruptive ransomware (Cassim and Chapanduka, 2024).

This hack created a lot of havoc, extending beyond patient care. While this will not be elaborated on for the purposes of this study, it's important to mention that patients were affected in that they had to get the same bloods tests repeated multiple times during this period because staff, including NHLS staff, couldn't access the system. It took approximately two months for the system to be operational. The fear expressed by the participants was about the damage that could occur if the hackers decided to release the results for public consumption. Little was done after the incident to explain to staff what measures would be in place for this not to occur again. At issue therefore, is the lack of ethical policies when collecting and storing patient data. In the hospital, patients' names are used across departments for procedures and prescriptions as that is how they are identified. At present, clinical details are not stored on computers but there has been no discussion regarding consent forms that patients can sign granting permission for their data to be collected and stored on the system.

There are various barriers that have been identified from the interviews that could hinder digital transformation within the public healthcare system. Each of these barriers needs to be addressed. While others may take a while to solve, there are those that can be addressed quickly and those should be prioritised for the end goal to be achieved.

4.4. Benefits of the adoption of digital transformation for the South African public healthcare system

All the participants, as previously stated, thought that adoption of digital transformation is beneficial to the system. These views are presented below.

Theme one: The enhancement of efficiencies in the workplace and access to reliable data

Digitising processes has led to the improvement of time management; it has allowed for easy access to pertinent information that aids in the diagnosis and treatment of patients. It also simplifies communication within the work environment. As digital capabilities are improved, it can aid with easily locating patients in the hospital and enhance the hospital database regarding diagnostics.

The improved hospital database can be leveraged to the university as all public tertiary hospitals are academic hospitals with university affiliations. Having advanced data management systems allows for better healthcare systems. In relation to health research, it allows for a pool of data to be generated and researchers would have access to diverse and reliable data that would not only help in the province but extend nationally and internationally.

Theme two: The potential instrumental role that digital transformation can have in attaining Universal Health Coverage

The last question that the participants had to answer was their opinion on the South Africa being able to achieve universal health coverage. All the participants believed that digitally transforming the system would aid in reaching this goal. Transforming the system and enabling interconnection between the different tiers of public health institutions not only allows for improved work efficiencies but it helps with achieving positive outcomes for the end users (patients) as delays in diagnosis and treatment will be minimised. It is anticipated that there will be proper escalation of patients through the referral system with patients being directed to the appropriate facilities that can correctly address their needs. This will improve the overall patient experience and help to cultivate a positive outlook among South Africans towards public health services.

4.5. The effect of digital transformation on a public health institution

The conceptual framework for this study has been derived from the themes that were generated from the interviews. As there are several themes that the data provided, the ones that are pertinent to the inception of the conceptual framework are: the identified expected benefits that would occur as the institution digitally transforms and the dual interaction that some of the barriers have on the institution's capacity to successfully do so. The diagram below depicts the effect that digital transformation has on the public health institution and the relationship between the institution and dependant variables.

The independent variable is the public health institution as digital transformation is the change that affects it. As the change occurs within the institution workplace efficiencies such as time management, diagnostics, easy access to data and storage of information are improved and enhanced – these are the dependant variables. The causal relationship between the independent

variable and dependant variables is mitigated by the mediating variables that are: adequate training for staff as the institution digitally transforms, establishment of a reliant network infrastructure, introduction of cyber security measures to protect digital systems, cultivation of a learning culture within the institution. All this can be achieved by having a collaborative and agile leadership structure.

