

**UNIVERSITY OF KWAZULU-NATAL**

**Challenges affecting e-Health adoption in South African public hospitals: A case of  
Edendale hospital**

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College of Law and Management Studies

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## **ABSTRACT**

Information and Communication Technologies (ICT) plays a crucial role in improving healthcare by providing innovative and more efficient ways of accessing, communicating, and storing information. The use of ICT in healthcare is often referred to as e-Health. With the increase in costs of healthcare services and shortage of healthcare professionals in the public sector, it has become vital that healthcare organisations consider adopting e-Health. This is because e-Health enables healthcare organisations to provide services in a more efficient and cost-effective manner, and allows healthcare providers to streamline many of their processes. The adoption of e-Health in developing countries has shown numerous benefits. These benefits include, giving patients access to quality healthcare services; provide healthcare providers with the ability to make informed decisions, access to medical knowledge databases and best practices. However, the literature shows that the adoption of e-Health in South African public hospitals has been slow and has been characterised by number of challenges such as a lack of skills, lack of ICT infrastructure, lack of management support, and lack of policies and standards to support its adoption. Using Edendale hospital as a case study, this study therefore tries to understand the factors that affect e-Health adoption in the South African public hospitals. This study adopted a quantitative research approach using questionnaire surveys as means to collect data from a total of 265 respondents that represented the study's sample. A descriptive approach was employed in this study, and questionnaires were used to obtain data from healthcare professionals. The data collected was analysed with the use of the SPSS software. During the analysis of the data, the results obtained were based on the descriptive and inferential statistics produced. Based on this study's results, the healthcare professionals expect an e-health system to produce an accurate patient diagnosis, improve patients' education regarding their health, ensure stronger data privacy and security and improve the quality of safety of healthcare centres. Healthcare professionals indicated that if these expectations are met by an e-Health system, then they will adopt and use it. Also, healthcare professionals indicated that if an e-Health system is web-friendly and easy to access and use, then they will adopt and use it. The study showed that the presence of facilitating conditions (such as access to the Internet and at a low cost, adequate ICT infrastructure, relevant computer skills training, government support and involvement of the hospital management) would encourage healthcare professionals to adopt and use an e-Health system.

Furthermore, the results of this study showed that most of the healthcare professionals intend to use e-Health systems in the future and more frequently. Chi-square tests conducted in this study produced results which showed that the intention of healthcare professionals to adopt and use an e-Health system is statistically related with their expectations (regarding its implementation) in terms of performance, effort and facilitating conditions. Moreover, other results of this study showed that the ages of healthcare professionals and the digital generation they belong to also influence their intention to adopt and use e-Health systems. Also, it was observed that the years of experience of a healthcare professional has no statistically significant influence on their intention to adopt and use an e-Health system.

**Keywords:** e-Healthcare, Health challenges, South African Public Hospitals, Edendale hospital

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## **LIST OF ACRONYMS**

AMRS :	AMPATH Medical Record System
BACIS:	Basic Antenatal Care Information System
BANC:	Basic Antenatal Care Checklist
CASA:	Independent Communications Authority of SA
CBHI:	Community-Based Health Insurance
DHIS:	District Health Information System
DOH:	Department of Health
e-Health:	Electronic Health
HER:	Electronic Health Record
GDP:	Gross domestic product
HIS:	Hospital Information Systems
HMIS:	Health and Management Information Systems
HODs:	Heads of Departments
ICT:	Information and Communications Technology
IDT:	Innovation Diffusion Theory
IT:	Information Technology
m-Health:	Mobile Health
MI:	Management Innovativeness
MM:	Motivational Model
MPCU:	Model of PC Utilization
Open MRS:	Open Medical Record System
ROI:	Return on investment
SCT:	Social Cognitive Theory
IMB SPSS:	Statistical Package for the Social Science
TAM:	Technology Acceptance Model
TAM2:	Extended Technology Acceptance Model
TB:	Tuberculosis
TPB:	Theory of Planned Behavior
TRA:	Theory of Reasoned Action
UTAUT:	The unified theory of acceptance and use of technology
WHO:	World Health Organization

# CHAPTER ONE

## INTRODUCTION AND OVERVIEW

### Introduction

Information and Communication Technologies (ICT), provides access to information over telecommunications, telehealth, telemedicine, electronic health records (HER) and as well as with the use of mobile health (mHealth) and play a crucial role in improving healthcare. ICT improves healthcare by providing innovative and resourceful ways of accessing, communicating, and storing information. According to Kapadia et al. (2015), for the healthcare sector to improve and maintain its clinical operations, it must adopt ICTs. The use of ICTs in healthcare is known as electronic Health (e-Health, the researcher adopted to use short version in most parts of this research) (Kleinpeter, 2017). With the increase in the costs of healthcare services and healthcare professionals, it has become vital that healthcare organizations consider adopting e-Health (Zayyad & Toycan, 2018). This is because e-Health enables healthcare organizations to provide services in a well-organized and cost-effective manner, and also allows healthcare providers to streamline many of their processes (Jagadeeswari et al., 2018).

The use of e-Health technology in developing nations has shown numerous benefits (Zayyad & Toycan, 2018). These benefits include; giving patients access to quality healthcare services, provide healthcare providers with the ability to make informed decisions, access to medical knowledge databases and best practices (Kiberu et al., 2017). Furthermore, adopting e-Health allows healthcare managers to make better monitoring and evaluation of health intervention programs, through access to extra precise national healthcare information (Abawajy & Hassan, 2017). The use of e-Health may give policymakers access to precise and dependable information, that healthcare investment decisions may be taken from (De Rosis & Barsanti, 2016).

South Africa being one of the developing countries is also faced with challenges such as poverty, and economic growth difficulties that have prevented the country from achieving its development targets. One of the South African government's goal is to provide its citizens with access to high-quality healthcare services (Lince-Deroche et al., 2016). However, challenges such as insufficient healthcare facilities, high cost of healthcare services and lack of

professional health care practitioners are hindering the provision of such high-quality healthcare services (Katurura et al., 2018). Having been faced with similar concerns, many developing countries are realizing that adopting e-Health may be significant in addressing these challenges (Ouma & Herselman, 2008; Furusa & Coleman, 2018).

## **Research Background**

In the 1950s, ICTs was used to collect, manage, and disseminate healthcare information (Oldenburg et al., 2015). The personal computers with large storage, large memory space and processing speed capabilities was developed in the 1970s, it created ever-expanding prospects of assessing and delivering healthcare information to medical practitioners and patients (Saracci, 2018). Moreover, the increase of electronic network infrastructures such as Internet, and telecommunication networks, used in disseminating huge amounts of data, also accelerated the process. The term “e-Health” was introduced in 1999 (Eysenbach, 2001). In its simplest term, e-Health is well-defined as the usage of - ICT to access, provide, and share healthcare services and information (Kampmeijer et al., 2016). Over the past years, the use of e-Health across the healthcare sector has increased dramatically, and its continuous development and potential benefits within the healthcare sector have received recognition from states around the world (Rahmani et al., 2018). The use of ICT to offer healthcare services in South Africa commenced in 1997 (Petersen et al., 2020). Back then, computer systems were used in few public healthcare facilities to automate record keeping and to facilitate tasks such as financial record keeping and patients billing (Cilliers & Flowerday, 2013). The latest digital transformation in healthcare has seen hospitals being able to allow patients in remote areas to receive the highest quality of care. They are also now able to keep patient medical records, for example, using cloud computing technology.

The challenges of having a reliable, consistent and integrated system for sharing patients’ medical records through healthcare systems, the need of real-time information, and ensuring of patient’s confidentiality and information security, has led to the need of implementation of ICT applications that might help to solve these challenges. Having been faced with these challenges, South African government, through the Department of Health have made efforts to adopt e-Health, because of its promises to address the healthcare challenges (Walters et al., 2016). However, it has been found that the South African government's effort to implement e-Health project has been faced with challenges like inadequate ICT infrastructure and skills, absence of standardization and integration amongst healthcare information systems, and security

concerns, that have affected its adoption (Ruxwana et al., 2010;Katurura et al., 2018). As a result, several e-Health implementation projects have been unsuccessful (DoH, 2012;Katurura et al., 2018). Until these challenges are studied and addressed, the benefits of adopting e-Health will continue to be fruitless. Even more, healthcare facilities will continue to provide services that are costly, inefficient and inaccessible as is the case currently.

### **Motivation for Research**

The literature has shown that there have been major challenges to e-Health adoption amongst developing countries. South Africa is listed in the countries that have been struggling with e-Health adoption (Scott et al., 2015). This is because, e-Health project designers usually focus more on the benefits that come with the adoption of technology and pay less attention to the challenges that may hinder the success of e-Health implementation. Whilst studies have been conducted to identify e-Health adoption challenges so as to improve its adoption, e-Health adoption in South Africa has remained low, primarily due to insufficient studies on understanding its challenges.

It is important that research is conducted to understand and address some of the challenges facing e-Health adoption in South Africa, so as to facilitate the realization of the maximum benefits that can be derived from e-Health adoption. Moreover, studying and addressing the challenges of e-Health adoption in South African healthcare will increase adoption and boost the trust of e-Health users and may also be helpful to the government in the designing and implementation of e-Health projects at a public healthcare facility. User acceptance has been identified as one of the factors that might be a possible obstacle to the positive implementation of e-Health and its adoption. Over 40% of information technology (IT) projects across numerous sectors, including the health sector have been neglected (Walsham, 2017), due to lack of acceptance by users. Therefore, user acceptance is one of the major determinants of the technology project success in the whole world. The main the aim of this study was to investigate the challenges (socio-technology) that affect the adoption of e-Health in a South African public hospital. .