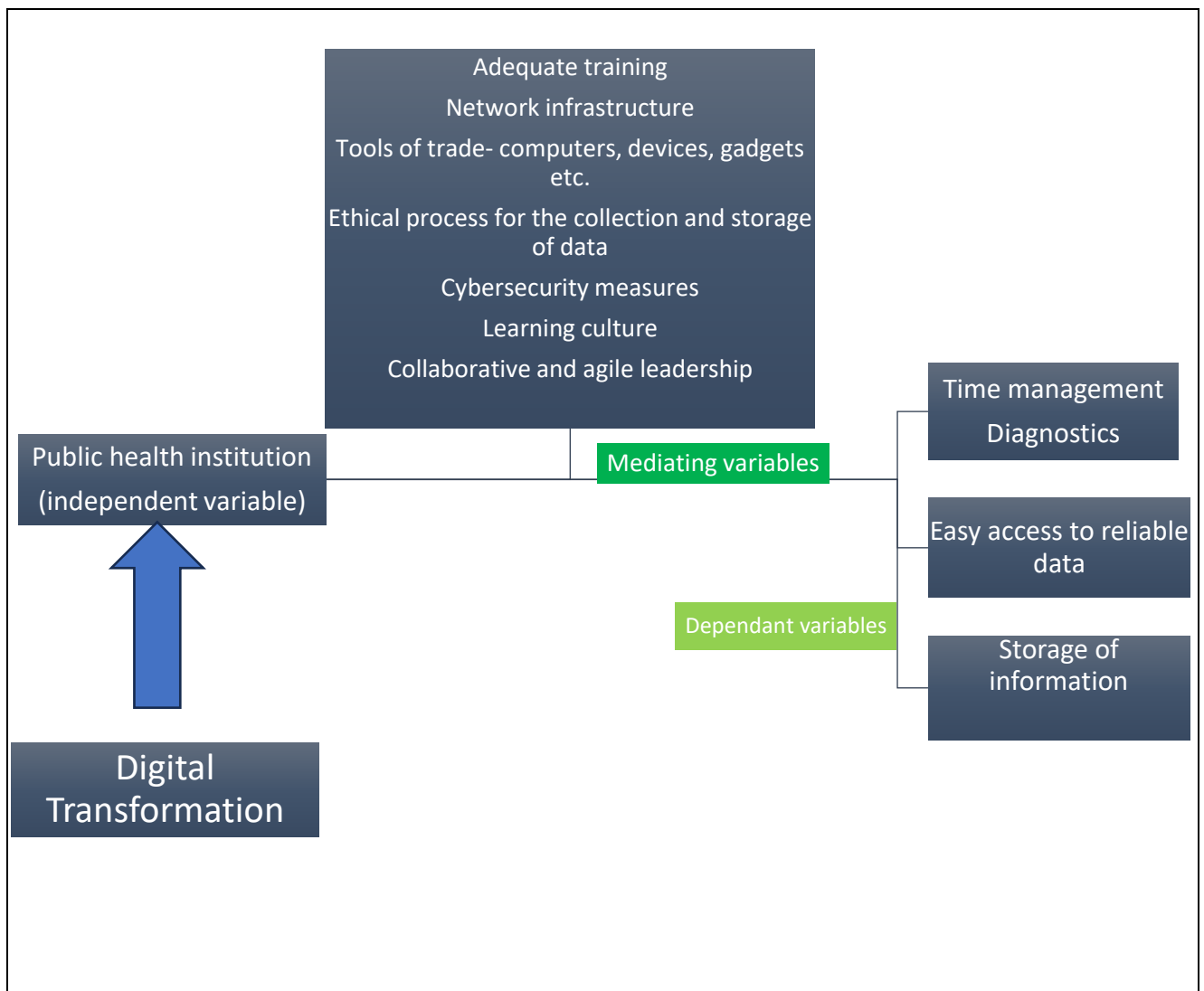


Figure 1: Diagrammatic illustration of the effect digital transformation has on a public health institution

4.6. Implications

The findings indicate that digitally transforming a public health institution can have a positive effect on operations as well as patient care, however there are several issues that need to be addressed. Some of the issues that have been highlighted by the participants are similar to the nine strategic principles that are in the National Digital Strategy of Health 2019-2024 (Appendix 1), in particular points 7-9 which in summary refer to network infrastructure, data protection and staff training. Ogundaini and Mlitwa (2024) did a situational review of national digital health strategies in the sub-Saharan Africa and some of their key findings were that there is inappropriate capacity to monitor and report progress, limited resources and lack of digital health leadership to effectively operationalise national digital strategies in sub-Saharan Africa. Two of their three findings are similar to those of this study and, like their study suggests, if these issues are not rectified there will continue to be an uncoordinated and slow rate of digitising within the healthcare system.

The above-mentioned issues that are illustrated by the conceptual framework tie into the theoretical framework (TOE) framework that underpins this study.

Technology: The South African government is geared towards creating a pro-digital ecosystem within the public health institution that will result in universal health coverage. External factors such as Eskom power cuts affect network infrastructure that is already lacking in its capabilities. New digital platforms have been adopted by the institution to help improve workflow. At an organisational level lack of resources, adequate training affects that the institution's ability to cover its vast scope as a tertiary that provides various services and requires integration of all departments internal and external to be effective. **Environment** is the public healthcare industry that is governed by government policies, health leadership which seems to be lacking and not adequately agile.