### **Problem Statement**

Since the independence of South Africa and its becoming a democratic country, the government has struggled to deliver quality healthcare services to its people. Some of the major problems the South African government is facing in the healthcare sector include insufficient

funding, geographical isolation of citizens, and a shortage of qualified healthcare practitioners (Mburu et al., 2017). After understanding the promises of e-Health to help address healthcare challenges, the government has been trying to implement e-Health programs. However, the implementation of several healthcare information systems projects have been unsuccessful. This is because, it has been noted from the literature that e-Health systems in South Africa have been characterised by lack of adoption by healthcare professionals. Considerable resources have been invested in IT projects by Government in public health sector, but the final analysis, has failed to produce the expected returns on investment.

The unsuccessful implementation of e-Health have consequently prevented healthcare institutions in the country from adopting e-Health and realizing the maximum benefit of its adoption. Hence, it is vital that the adoption of e-Health systems be re-assessed such that best practices can be implemented, thus ensuring the delivery of optimal value. There are many studies on e-Health adoption that have been conducted in other parts of the world. Some of common challenges that have been found amongst literature to positively (but sometimes others negatively) influence adoption of electronic health, includes but not limited to socio-technology (Performance expectancy of an e-Health systems, effort expectancy of an e-Health systems, facilitating conditions, and the roles of gender, age and experience) aspects. However, there is not much literature that attempts to understand and address e-Health adoption challenges in the South African context. As such, the aim of this study was to investigate the challenges (socio-technology) that affect the adoption of e-Health in a South African public hospital.

### **Aim and Objectives**

The aim of this study was to investigate the challenges (socio-technology) that affect the adoption of e-Health in South African public hospitals.

The objectives are:

1. To determine the extent to which the performance of an e-Health system may influence its adoption and use at public hospitals
2. To determine the extent to which the effort of using an e-Health system may influence its adoption and use at public hospitals
3. To determine the facilitating conditions that may influence the adoption and use of an e-Health system at public hospitals

4. To determine the roles of gender, age and experience in the adoption and use of e-Health systems at public hospitals

## **Research Questions**

The main questions as derived from the research objectives are presented below:

1. What is the extent to which the performance of an e-Health system may influence its adoption and use at a public hospital?
2. What is the extent to which the effort of using of an e-Health system may influence its adoption and use at a public hospital?
3. What are the facilitating conditions that may influence the adoption and use of an e-Health system at a public hospital?
4. How does gender, age and experience influence the adoption and use of e-Health systems at public hospitals?

## **Methodology**

In this study, the quantitative research methodology was used so as to get enough samples of all relevant stakeholders affected by e-Health adoption. This study is descriptive and implemented the quantitative research methodology to collect primary data from respondents. The quantitative research methodology was used because it involves the investigation of relationships between variables (dependent and independent) (Sekaran & Bougie, 2016b). The selected members of the sample (265) for this research were carefully chosen, using Stratified sampling technique. The researcher selected the stratified random sampling technique because the target population consists of various units (professional staff members) that can be easily divided into different groups (such as Heads of Departments, Nurses, Doctors, Administrators, and Pharmacists). The primary data of this study were collected using structured questionnaires. The study was conducted in Edendale hospital, Pietermaritzburg, KwaZulu-Natal. In this study, the survey research design was adopted because the researcher needed to use a representative sample to draw conclusions about a target population. The researcher adopted the questionnaire survey method for data collection due to the busy nature of the healthcare professional workers.

## **Limitations of Study**

The study was conducted in only one hospital. This is because time and financial factors were constrained. In addition to that, e-Health is still a growing concept in academic research, there

exists limited research literature concerning e-Health adoption, particularly in the South Africa context. Availability of healthcare specialists also limited the number of study participants. An effort to increase the availability of healthcare specialists to participate in the study was made by frequent visits to the hospital as means of conveying emphasis of the importance of this research to the approached professionals and this increased the participation and seriousness of the study respondents. The researcher gave healthcare specialists an explanation on how the results of this study may contribute to the designing and implementation of e-Health projects in public healthcare facilities, at Edendale hospital.

### **Summary outline per chapter**

- **Chapter one:** This section presents a short discussion of e-Health background, explains the research problem statement and explains the motive behind the study. In this chapter, study objectives, and research questions are presented. The chapter concludes with a summary of all chapters covered in the study.
- **Chapter two:** The purpose of this chapter is to present a literature review on e-Health, drawing from the cases of developed and developing countries. The chapter also presents the experience of e-Health implementation and adoption challenges in South Africa, while attempting to offer a logical explanation of these challenges. The chapter further presents and discusses technology adoption theories. Discussion of the relevance and application of the “Unified theory of acceptance and use of technology” (UTAUT) framework in this study is presented in this chapter
- **Chapter three:** explains the method used in this study and discusses research constructs that were used to accomplish the objectives of this study. This includes research design, ethical clearance, sampling techniques, data collection methods, data analysis techniques.
- **Chapter four:** Presents the findings from the survey. The chapter also provides the analysis of results and discussion as related to the objectives.
- **Chapter five:** Presents a full summary of the main findings, conclusion, and recommendations for future research in this study.

### **Chapter Summery**

This chapter consist of a brief overview of e-Health, a problem statement, motivation to conduct the study, objectives, and research questions. It also provided an overview of this dissertation. From this chapter, it may be concluded that without having a deeper understanding of the challenges affecting e-Health adoption in South Africa, proposed intervention strategies

and e-Health implementation programs will continue to prove futile. The results of this study has the potential to influence the South African government in designing and implementation of e-Health projects at public healthcare facilities.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The previous chapter presented a brief overview of e-Health. This chapter further presents an extensive literature review on e-Health and its concepts. The literature reviewed in this study has highlighted the need for the provision of access to high-quality healthcare for the public in every country. However, literature indicates a lot of existential challenges to the success of such attempts. Some of the difficulties most experienced in underdeveloped countries are insufficient healthcare facilities, high cost associated with the delivery of public healthcare, and the lack of professional healthcare practitioners in the public healthcare (OECD, 2016). The aforementioned challenges propelled many developing countries to adopting e-Health as means to address the challenges that affect the smooth delivery of healthcare services to the public (Rahmani et al., 2018). Ross et al. (2016b) suggest that the benefits of adopting e-Health include an increase in access to quality healthcare, and costs reduction for providing/receiving healthcare. Ross et al. (2016a), further reported that e-Health adoption increases patient-practitioner relationship and decreases the time that healthcare practitioners spend on non-urgent tasks to allow the healthcare practitioners to spend more time attending to patients with urgent care.

While the literature has indicated the benefits of e-Health systems adoption, the adoption has been slow in many developing countries including South Africa, due to a lack of understanding challenges within context of each country before implementation (Petersen et al., 2019) . Hoque et al. (2017), express that the state of e-Health adoption in South Africa is relatively low as compared to other developing countries.

#### **2.2. Understanding E-Health as a means of healthcare service delivery**

A number of definitions have been given to e-Health, thus, the term has been used differently amongst scholars and in some cases, and it has been incorrectly used (Fortuin & Molefi, 2006; PAHO, 2015; Skogan, 1974). The mostly commonly used e-Health definitions in literature are the ones given by Eysenbach (2001b) and WHO (2009). According to Eysenbach (Eysenbach, 2001b, p. 1) e-Health is “an emerging field in the intersection of medical informatics, public health, and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a

technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology.” The World Health Organization, (WHO, 2009, p. 1) describes e-Health as the utilisation of Information and Communication Technologies (ICT) for health. The (ICT) can be applied in the treatment of patients, in conducting research, in educating the health workforce and tracking diseases as well as in monitoring public health.

Eysenbach (2001b), further stated that, the ‘e’ in e-Health does not only imply ‘electronic’, but also involve a number of other ‘e’s’, which altogether best define e-Health . These “10 e’s” thus stands for:

- *“**Efficiency:** e-Health must increase efficiency in health care, thereby decreasing costs.”*
- *“**Enhancing Quality of care:** increasing efficiency in health care should not only reduce costs but must also improve the quality of care.”*
- *“**Evidence-Based:** e-Health interventions should be evidence-based, such that the effectiveness and efficiency of e-Health should not be assumed but must be proven through scientific evaluation.”*
- *“**Empowerment of consumers and patients:** e-Health opens new avenues for the patient- centered medicine, and enables evidence-based patient choice, by making the knowledge bases of medicine and personal electronic records accessible to consumers over the Internet.”*
- *“**Encouragement of a new relationship between the patient and health professional, towards a true partnership, where decisions are made in a shared manner.”***
- *“**Education of physicians through online sources (continuing medical education) and consumers (health education, tailored preventive information for consumers).”***
- *“Enabling information exchange and communication in a standardized way between healthcare establishments.”*
- *“**Extending the scope of health care beyond its conventional boundaries.”***
- *“**Ethics:** e-Health involves new forms of patient-physician interaction and poses new challenges and threats to ethical issues such as online professional practice, informed consent, privacy and equity issues.”*
- *“**Equity:** to make healthcare more equitable is one of the promises of e-Health, political measures must be put in place to ensure equitable access for all, thus preventing digital divide*

*(a threat that e-Health may deepen the gap between the 'haves' and 'have-nots')*" (Eysenbach, 2001b, p. 1).

According to Sharma et al. (2019), e-Health is an umbrella term that alludes to the joint utilization of electronic correspondence and data innovation for clinical, educational and administrative purposes for the enhancement and promotion of healthcare service delivery. The current study will adopt the e-Health definition by Okunhon (2016). The main component of e-Health is Electronic Health Record (EHR), which allows the sharing of healthcare information between patients and healthcare providers offers electronic patients information that can be used as input to further e-Health applications. Other components of e-Health include Hospital Information Systems (HIS), Telemedicine, and Mobile Health (m-Health) (Qureshi et al., 2015).

### **2.2.1. Electronic Health Records (EHR)**

HealthIT (HealthIT, 2013, p.1) define Electronic Health Records as "real-time, patient-centred records that make information available instantly and securely to authorized users". Underpinning the above definition, Kruse, Sein and Kaur (2017) describe (HER) as the systematized collection of patient and population electronically-stored health information in a digital form. These records can be shared across different healthcare settings through a network-connected, enterprise-wide information systems or other information networks. EHR may include data that include patient's demographics, past health history, laboratory data, medication history, and/or radiology reports (Pendergrass & Crawford, 2019). Kruse et al. (2016) suggest that the main objective of Electronic Health Records is to make healthcare information available in any healthcare setting and to all rightful healthcare suppliers involved in the care of a patient, at any time. The ability of electronic health records to include digital images and scanned documents enables the creation of a complete patients' medical history (Pendergrass & Crawford, 2019).

The literature has shown a number of benefits associated Electronic Health Records compared to paper based. This involve more secure, easy to access, store, maintain, and shared as compared to paper-based (Farmer et al., 2013).The use of Electronic Health Records improves access to healthcare information, which in turn brings about efficiency into healthcare services (Musango et al., 2013). Additionally, Electronic Health Records enhance the capacity to utilize healthcare information, either in benchmark against similar practices or within practices, with

the aim of achieving quality healthcare (Kruse et al., 2018). Other advantages of EHR that are imperative to present healthcare challenges includes sharing of information, enhanced information security, visualization of patients health records, and more detailed reporting of healthcare information. Having access to shared health information by a multidisciplinary team of healthcare professionals may result in enhanced continuity of care and may further support team-oriented care across geographical boundaries.

### **2.2.2. Hospital Information Systems (HIS)**

According to Piette et al. (2012,p.125), Hospital Information Systems (HIS) is a “comprehensive and integrated information system designed to manage all the aspects of a hospital operation, such as medical, administrative, financial and clinical aspects of a hospital”. HIS is made up of one or more healthcare software. Both the old and the latest version of Hospital Information Systems include patient demographics and financial transactions (Health, 2012). However, the recent one serves as the main point of data entry for nearly all hospital transactions (Health, 2012) though not widely recognized and therefore used accordingly. For example, HIS now helps with “patient registration, admissions & order capture, financial reporting etc.” (Juma et al., 2012, p. 43). Observation from the study by Mamlin & Biondich, (2005), the benefits of using Hospital Information Systems include easy and improved monitoring of supplies, inventory and medicines, improved turn-around time for hospital task reliant on paper-based slips and registers, and improved audit controls and policy compliance. Hence, using HIS may allow healthcare professionals to make informed decisions as it permits daily workflow of clinical services in all divisions within the hospital to be monitored and evaluated in a single point.

Underpinning the above, Khalif and Alswailem (2015), stated that healthcare delivery within hospitals and different health institutions depend on HIS. This is because HIS helps in keeping all types of patient data and the recordings of all medical services that have been provided to the patient. Such data may include diagnoses, follow up reports, treatments and important medical decisions. Khalif and Alswailem (2015), continued to report that HIS is able to improve individuals’ health and healthcare providers’ performance, thereby yielding cost savings, improved quality and greater engagement by patients in their own healthcare. However, in spite of the evidence of these benefits, information systems’ adoption and use is still a big challenge for both practice and research (Dwivedi et al., 2019). Furthermore, in spite of the advancements in the capabilities of hardware and software, information systems are still

underutilised (Mohamed Khalifa, 2015). However, in the past 20 years, authors have been predicting an improvement in users' acceptance of information systems (Venkatesh et al., 2016).

### **2.2.3. Telemedicine**

According to Tierney et al. (2010), telemedicine is "the delivery of healthcare services by all health care professionals, using information and communication technologies for the exchange of valid information for diagnosis, where distance is a critical factor. It also helps in the treatment and prevention of diseases and injuries, research and evaluation, and for the continuation education of healthcare providers, all in the interests of advancing the health of individuals and their communities". In e-Health, "telemedicine can be as simple as two healthcare professionals discussing a case over the telephone or as complex as using satellite technology and video conferencing equipment to conduct a real-time consultation" (Seebregts et al., 2015,p. 1).

Telemedicine can be categorized as real-time or pre-recorded Telemedicine (Mars and Scott, 2010). The Real-time Telemedicine permits users to transmit and accept medical data almost immediately with very less interruption, whereas in Pre-recorded Telemedicine, information is summarized and then sent to the receiver for later response (Ngoma et al., 2012). The evolution of the Internet and emergence of mobile computers aided on the progression of Telemedicine adoption (English et al., 2011). Poudel et al. (2016) stated that Telemedicine has transformed the way health services are offered, as it enables the covering of locations where provision of healthcare is challenging due to the isolation of citizens. Additionally, Telemedicine offers education opportunities to the healthcare professionals in non-urban locations and also offer a way of sharing additional ideas amongst healthcare employees (Snyders, 2013). Black et al. (2011), argued that the implementation of Telemedicine in underdeveloped nations might be suitable to address the difficulties that exist in those regions concerning IT, its adoption, implementation and application to healthcare as well as the quality of life of the population of the region, these difficulties include poor communication infrastructures and high mortality rates. However, Hassibian and Hassibian (2016) claimed that despite its suitability, Telemedicine has not been fully implemented in many developing nations because of the lack of EHR interoperability and that of the required infrastructure to successfully implement and utilize telemedicine for the enhancement of service delivery in the healthcare sector.

#### **2.2.4. Mobile Health (m-Health)**

One part of technology innovations in the healthcare industry that is increasingly demanding attention all over the world is m-Health. According to Horner et al. (2013) defines m-Health as an umbrella term for health-related utilization of mobile telecommunication and multimedia technologies within health service delivery and public health systems. Although this description of m-Health first emerged in 2003, it has subsequently been protracted to cover public healthcare (Heeks, 2005). M-Health has also gained noteworthy growth through the pervasiveness of mobile communications infrastructure throughout middle and low-income countries (Heeks, 2005). According to Horner et al. (2013) m-Health is still in an emerging stage, but it has transformed the healthcare systems – by showing its ability for spreading the scope of delivering healthcare services to isolated areas and encouraging a move toward citizen-centered healthcare. Some of the benefits of adopting m-Health include:

- Improve access to medical service and information, particularly for isolated residents.
- Lower cost and increased efficiency of healthcare services distribution.
- Enhanced capability to detect, and treat illnesses
- Timely, extra actionable healthcare data
- Extended exposure to continuing healthcare education for healthcare professionals
- Also, the information provided here is not sufficient enough for you to have this part as a separate section. Add more information.

#### **2.3. Benefits of E-Health Adoption**

The literature has shown that electronic health adoption in public hospitals has both benefits and challenges to the patients and healthcare practitioners. Ross et al. (2016b) , stated that while research on the effect of e-Health on patients and healthcare practitioners is still needed, the benefits of e-Health on patients may include improved access to healthcare services, self-management of long-term conditions, increased patient’s participation in health care decisions making, and increase patient’s knowledge through the access to their healthcare information. E-Health is also said to have the potential of improving the monitoring of patients’ health conditions, increasing the access to healthcare service providers, and allows for quicker healthcare discussion and diagnosis (Farmer et al., 2013). According to Latif et al. (2017), e-Health adoption may save physicians and patients’ money and time, as patients do not need to take lengthy distances to provide or receive health care services. Moreover, e-Health adoption can allow underprivileged rural hospitals to share human resources and equipment with well-equipped hospitals (Mathur et al., 2019). Healthcare practitioners’ involvement in e-Health

activities increases and improves communication with the patients and strengthens patient-practitioner relationship. Additionally, e-Health encourages patients to be more involved in their self-care and self-management and that in turn improves patient compliance to treatment routines (Haugeneder, 2016). Qureshi et al. (2015), also noted that E-Health is capable of enhancing the healthcare practitioner's productivity by increasing efficiencies in gaining patient information, storage of the information and as well lower administrative burden. In addition e-Health may also assist to reduce instances of medically unnecessary adverse effects through the continuing education and monitoring of healthcare practitioner's adherence to best practices.

## **2.4 State of public health in South Africa**

Barron & Padarath (2019) describes the health system in South Africa as a pluralistic system, consisting of partially privatized and partially socialized healthcare. They continue to report that the comparatively broad public health system overwhelmingly supports the black African population, with programs ranging from free primary health care (PHC) services to secondary and tertiary care available in state-owned hospitals, whereas the private sector provides world-class facilities for the covered minority or others who can afford out-of-pocket care. Although the public sector is responsible for the well-being of the majority of the population, most of the resources are concentrated in the private health sector, which consumes 55-60 per cent of the total health care budget but caters to less than 15 per cent of the population (Dramowski & Whitelaw, 2017). The public health sector is largely dependent on general tax revenues, which are estimated to consume about 11 per cent of the government budget, allocated and spent by the nine provinces of South Africa on the basis of their needs and priorities. However, the quality of care depends to a large extent on the budget allocated to individual districts and provinces (Dramowski & Whitelaw, 2017). Cash strapped provinces such as Eastern Cape and Limpopo face greater health challenges with fewer resources and higher levels of poverty than richer provinces like Western Cape or Gauteng.

### **2.4.1 Challenges facing the public health sector in South Africa**

Dunjwa (2020) argues that there is clear evidence that diverse problems affecting healthcare systems have affected the quality of health care in South Africa. Improving quality treatment means less mistakes, decreased gaps in delivery of care, better performance, greater market share and lower costs (Kama, 2019). The deterioration in quality health care has contributed to a lack of public interest in the health care system in South Africa. Quality health care delivery

is a statutory requirement in South Africa (Kama, 2019). The South African government has also launched various innovations and initiatives aimed at enhancing the effectiveness, protection and quality of delivery of health care for all users (Kama, 2019). Kama (2019) further expresses that significant reforms in health policies and regulation have been introduced to ensure compliance in the delivery of quality care. Despite a range of commendable targets set by the Government of South Africa to increase the level of service delivery in healthcare environments, media reports and community studies in 2013 showed that services in public health facilities did not meet minimum levels of treatment and patient needs (National Department of Health 2016). This has contributed to a lack of general interest in the healthcare system (Regchand, 2019). Regchand (2019) describe the healthcare system in South Africa as one that needs serious improvements to meet the needs of the public interest. While equity is at the top of the South African government's agenda in the democratic period, nothing has been done to reallocate money from private to public health (Kollapen et al., 2017). This has led to delays in the implementation of the National Health Insurance (NHI) policy.