Another implication to consider which refers to technology acceptance theory, has been mentioned in the literature review and by the participants in the study is the importance of having management strategies in place that will enable the healthcare system to effectively transform through correct utilisation of digital technologies. This would mean that healthcare policies need to be reviewed and possibly the creation and adoption of new policies need to be considered.

CHAPTER 5: Conclusion

5.1. Recommendations

These recommendations have been informed by findings that were gathered from the participants. One of the aims of the study was to identify barriers to digital transformation and these recommendations provide an approach that could be used to help overcome some of them. The recommendations will be stratified for each group that it affects. It is important to note that at a tertiary hospital the healthcare professionals are part of the academic staff from the university associated with hospital.

Policymakers and health leadership (national and provincial government):

1. To create policies that are in keeping with a stepwise process for the integration of digital systems: this will communicate to staff that the expenditure on digital transformation is not the sole focus thus allowing buy-in from the staff who are worried that there are other pertinent issues that need to be addressed urgently.
2. To collaborate with staff on the creation of ethical policies that will ensure that the data obtained from the end users (patients) is captured correctly and stored appropriately.

Management at the hospital and staff:

3. Training will need to be approached through a three-pronged process: This can be an immediate goal that can be started within the year. It would be a continuous process as updates can be made to the digital systems which staff would need to be aware of.
 - Training of staff at the hospital on the National Digital Strategy that addresses the different roles that each department will have in attaining the goals set out in the strategy. This provides an opportunity for staff and management to engage and collaborate on the different ways in which the strategy can be implemented practically. The challenge is creating the time for this training and all stakeholders having an open mind to each other's ideas.
 - Ascertaining the computer literacy of staff at the hospital to delineate those with competency from those that will require skills development prior to the introduction of new or complex digital systems. This would have to be addressed by use of external vendors

who will be able to be objective and staff won't feel embarrassed versus being trained by internal staff members.

- Training on the new digital system that the hospital has adopted needs to be done by well-informed instructors that can answer questions that the staff have. The training needs to be extensive and provided in groups to ensure that each member of staff has been adequately trained. Training also provides the opportunity to upskill employees by improving their confidence. This will help dispel their fear of job security as the institution digitally transforms.

Health leadership (national and provincial government), management at the hospital and staff:

The process for this recommendation should be started within the year, however completion may be targeted for the next year.

4. The establishment of a monitoring and evaluation system that can assess the successes and failures that the digital system has, as well as assess how well staff have adopted the new system. The monitoring and evaluation should also extend to platforms that are existing such as *MomConnect*, tracking their coverage and use particularly at tertiary hospital level. There must be regular feedback sessions where staff is informed of the findings that the monitoring and evaluation process has yielded. This will continue to encourage an agile, learning and collaborative culture within this environment.

5.2. Conclusion

This study has allowed for an individual tertiary hospital to be analysed in terms of how it has been digitally transforming over the years. While a number of studies that address digital transformation in the public health system focus on broad concepts and digital systems that exist, there are few that examine how they have been practically implemented at a hospital or clinic level. More importantly is how the staff perceive digital transformation. That is this study's contribution.

While this study is limited to an individual hospital, the insights that have been drawn from the participants have allowed the researcher to understand the extent to which digital technologies are disrupting public healthcare and the important roles that collaboration and innovation have within

the public healthcare system to ensure that it runs effectively and efficiently. While public healthcare institutions may be perceived as lagging behind, there is evidence of measures being put into place to bridge the gap between primary and tertiary health and to propel the public healthcare system into the digital era. Based on the findings of the study, the barriers currently outweigh the benefits of digitally transforming the system. However, based on the positive comments that were made regarding digital transformation, if those barriers are addressed the converse should occur.

The implications indicate that within the South African context the public healthcare system requires strong, dedicated health leadership with a transformative mindset to create and integrate policies that will help promote and quicken the pace of digital transformation in this sector. The people within health leadership need to be strategic and able to fulfil targeted goals. The other challenge is finding a way for the leadership, management and the frontliners (healthcare professionals and administrators) to actively engage with one another and work collaboratively on new policies/strategies that would satisfy all the stakeholders and to successfully implement the existing strategies.

The analysis of data was subjected to the researcher's biases as this is a qualitative study – which is by nature subjective. Generalisations can't be made with this methodological approach as a result. To counter this limitation, it would be prudent for further research to be done to determine the perceptions of those in managerial roles within the institution, while also extending this research to other public health institutions within the province and across the country.

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APPENDICES

Appendix 1

Nine strategic principles of the National Digital Strategy:

1. Development of leadership capacity at the different government structures to ensure digital health innovation and adaptive management.
2. Collaboration between multi-stakeholders for cost-effective implementation of digital health.
3. Establishment of a national grant that will be monitored by National Treasury.
4. Review and strengthening of all governance structures by 2020 to ensure that there is alignment to the strategy, accountability of digital health resources and deployment of health information systems.
5. An adoption of open architecture approach allowing for the expansion of the National Health Normative Standards Framework for Interoperability of eHealth in South Africa.
6. Development of appropriate digital applications like a health play store and design of services that improve health services for both patients and healthcare workers.
7. Establishment of robust physical and network infrastructures that will help alleviate connectivity constraints and create a cloud service for health.
8. Review of current digital health regulations and development of new regulations where necessary, especially in data protection, data sharing between sectors and cybersecurity.
9. Enhancing digital health capacity with the required technical skills from personnel to ensure successful implementation of the strategy. NDoH (2020)

Appendix 2:

Research instrument

Interview guide 2024

Demographics:

Qualification(s):

Work experience:

Designation/position at the hospital:

1. What is your understanding of digital transformation and how it applies to the healthcare system?
2. What is your understanding of digital technologies (AI, Big data, Internet of things, etc.) and how they can be used in healthcare?
3. Have you read the South African National digital strategy?
4. If the answer is yes, what are your thoughts on the strategy and are the goals highlighted in the strategy attainable?
5. If the answer is no, please provide a reason(s):
6. Do you think that the adoption of digital tools (a list of tools will be provided) will enhance efficiency? (Please provide reasons for your answer)
7. Do you think that the staff is eager to adopt digital tools in the workplace? (Please provide reasons for your answer)
8. What concerns do you have with the adoption of digital tools?
9. What challenges/barriers do you perceive may occur as the healthcare system digitally transforms?
10. Do you think that the South African public healthcare system is equipped to transition to healthcare 4.0? (Please provide reasons for your answer)
11. Which eHealth platform do you think has been successfully implemented in your institution? (Please provide reasons for your answer)
12. Which eHealth platform has been the least successfully implemented in your institution? (Please provide reasons for your answer)
13. What is your opinion on the MomConnect platform?
14. Is Universal Health Coverage an attainable goal? (Please provide reasons for your answer)

Appendix 3

Theme codes:

Question: Understanding of digital transformation

Types of responses	No. of participants	Code
Shift from paper to digital records and Improves time management	5	A1
Used to capture patients' information but not clinical records	6	A2
Changing of systems	2	A3
Changing of systems e.g. Medicom to SAB	1	A4
Leveraging digital technologies to improve operations	1	A5
Optimisation of resources:	2	A6
Accessibility and reliability of records e.g. blood tests, radiology and pathology reports	3	A7
Use of digital technologies to treat patients	1	A8

Question: Understanding of the digital technologies and their use in healthcare

Types of responses	No. of participants	Code
Use of Apps like chat GPT to find simplified ways to explain concepts	1	B1
Easy access to information without needing to use textbooks	1	B2

Machine learning requires human input to ensure that the system is able to provide correct diagnostic information	1	B3
Creation of large databases that can compare findings in the different countries of the world	1	B4
Doesn't understand the different technologies	4	B5
Advantageous as diagnostic tool/patient care	3	B6
Helps with research and integration of records across institutions:	2	B7
Use of digital technologies to treat patients	1	A8

Question: Challenges and barriers to digital transformation

Types of responses	No. of participants	Code
Lack of financial resources	10	C1
Poor network infrastructure	15	C2
Lack of equipment e.g. computers	4	C3
Adequate staff skills	8	C5
Poor training on digital platforms	6	C6
Cybersecurity measures	7	C7
Accessibility and reliability of records e.g. blood tests,	3	A7

radiology and pathology reports		
Use of digital technologies to treat patients	1	A8