The continuous deteriorating infrastructure in SA has compelled the need for the South African government to develop infrastructure in rural communities where some primary healthcare centres lack basic facilities. This is a strong indication that the public health system is overburdened and incapable of delivering good quality care (Kollapen et al, 2017). Kama (2019) points out that Bad record keeping creates undue complications for patients. Perhaps the patient directories are absent or misplaced, and instead of the healthcare professionals communicating this to the patient, they just make the patient wait (Kama 2019). In a few cases, the patient's medical history is lost, which can lead to additional complications leading to erroneous diagnosis and, in some cases, to the death of the patient (Kama 2017). As reported by Regchand (2019), the Pietermaritzburg High Court directed a district hospital in KwaZulu-Natal to hand over medical documents to the patient's counsel in a case in which the patient had delivered a set of twins in the hospital in July 2006, reportedly losing one of the twins when the remaining twin had cerebral palsy due to hospital neglect (Regchand 2019).

## **2.5 State of ICT adoption in South Africa**

Adopting information and communication technologies (ICTs) has contributed to the nation's economic development (Mokoena, 2017). Literature shows that as the use of technology declines, so does per capita income, skills development and productivity. Mokoena, (2017) further reports that the adoption of ICT in South Africa has characteristics of both the First World and Third World. As South Africa faces a double-edged challenge of establishing its

competitive position in the global market while at the same time addressing the internal problems created by the legacy of apartheid, governments and economists continue to look to ICT to ensure better service delivery, skills development, improved productivity and economic growth. Kilonzo & Ikamari (2015) reported that while some positive outcomes of ICT initiatives have been achieved, ICT adoption has typically been slow in some areas of the economy and some ICT policy decisions are regarded to have failed.

Many factors affecting the adoption of ICT have been identified in the literature. These tend to be studied in isolation, and, as such, the key determinants are not well established in South Africa. Similar problems exist in studies done in other countries where different determinants of ICT adoption have been highlighted. Studies on e-business adoption, for example, emphasize stable economic systems or the environment (Kilonzo & Ikamari, 2018). Others argue that availability of relevant infrastructure is a key determinant of ICT adoption (Regchand, 2019). Furthermore, some authors stated that cultural issues and high levels of entrepreneurship are major drivers of ICT adoption. Although there is no question that human, social, economic, political and other factors have an effect on ICT adoption, the relevance of these factors must be identified in developed nations (Regchand, 2019). Understanding the relative influence of these factors is particularly important for policy direction and for the proper allocation of limited resources in developing countries such as South Africa. Kama (2019) argue that most of the important studies describe three sets of variables that influence the acceptance of technology. This include, capacity to follow and use ICT, exposure and state policies. Kama (2019) noted that the ICT sector has proven to be the backbone of many developing and developed economies. With that realization, many companies in the past five years have been making a lot of investment into the sector, from new Internet Service Providers (ISP's) to postal services companies and Television and radio broadcasters. However Kama (2019) in his study noted that the sector need to adapt to Fourth Industrial Revolution (4IR) which offers a transformation that triggers new business models.

## **2.6 State of E-Health Implementation in South Africa**

Winchester and King (2018) reports that several fields for developing e-Health foundations have fallen behind schedule and need rapid delivery. Although the national master index for specific patient identity has not been completely introduced in the public sector, In 2012, an important policy decision was made by NDoH 22 saHr 2013/14 that the South African Identification Number should be the default identifier for all information systems, and written correspondence to that effect was sent to all nine provincial health departments. Winchester

and King (2018) continue to clarify that the successful application of this directive requires greater commitment at the sub-national level of the health system. Ensuring broadband access and last mile connectivity remains a key problem, especially in primary health care facilities and rural areas. They were scheduled to be finished by May 2013. However, Telkom's quote for access to all primary health clinics in need of this resource amounted to more than R500 million nationwide. Cost estimates from Sentech, a state-owned corporation founded under the Sentech Act (63 of 1996), amounted to more than R700 million. It is extremely probable that the main impediment to this work was more connected to the shortage of networking infrastructure in the health sector than to the exorbitant service charges charged by the two firms. Winchester and King (2018) stated that cooperation and cost sharing with other government agencies are required to address these networking challenges. For example, as soon as the appropriate infrastructure has been built in a local area, many other government agencies, aside from the health sector, would benefit. The introduction of the Basic National Electronic Health Record (EHR), including an exchange of information to promote interoperability, was planned to be completed by May 2013. The work conducted by the CSIR provides a significant basis for the design of the basic EHR and the piloting of the concept in health facilities across districts (Winchester & King 2018).

Booty and Ansell (2019) stated that there are two systems that have been implemented at the Pretoria clinic. The first is a primary EHR system and the second is the m-health care system used for community healthcare staff. Interconnectivity and thus specifications were a crucial factor in their architecture. As the literature indicates, South Africa has a host of diverse structures, most of which hinder interoperability (Department of Health 2016). The Department of Health has tasked the Council for Scientific and Industrial Research (CSIR) to develop the required standards, but, as at the time of writing this statement, these have not yet been published. The EHR system was deployed in private healthcare institutions and more than eight hundred (800) medical practices and will also promote interoperability with the private sector (Booty & Ansell, 2019). The concern, however, is that even within the private sector, such interoperability continues to fall within the limits of financial information transfer, which is essentially used to make claims to medical assistance. The vendors of the two systems therefore needed to modify their systems to ensure interoperability. Booty and Ansell (2019) further stated that the director of the EHR system provider indicated that "third generation" source code had been used in the development of the applications, specifically C# (C Sharp) and the Microsoft Studios environment. The programs have been configured to promote the use of the

systems by end users. However, the end user will need to be qualified in the use of the application as part of the change control process, an element to be discussed in the issuing section. The identification of patients and medical practitioners was a significant factor in the systems design. This has a huge effect in terms of management and confidentiality of information. In several South African healthcare facilities, the paper-based patient health record system continues to be used in combination with the EHR system. The patient files are assigned a specific file number that is cross-referenced to the patient's national identification number and name. The file number is used as a key identification element in the EHR system (Booty & Ansell 2019).

Alami, Gagnon and Fortin (2017) stated that the difficulty associated with the EHR system is the need to capture all the legacy information and on-going information that is still generated in the system. Alami, Gagnon and Fortin (2017) describe data capture as the transfer of paper-based information into an electronic system. Literature suggests that in the introduction of the m-health services to be used by community health professionals, touch screen mobile phones and portable computers provided the foundation for the processing and transmission of patient/community information to the EHR system. The information to be obtained by health care staff during home-to-home visits to the group was predetermined by medical professionals at the clinic (Alami, Gagnon and Fortin, 2017).

National Department of Health (2016) reported that International history shows that, amid the presence of goodwill and dedication, the production and adoption of eHealth has created crucial obstacles for a number of countries. In South Africa, these problems have been illustrated by the inability to introduce a hospital information system in the province of Limpopo. The initiative started in 1998 with the goal of installing the system in all 42 hospitals in the province (NDH, 2016). The overall cost of the project was R134 million, which at the time accounted for 2.5 per cent of Limpopo's annual health and welfare budget. Problems with the implementation were faced immediately after the launch of the project, and when the original contract for the work expired in 2000, the system did not work as expected. NDH (2016) continue to report that a second contract was entered into with another provider and this work too failed to achieve the goals of the project. Subsequent analysis by Manyisa and Aswegen(2016) identified key factors for the failure of the project, including a lack of basic facilities, such as reliable power and air conditioning, a bad match between system configuration and day-to-day workflow requirements, and insufficient project management. Manyisa and Aswegen (2016) concluded the report by indicating that the Limpopo case study

highlighted critical factors that should be addressed as countries or provinces adopt health information systems in which the author also described the depth of maintaining adequate change management that recognizes the effect of health information systems on complicated business processes.

## **2.7 State of e-Health Implementation in Africa and other developing countries**

World Health Organisation (2016) noted that the principles of sustainable development (SDGs) are optimistic, universal and accessible to all nations. These priorities cover the most contemporary development issues which are based on the values of justice (leave no one behind), equal rights, transparency and sustainability. The same values underpin public health work and are essential to the current push toward universal health coverage (UHC), the third SDG's umbrella goal. UHC ensures that both people and families are provided with the health care they deserve, of high quality and without enduring financial distress. WHO (2016) agrees that the promotion of the achievement of the SDG3 is a priority. However, there are many barriers to achieving UHC in Africa, including but not limited to the high operating and financial costs required to extend connectivity to many areas where there is no existing access, while retaining a reasonable standard of service quality. Such obstacles include pervasively weak health services, insufficient physical connectivity to a variety of areas due to rough geography and vulnerability, limited housing, travel and socio-cultural barriers. WHO (2016) proceeds to state that existing care delivery approaches do not offer full health coverage because of these impediments. Innovative ways to delivering care that can guarantee universal delivery of essential services are also required in the current social and economic climate. Konduri et al (2018) stated that Digital Health (DH) has achieved a great deal of global momentum as a breakthrough driver to overcome the complexities of e-Health Adoption and the leapfrog achievement of SDGs and UHC. Subsequently, many DH programs and pilot projects have been successfully initiated in several African countries.

Da et al. (2015), carried an investigation to study hurdles and challenges of e-Health implementation in developing countries, using Asian and South American countries as the case study. The findings of their investigation revealed that there are cultural and educational issues affecting e-Health implementation in developing countries. Similarly, Aranda-Jan et al. (2014), investigated how Kenyan public hospitals were adapting to e-Health systems implementation. They discovered several challenges to e-Health implementation, which includes the lack of ICT infrastructure, computer skills, and excessive cost of computer equipment and Internet. Similarly, Khan (2019), studied infrastructural barriers to e-Health implementation in Pakistan.

This study showed that ICT infrastructure plays a very important role in e-Health implementation. Furthermore, Khan (2019), found that the lack of Internet access and less adequate technologies devices to support the implementation of e-Health systems are the challenges in developing countries. There are studies on e-Health implementation in developing countries, these studies rarely provide an in-depth explanation to the reasons of the factors that influence adoption, but rather focus on explaining the use of e-Health systems by healthcare specialists. Insufficient knowledge of the socio-technical sides of technology, mostly on how organizations adopt new technologies is one of the main reasons resulting in the failure of most IT implementation projects (Kilsdonk et al., 2017) . According to Zhang et al. (2015), having a knowledge of the socio-technical factors that affect how healthcare professionals and patients accept and use e-Health, enables more effective implementation and increases adoption. However, Oesterreich and Teuteberg (2019) believes that research in this area is still needed for the success of e-Health systems implementation.

### **2.7.1 Digital Infrastructure**

According to Shuvo *et al* (2015), Digital Infrastructure enables the creation, provision, usage and distribution of digital systems (products and services). That include telephone, fixed and cellular networks, including cable and high-speed networks, terrestrial fibre networks and smart devices. The cornerstone pillar also looks at inexpensive computers and digital platforms. Shuvo et al (2015) continue to express that affordable, open and secure technology is the basis for an equitable digital transition. Several studies have shown that broadband coverage and broadband efficiency are essential drivers for economic development. According to the World Bank report, every 10 percent rise in broadband penetration in low-and middle-income countries is expected to result in a commensurate increase of 1.38 percent of GDP<sup>3</sup>. Literature further shows the economic effect of broadband expansion directly by employment generated by the deployment of broadband networks and indirectly by 'spill-over' externalities, such as improved efficiency and new goods and services through rapid innovation. The Internet penetration in Africa is projected to be 36% or 473 million users online. Despite existing technology problems, an additional 300 million users are expected to be online by 2025. For the gain of digital transformation, therefore, plentiful, low-cost connectivity is important, as it is generally recognized that broadband fuels competitiveness, innovation and growth. According to McVeigh (2018) digital platforms are now an integral part of digital technology which can support individuals, enterprises and government departments in all facets of life, including health care, education, trade, transport and public benefits. For governments, digital

platforms can enhance the quality and efficacy of core functions and facilities, eliminate needless duplication of processes, fight bribery and corruption by increasing protection and traceability of transactions, and improve public participation and transparency. Commercial platforms are an important tool for helping businesses, particularly small and medium-sized companies, expand access to markets, trade goods and services, and tap into underutilized assets and human capital, eventually contributing to more and better employment in the economy (McVeigh, 2018).

### **2.7.2 Digital skills & human capacity**

According to, Dhaliwal (2018), a variety of preconditions must be fulfilled for Africa to realize the much-desired digital transition and to be a globally competitive continent. The major precondition is the investment in and cultivation of highly qualified individuals, as producers, consumers and innovators of emerging technology. Investing in citizens' technical skills underpinned by both technical and human resources is the most robust approach for the future. Dhaliwal (2018) stated that a critical mass of professional workers who can efficiently learn and incorporate new technical innovations and their sophisticated penetration into every part of social, economic and political structures is required. Similarly, as active members in the digital ecosystem, people must have technology skills to adopt and use digital innovation in their everyday lives. Emerging technologies need steps to continue developing people's digital capabilities not only as customers but also as individuals. Collective digital capability at the individual, organizational and sectoral level is considered crucial to sustainably capitalizing on home-grown and adaptive technical advances (Dhaliwal, 2018).

Pillay and Motsoaledi (2018) noted that with the development of the digital economy and the exploitation of labor-saving technology, African countries will need skilled people that complement these technologies to allow new opportunities to emerge. In the light of this, any capacity-building initiative to digitize African society must be people-centred, locally owned, intentional and strategically structured to enable individuals, organisations and society as a whole, to activate, improve, grow, evolve and sustain capacity over time. Such a comprehensive approach to digital capability growth facilitates the ongoing development of the necessary digital skills and competencies and supporting environments. Pillay and Motsoaledi (2018) noted that education is a widely recognized fundamental human right that plays a vital role in deciding society's ability to succeed and flourish in the digital world. The skill-focused education system creates the requisite number, form and standard of the population to build and implement digital solutions, while the use of digital technology further

facilitates and constantly reshapes instructional curricula, implementation and management processes at all levels—from pre-primary to tertiary and lifelong learning. As a result, curriculum programs need to be scalable, comprehensive, proactive and in touch with the development of a new kind of workforce that can quickly and constantly develop and learn from a wide variety of complex skills and competencies available in the ever-changing modern environment (Pillay & Motsoaledi, 2018).

## **2.8. Socio-Technical Factors in E-Health Implementation**

In spite of the potential benefits and the number of e-Health initiatives in place, current studies show that the adoption of this service remains insignificant in many developing countries. In a study done by Sharifian et al. (2014) which aimed to examine the factors affecting hospital information system's nurse-user acceptance of HISs, it was suggested that nurse's acceptance of HISs was strongly influenced by Performance Expectancy (PE - the level to which individual(s) believes that using the e-health system will help them to improve their job performance). Also the study to investigate the factors that influences the healthcare information technology services in Thailand by Vassanadumrongdee and Kittipongvises (2018) found PE to have a significant effect on user's intention to use e-Health. Quaosar et al. (2018), proposed that users' intention to use mobile health services is strongly determined by PE. In alignment with this study, Bawack and Kamdjoug (2018) conducted a systematic literature review to investigate whether the UTAUT framework can be used to study mobile health adoption among clinicians. The review showed that the PE was largely linked with the actual use and adoption intention of the e-Health among healthcare professionals. Shiferaw and Mehari (2019), also identified effort expectancy (EE - the level of ease linked with the use of e-Health system) as a contributory factor to the adoption of eHealth systems. They also found that the effect of EE was more significance for older women. In contrast to these findings, a study by Quaosar et al. (2018), found that PE did not have a significance impact on the Thai's elderly intention to use smartphone devices for e-Health services. In order to obtain a better understanding of eHealth adoption in South Africa, there is a need to contextualise eHealth adoption behaviour according to technology acceptance variables such as PE and EE.

The study by Zhao et al. (2018b) to examine human motivations factors for on their decisions to adopt smartphone among medical doctors and nurses, found that their perception towards the adoption of smartphones for healthcare services was largely influenced by Perceived Usefulness. Similarly Ifinedo and management (2018) it was observed that that nurses Perception of Usefulness is the key factor that influenced their decisions to adopt mobile

technology, having image and subjective norm within the healthcare organization as important antecedents. However, Garavand et al. (2016) found that Perceived Usefulness was not significant factor affecting clinician's adoption of health IT. Having such differences necessitate the need to or compel the need to examine Perceived Usefulness of a particular e-Health service when implementing e-Health programs.

Several studies on e-Health implementation have examined the effect of Extrinsic Motivation and found it to be significant factor for successful implementation of technologies such as e-Health (Atinga et al., 2020;Hossain et al., 2019;Zayyad & Toycan, 2018). However Singh et al. (2018) argued that the existing body of knowledge does not well determine the roles of extrinsic motivators in the technology adoption process. Similarly, Yu et al. (2017) in their study which investigated factors influencing information communication technology adoption behaviour, found that extrinsic motivators was not significant in explaining adoption of technology by healthcare professionals. It is therefore important that the research be conducted to validate these findings within South African context.

A number of studies have shown that Effort Expectancy may have a significance influence on user's intention to use e-Health when it has been adopted. Of these studies was a field study done by Enaizan et al. (2020) to examine the physicians' acceptance of a pharmacokinetics-based clinical decision support system, the results of this study indicated that effort expectancy have major impact on physicians' intention to use the clinical decision support system. Garavand et al. (2016) study which investigated the factors that influences the health information technology adoption in Thailand's community health centres, also showed that effort expectancy was a significant influence on user's intention to use health information technology. However, a case study by Olorunfemi et al. (2020) which investigated the user's acceptance of Telemedicine in the public health care system in Nigeria, found that the effort expectancy have statistical insignificance towards the healthcare worker's intension to use Telemedicine for the areas in which the facility was located. Hoque and Sorwar (2017) find similar result on the study to examine the factors influencing health information systems acceptance amongst five healthcare professionals in Canada, the result of this study also confirmed that effort expectance has a less influence on healthcare professional's intension to use health information systems. Thus, there is a need for a research in this area.

Hoque and Sorwar (2017) applied the UTAUT model to investigate the factors that affect the physicians adoption of Electronic Medical Record (ERM) and discovered Effort Expectancy to have a positive influence on their intention to adopt ERM, they further suggested that physicians' effort expectancy is not only influenced by the ease of use of the EMR, but the effort required to integrate EMRs into current work processes. Cajita et al. (2018) stated that poor usability is one of the obstacles to the clinician's intension to use the health technology. According to Evans (2016) issues associated with usability of Electronic Healthcare Record (EHR) were non-intuitive data input, speed of data retrieval, slow login time, and inability to interact with the system while moving through the hospital. In responding to the effort required to integrate EHRs with existing work process problem, Downing et al. (2018) called for the need to develop better input interface so that work process changes would not increase the physician's effort required to use the new system. Hence issues concerning Effort Expectance need to be given attention when implanting e-health programs as they may cause barriers towards usage of the e-health services.

Although a number of studies have find effort expectancy to have positive influence on user's intension to use e-Health services, a very few number of the literature have shown the opposite (e.g. effort expectancy have no significance or no direct impact on user's intension to use e-health services). Sayi (2016) applied the UTAUT model to examine the context of the Certified e-Document Authority (CeDA) service used in the Republic of Korea, and found the effort expectancy to have less significance to user's intention to use Certified e-Document Authority services. Although the significance of this construct may be less than that of Perceived Usefulness, but if not taken into consideration when assessing the human factors that affect user's acceptance of technology, it may result into serious consequence affecting the adoption of e-Health in public hospitals.

A longitudinal study by Oyibo and Vassileva (2019) to investigate the influence of outcome expectations on computer usage found that outcome expectations had an influence on user's affective usage of information technology. Similarly Kwahk et al. (2018) study showed the same results as the previous longitudinal study, and further pointed that while Outcome Expectations-Performance was said to be positive influenced by computer self-efficacy, Personal outcome expectations were found to be influenced by the social influence. Although Ifinedo (2017) results showed that Outcome Expectations had positive influence towards technology usage, an individual Personal outcome expectations were found to have negative influence on usage of technology. These results from above studies may also have a significant

impact on e-Health adoption in public hospitals as healthcare professionals seeks to improve at their job performance to gain promotions as well as to improve the service offered to patients through the use of e-Health.

Sidek and Martins (2017) stated that physicians who have limited IT expertise could get frustrated by the limited user friendliness and complexity of the Electronic Health System software, but argue that intuitive software design may directly influence their intention to use EHS. (Garavand et al., 2016) study also found that Perceived Ease of Use was significant on the clinician's adoption of mobile technology. Similarly (Zhao et al., 2018b), indicated that Perceived Ease of Use has significant effect on the healthcare professional intention to adopt a smartphone for e-health service. However, it is not clear from the literature on which between Perceive Usefulness or Perceived Ease of Use has a stronger influence on user's intention to use and adopt e-Health services (Alsswey & Al-Samarraie, 2020).

A study by Cooke et al. (2018) showed that physicians' impression that the devices are hard to use in healthcare practice is a barrier slightly difficult to overcome. However Grünloh et al. (2018) indicated the similar argument that while physicians sometimes get comfortable with paper based system (as perceived as less complication, easier, and more used to it), they were found to prefer Personal Digital Assistance more to perform their healthcare practice because of the technology's relative advantages. Although less emphasis was given in the literature on this construct, it seems as if it contains less significant impact towards user's adoption of e-Health. (Benetoli et al., 2018) said that the Social Influence on healthcare practitioners does not only come from their peer's perceptions, but may be the result of how the patients perceive their usage of mobile technology for healthcare services.

Boontarig et al. (2012) stated that the social influence has direct influence on the Thailand elderly intention to use smartphone for e-Health services. Their argument was that since elderly people are less familiar with smartphones, individuals that they consider important to them such as family, friends or colleagues may have strong influence on elderly intension to use e-Health services for healthier lifestyle. However, the results from their study found that social influence was not a significant indicator of the elderly's intention to use smartphones for e-Health services. Similarly, Grout et al. (2018) found that the impact of social influence on user's intention to use Clinical Decision Support System (CDSS) was less significant than that of performance expectance and effort expectance. The reasons for these results were that the existence of the CDSS is not long enough for social influences from peers around the

participants to be significant, and the physician's personality (in general, professional healthcare workers who are well educated are more self-confidence and self-autonomy than others. They may have less willingness to commit themselves to social pressure). The impact Social Influence seems to have less influence on user's intention to use e-Health services. However, a study conducted by El-Kassem et al. (2020) to explore the adoption and usage of e-government services in Qatar provinces, indicated that there is strong positive relationship between social influence and user intention to use e-government services for the citizens of Qatar. Although Kurfalı et al. (2017) indicated that while the Performance Expectance and Facilitating Conditions were found to have strongest influence on user adoption and the actual usage of m-Health, it was also found that the Social influence may have impact on the user's intention to use e-Health. In overall e-Health adopters should examine the impact of this construct on user's intention to use e-Health as social settings plays an important role on individual's choices to perform actions or use any type of technology.

A study by (Roy & Management, 2017) found Subjective Norm to have a significance effect as precursor constructs to perceived usefulness in the extended TAM mode. However, a number of studies that have applied UTUAT model to study e-Health adoption did not found any impact of this construct on user's intention to adopt e-Health (Mourad, 2012;Nuq & Aubert, 2013;Sharifian et al., 2014). Also, a researcher's view on the literature studied which applied UTAUT to address issues of e-Health adoption found that it seems as that the current literature does not contain clear evidence about the effect of this construct on user's intention to adopt e-Health.

According to Venkatesh et al. (2012a), the user's perception of resource (financial and technical resources, support and training) availability may have influence on healthcare professional's or patient's decision to use or reject technology. Also, Sichone (2017) study found facilitating conditions to have direct influence to user's adoption of technology. In healthcare this means that healthcare professionals and patient's perception to adopt e-Health services will be strongly influenced by their perception of whether the hospitals have enough technical infrastructures and that programs to provide training and technical support will be available to support the e-Health program. In addition, Hossain et al. (2019), identified the facilitating conditions as most significant factors that affected healthcare professionals to adopt Electronic Medical Record. Similarly, a study by Bawack and Kamdjoug (2018) also showed that facilitating conditions had positive significance on Thailand's citizens to adopt health information technology. Another study that indicated this effect, was the study by Zhao et al.

(2018b) which showed that facilitating conditions was second most significance variable to influence the Thai elderly's perception to adopt smartphone use for e-Health services. Mohammed et al. (2018) showed that facilitating conditions are highly associated with the adoption of the technology among healthcare professionals. Hence it is shown that Facilitating Conditions are crucial towards the adoption of e-Health and therefore a study is needed to proper address this construct for successful adoption of e-Health in South Africa.

Rathert et al. (2017) study showed the importance of Perceived Behavioral Control over the healthcare technology among physicians, where by doctors expressed concern about security and reliability of the PDAs, and stating they were concerned about “dependency on the device as a substitute for clinical thinking”. Similarly Deng et al. (2018) found that Perceived Behavioral Control significantly predicted 45% of the variation in clinician intent to adopt a mobile technology. However Balapour et al. (2019) stated that healthcare professionals' interest to adopt the healthcare system does rely not only on their own self-efficacy, but also the perception of how much an organization is self-efficient and is able to offer with technical capabilities. Hence it is important to look at the construct from the two points of view, which are users and the healthcare organization itself, currently very little studies that have validated the effect of Perceived Behavioral Control for successful implementation of e-Health in South Africa.

A study by Tsai et al. (2019) found that there is a strong effect of compatibility on healthcare professional intention to adopt healthcare technology. Also Fox and Connolly (2018) study indicated that physician's concern towards adoption of mobile health was data security issues, which doctors indicated as the major barrier for adopting healthcare technologies. Bruno et al. (2018) indicated that a lot of healthcare professionals were more concerned with the need to integrate multiple healthcare systems and services within the organizations and practices to deliver an integrated solution which aligns with the tasks and information-loaded nature of healthcare professionals work. Similarly Ash et al. (2020) study showed that nurses indicated a lack of cultural fit between the health information system and their work, stating that they were not ready to change or adapt their on-site activities to integrate the health information system into their work. Thus, an important factor that must be studied when implementing e-Health systems.

## **2.9. Research Framework**

### **2.9.1. Technology Adoption Theoretical Models**

Over the years, studies that focused on technological adoption, as well as factors associated with user intention to use technology, have produced numerous competing models. Examples of such models include; the Theory of Reasoned Action (TRA) (Littlejohns et al., 2003), the Technology Acceptance Model (TAM) (Aarts & Gorman, 2007), the Motivational Model (MM) (Haux et al., 2013), the Theory of Planned Behaviour (TPB) (Häyrynen et al., 2008), the Combined TAM and TPB (C-TAM-TPB) (Detmer et al., 2003), the Model of PC Utilization (MPCU) (Williams et al., 2011), the Innovation Diffusion Theory (IDT) (Venkatesh et al., 2011a), the Social Cognitive Theory (SCT) (Venkatesh et al., 2012b), the Extended Technology Acceptance Model (TAM2) (Aggelidis & Chatzoglou, 2009), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).

TRA is the most influential and fundamental theory of human behavior used to predict a number of behavioral factors for a user's acceptance of new technology (Venkatesh et al., 2003). TAM was developed to predict the acceptance and usage of new information technology on the job (Aarts & Gorman, 2007). It suggests that Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are the two crucial factors used in explaining users' intent to adopt and use technology (Aarts & Gorman, 2007). Aggelidis and Chatzoglou (2009) extended TAM to form TAM2 by adding subjective norm as an extra predictor of users' intention, in the case of mandatory situations. In Motivational Model, Haux et al. (2013) regarded Extrinsic Motivation as an explanation of behaviour. The authors defined Extrinsic Motivation as "the perception that users will want to perform an activity". The model has been used to explain users' intention to adopt and use new technology (Welman & Kruger, 2001; Cooper et al., 2006). Theory of Planned Behavior extended TRA by including perceived behavioural control as an additional determinant of intention and behavior (Häyrynen et al., 2008). Several studies have employed TPB to understand users' acceptance and usage of new technologies (Kothari, 2004; Braun & Clarke, 2006; Vaismoradi et al., 2013). C-TAM-TPB provides a hybrid model by combining perceived usefulness from TAM with predictors from TPB (Detmer et al., 2003).

Derived from the Theory of Human Behavior, MPCU predicts usage behavior of new technology, rather than intention (Williams et al., 2011). IDT suggests seven predictors as the determinant rate of adoption of a new technology namely, relative advantage - "the degree to which an innovation is perceived as being better than its precursor", ease of use - "the degree to which an innovation is perceived as being difficult to use", image - "the degree to which use

of an innovation is perceived to enhance one's image or status in one's social system", compatibility – "the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters", visibility – "the degree to which one can see others using the system in the organization", results demonstrability – "the tangibility of the results of using the innovation, including their observability and communicability", and voluntariness of use – "the degree to which use of the innovation is perceived as being voluntary, or of free will" (Venkatesh et al., 2011a, p. 195). Social Cognitive Theory has five core constructs (outcome expectations-performance, outcome expectations-personal, self-efficacy, affect, and anxiety) and uses usage behavior as a dependent variable to predict individuals intention to use new technology (Venkatesh et al., 2012b).

### **2.9.2 The Unified Theory of Acceptance and Use of Technology (UTAUT)**

By making use of the Unified Theory of Acceptance and Use of Technology (UTAUT) theoretical model by Venkatesh et al. (2003), this study explores the predictors of individuals' (healthcare professionals) intentions to adopt and use e-Health systems in South African public hospitals, particularly at Edendale Hospital, Pietermaritzburg. The model resulted from the unification of eight prominent technology use and acceptance models (Venkatesh et al., 2003). The UTAUT is based on the investigation of new technology usage and adopted by users (Venkatesh et al., 2003). The UTAUT has two key dependent variables; Behavioural intention and Usage behaviour. The model has four key determinants of behavioural intention regarding people using new technology (Performance Expectancy, Effort Expectancy, Facilitating Conditions and Social Influence), with four moderators (voluntariness, experience, gender, and age) (See figure 1) (Venkatesh et al., 2003).

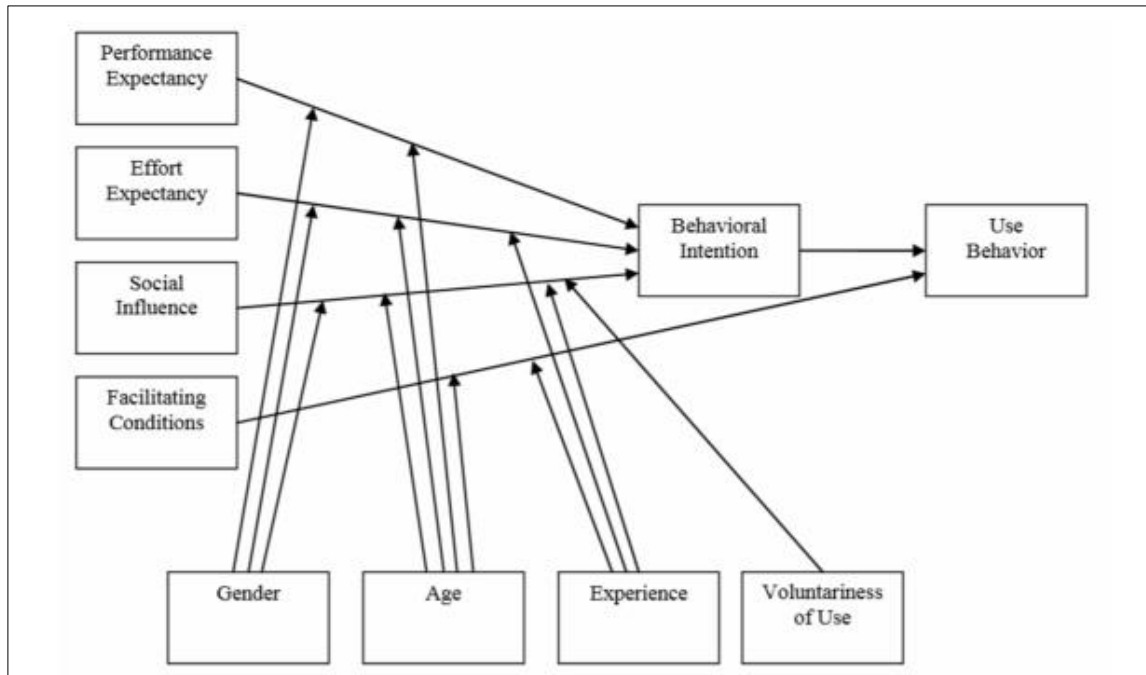


Figure 2.1: UTAUT model (Venkatesh et al., 2003.)

Behavioural Intention (BI) is defined as “the degree to which a person has formulated conscious plans to perform or not perform some specified future behaviour” (Ross et al., 2016a, p. 214). Usage Behaviour (UB) is “the actually observed and measured usage, for example, frequency and duration of the usage” (HealthIT, 2013, p. 218). According to Venkatesh et al. (2003, p. 447), Performance Expectancy (PE), can be described as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance”. Effort Expectancy (EE) is considered to be “the degree of ease associated with the use of the system” (Venkatesh et al., 2003, p. 447). The Social Influence (SI) is defined as “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh et al., 2003, p. 451). The last of the four determinants is Facilitating Conditions, defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system” (Venkatesh et al., 2003, p. 453).

### 2.9.3 Application of UTAUT in the current study

The UTAUT model aims to explain users’ intention to use an information system and their subsequent usage behaviour. The theory identifies four constructs that are direct determinants of usage intention. They are performance expectancy, effort expectancy, social influence and facilitating conditions (Venkatesh, et al., 2003). The UTAUT model integrates eight major theories, theory of reasoned action (TRA), theory of planned behaviour (TPB), technology

acceptance model (TAM), Innovation diffusion theory (IDT), the social cognitive theory (SCT), the motivational model (MM), the model of PC utilisation and a combined model of TAM and TPB into one unified theory, with the aim to use them as the main dependent variables (Venkatesh et al, 2003). Since its introduction, the UTAUT model has attracted researchers' attention, and has recently been tested and applied to several technologies for both individual and organisational use (Im & Kang, 2011). The application of the constructs of the UTAUT model to this study is explained below:

### **2.9.3.1 Performance Expectancy**

Performance expectancy refers to the extent to which a person perceives that using a device can enable him or her to obtain a benefit in job performance. (Venkatesh et al., 2003). In this study, it is the degree to which healthcare staff believe that the use of e-Health systems will enable them to attain improved productivity and subsequently, quality service. Based on the UTAUT model, performance expectancy has a direct relevance to the adoption and use of e-health systems for improved service delivery. Therefore, if a healthcare staff perceives that the use of e-health will positively enhance the health services delivered, they may be favourably disposed to using it. "The influence of performance expectancy on behavioural intention will be moderated by gender and age, such that the effect will be stronger for men and particularly for younger men" (Venkatesh et al., 2003, p. 450).

### **2.9.3.2 Effort Expectancy**

Effort expectancy is aimed to measure the level of ease-of-use associated with information technology. Venkatesh et al. (2003) viewed effort expectancy as the degree of ease associated with the use of an information system. Effort expectancy is based on the idea that there are relationships between the effort put forth at work, the performance achieved from that effort, and the rewards received from the effort (Ghalandari, 2012). For the purpose of this research, effort expectancy was deemed to have a direct link to the use of e-health for improved quality service delivery by healthcare professionals. This is because the use of e-health for improved quality service delivery by healthcare staff is likely to be influenced by how easy or complex it is to utilize the e-health systems within the shortest time possible. Hence, if healthcare staff realize that it is rather easier to use e-health systems for improved quality service delivery, than doing things manually (i.e. paper based administration), they may be inclined towards using the e-health systems. Furthermore, based on the literature (Lucas, 1981;Thong et al., 1996;Boonstra & Broekhuis, 2010), "the influence of effort expectancy on behavioural intention will be moderated by gender, age, and experience, such that the effect will be stronger

for women, particularly younger women, and particularly at early stages of experience” (Venkatesh et al., 2003, p. 450).

### **2.9.3.3 Social Influence**

Social influence is defined as the degree to which other people (family, friends, peers, etc.) will affect someone to use a new system (Venkatesh et al., 2003; Alraja, 2015; Carter et al., 2011; Irani et al., 2009). In this study, this construct was left out because regardless of the influence or opinions of friends, family or peers, if the management of public hospitals is committed to implementing and using e-health systems, the healthcare staff will have no other choice than to use the e-health systems. Moreover, Benetoli et al. (2018) stated that social influence regarding the use of mobile technology (e-Health) in healthcare services often results from patients’ perception of their own usage of the mobile technology. Since patients are not involved in this study, the social influence construct was left out and not investigated. Furthermore, according to the study by Grout *et al.* (2018), social influence can only be a factor that affects healthcare staff’s adoption of e-Health in a hospital if the e-Health system has been used once (and for a long time) in the hospital. This is not the case at the Edendale Hospital because the use of e-Health systems at this hospital is relatively new.

### **2.9.3.4 Facilitating Conditions**

Facilitating conditions as a construct in UTAUT refers to the extent to which an individual believes that there are available organizational and technical infrastructures to use a system (Ghalandari, 2012). Facilitating conditions are factors in an environment that make possible the use of e-health technologies for quality service delivery by healthcare staff. The effective use of e-health for quality service delivery by healthcare professionals hinges on the availability of organizational resources (human and materials) and appropriate technical infrastructure required for its optimum performance. This implies that the degree to which healthcare staff believe that organizational resources and technical infrastructure exist to support the effective use of e-health systems may determine if they will actually use the systems or not.

### **2.9.3.5 Behavioural Intention**

Behavioural intention refers to the extent to which someone has conscious plans to undertake or not undertake a specified task in the future (Davis, 1989). In this study, this construct was used to determine the willingness of healthcare staff to adopt and use e-health systems more frequently or in the future.

## **2.10. Chapter Summery**

This chapter presented literature on the benefits, challenges e-Health adoption in South Africa and globally. It was also established from studies reviewed that, even though e-Health provides numerous benefits which could assist to overcome some of the challenges faced by South African healthcare facilities, there are still major challenges to its adoption. Notable among the challenges is lack of IT knowledge and skills which were found to be the biggest challenges faced by healthcare professionals and patients in many developing countries. Despite the many impressive capabilities of ICTs as a method of improving services delivery, the healthcare sector in most developing countries is not yet fully benefiting from the supposed benefits of ICTs due to, amongst other issue, the lack of IT infrastructure, skilled personnel. The poor internet availability and high cost associated with internet access are also among the challenges that were identified in the literature review. The concluding part of the chapter presented the literature on e-Health implementation factors using key variables from UTAUT model to address barriers affecting the healthcare professionals and patient's adoption and usage of e-Health. The next chapter will aim to test the application of the UTAUT model to investigate challenges of adopting e-Health in South African public hospitals, particular at Edendale Hospital. It will also present and describe the research methodology that was used to attain the objectives of this research.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1. Introduction**

The previous chapter presented a literature review on different studies related to this research and discussed technology adoption theories. This chapter presents the research methodology used to achieve the objectives of this study. The research methodology forms an important part of any research study since the quality of the research outcomes is determined by the quality of data collection and other research methods employed. Hence, the main objective of this chapter is to explain the research design and methods used to underpin this study. Also, this chapter describes the data collection method (survey research), the research instrument used (questionnaires) and the sampling method employed (stratified random sampling). Furthermore, this chapter shows how the researcher ensured the validity and reliability of the data collected, as well as how ethical principles were upheld.

### **3.2 Research design**

To achieve the objectives of this study, the researcher adopted a descriptive research design. This type of research design is useful when a study involves describing the features of an already-known phenomenon (Bhattacharjee, 2012), in this case, e-Health. The literature already shows that e-Health is a phenomenon that is already known and has been studied. Thus, using a descriptive research design contributes towards shedding more light on this phenomenon. Furthermore, since the research intends to answer the “what” type of questions associated with e-Health, the descriptive research design suits (Shields & Rangarajan, 2013).

### **3.3 Research approach**

In this research, a quantitative approach was adopted. The quantitative approach deals with the collection of numerical data often useful and required while explaining a phenomenon (Skills, 2016). “This approach is used to quantify attitudes, opinions, behaviours and other defined variables, and generalize results from a larger sample population” (Wyse, 2011, p. 1). Furthermore, this study adopted the quantitative approach because it involves the investigation of relationships between variables (dependent and independent) (USC, 2016). By using this approach, it would be possible to generalise the results of this study.

### **3.4 Target population**

Bhattacharjee (2012) described population as all entities or artifacts (units of analysis) with the characteristics one wishes to analyze. The unit of analysis may be a person, community, agency, region, object, or some other entity that you want to draw scientific conclusions from. The target population of a study is usually obtained from the study site and it consists of the total number of individuals that could be surveyed. In order to qualify as a target population, a target population must contain individuals, units and people who meet a specific set of criteria which are beneficial to the research (Lavrakas, 2008).

For the purpose of the current study, the researcher opted to use the Edendale Hospital as the primary source of data collection. This choice is motivated by the researcher's knowledge of the use of an e-health system currently being implemented in that hospital. The Edendale Hospital is situated in the uMgungundlovu District, the 2<sup>nd</sup> most populous district in KwaZulu-Natal Province with a total population of approximately 1.4 million. The hospital was opened in 1954 and has a bed capacity of 900 and is currently the 4<sup>th</sup> largest hospital in the country. The participants in the study consists of medical Heads of Departments, nurses, doctors, administrators and pharmacists. The target population consisted of 893 professional staff members.

### **3.5 Sampling process**

Sampling is the statistical method of choosing a subset of a population of interest (also referred to as 'sample') for the purpose of drawing findings and statistical inferences about that population (Bhattacharjee, 2012). Sampling is broken into two categories; probability sampling and non-probability sampling (Bhattacharjee, 2012; Saunders et al., 2009). Probability sampling is also referred to as random sampling, because there is a fair probability of choosing any person in the population. Examples of probability sampling include simple random sampling, stratified sampling, cluster sampling and systematic sampling (Bhattacharjee, 2012). Non-probability sampling is a non-random sampling method which uses techniques that are based on a subjective analysis and that are non-statistical. Types of non-probability sampling include convenience sampling, quota sampling, expert sampling, purposive sampling and snowball sampling (Saunders et al., 2009). A sample can also be referred to as "a subgroup of a population" (Botan et al., 2000). By selecting a sample from a target population, it is possible for a researcher to generalise the results obtained from the sample, to the whole study population (Trochim, 2006b).

### **3.5.1 Sample size of this study**

The sample size used in this study was obtained based on the Krejcie and Morgan (1970) table for determining sample size from a given population. According to the Krejcie and Morgan (1970) table, the sample size required for a target population size between 850 and 899 is 265. Therefore, given that the size of the target population in this study was 893, the sample size used was 265.

### **3.5.2 Sampling techniques**

The research approach and objectives employed in a study determine the sampling technique to be applied in a study (Latham, 2007). The two major categories of sampling techniques are probability and non-probability sampling techniques. In probability sampling, all elements in the target population have an equal opportunity of being selected as the sample subjects (Creswell, 2013). However, non-probability sampling refers to a sampling technique where different sample subjects in the target population have unequal opportunity of being chosen, that is, elements are selected from the judgment of the researcher (Cooper et al., 2006). When factors such as time constraints and generalization of results are at stake, the probability sampling technique is considered most suitable (Bhattacharjee, 2012). The objective of this sampling technique was to enable the researcher to generalise the results of the study to the population of users of the e-health system at Edendale Hospital,

#### **Simple random sampling**

This has been identified as one of the most reliable methods when it comes to generalising a sample to an entire population (Sekaran & Bougie, 2016a). However, this method is usually most effective in a study with a small target population and when all the study participants are known upfront (Ormrod & Leedy, 2010). Therefore, for a large population like that of this study, it may be impracticable to use this method.

#### **Cluster sampling**

This method is used when the target population of a study is spread over a wide geographic region (Bhattacharjee, 2012). While using the cluster sampling method, the whole target population is sub-divided into smaller clusters, then random samples are obtained from each cluster (Ormrod & Leedy, 2010). In this study, the target population exists within the same location (Edendale hospital, Pietermaritzburg), hence this method was not used.

### **Systematic random sampling**

The systematic random sampling technique involves sorting the target population in a particular order or criterion, after which the participants are selected using regular intervals (Sekaran & Bougie, 2016a). The number of individuals in the target population is divided by the sample size required to obtain a sampling ratio (Trochim, 2006a; Bhattacharjee, 2012). This sampling ratio is then used to determine the regular intervals by which participants will be selected. This method was not employed in this study because it requires all participants to be present at the same time which may not be possible given the nature of the different health workers.

### **Stratified random sampling**

The stratified random sampling technique was employed in this study. In this technique, the target population is divided into smaller subgroups - strata (Sekaran & Bougie, 2016a). Afterwards, “a simple random sampling method” is carried out on each of the strata to obtain equal sub-samples from each stratum (Bhattacharjee, 2012). The researcher selected the stratified random sampling technique because the target population consisted of various units (professional staff members) that can be easily divided into different groups such as Heads of Departments, Nurses, Doctors, Administrators, Pharmacists (details are provided in Figure 4.2 in Chapter 4)). According to Pirzadeh et al. (2011), stratified sampling methods are “used to select sample from the target population, when the population on which sampling is applied is heterogeneous as a whole but can be divided into homogeneous sub-populations”.

## **3.6. Data collection**

In a descriptive research, the collection of data can be done by making use of four different types of designs. These are correlational study design, observational research design, developmental research design and survey research design (Ormrod & Leedy, 2010). In a correlational study design, two different variables are measured to determine if they are related (correlated). In developmental research design, the aim of this researcher is to collect data that relates to specific characteristics over an extended period. Such characteristics may include students, adults, children, workers etc. (Heffner, 2017). When a phenomenon or behaviour under study needs to be observed and quantified objectively, then an observational research design is employed. Whereas, in a survey research design, data is collected by asking questions directly from the study’s participants (Ormrod & Leedy, 2010). These answers are then presented in a format which is suitable for quantitative data analysis. Furthermore, the survey

research involves “the use of standardized questionnaires or interviews to collect data about people and their preferences, thoughts, and behaviours in a systematic manner” (Bhattacharjee, 2012). It is suitable when conclusion needs to be drawn about a target population, by using a sample of that population.

In this study, the survey research design was adopted because the researcher needed to use a representative sample to draw conclusions about a target population. Furthermore, the survey research design was adopted because it is suitable for research that which individual people serve as units of analysis (Bhattacharjee, 2012).

In a survey research, data may be collected in two ways – interview surveys and questionnaire surveys (Bhattacharjee, 2012). The choice depends on the type of data required in the study.

### **Survey - Interview**

“Survey interviews are a more personalized form of data collection method than questionnaires, and are conducted by interviewers, using the same research protocol as questionnaire surveys (i.e., a standardized set of questions)” (Bhattacharjee, 2012). Interviews may be unstructured or structured and can be conducted face-to-face, via telephone or in focus groups (Barribeau et al., 2012).

### **Survey – Questionnaire**

“A questionnaire is a research instrument consisting of a set of structured or unstructured questions (items) intended to capture responses from respondents in a standardized manner” (Bhattacharjee, 2012). In a structured questionnaire, there are a list of choices that a respondent may choose from. However, in an unstructured questionnaire, there is room for respondents to answer the questions in their own words. These questionnaires may be distributed via post, administered to a group or online (Barribeau et al., 2012). In this study, the researcher adopted the questionnaire survey method for data collection due to the busy nature of the healthcare professional workers.

Furthermore, questionnaires were considered as the most appropriate data collection tool for the current study for the following reasons:

- Firstly, questionnaires allow the researcher to investigate the research problem without the researcher’s interference with the way respondents answer the research questions.
- Secondly, due to time and financial constraints, the interview survey method was less suitable for the study.

According to Sekaran and Bougie (2016a), questionnaires may be distributed personally, by postal mail or electronically via websites or emails. Personally administered questionnaires are hand distributed questionnaires to the participants (Bowling, 2005). This method allows a researcher to collect the completed questionnaire in a short period of time. In addition, the researcher can clarify any misunderstanding that a respondent may have with the questions asked on the spot. Postal mail administered questionnaires are questionnaires mailed to respondents' postal addresses using postal mail (Bowling, 2005). This method may be suitable when research participants are scattered in various locations. However, postal mail questionnaires have a very low response rate (30%), and it is hard to warrant fair representation of the population in the sample (Sekaran & Bougie, 2016a). Electronic or web-based administered questionnaires are sent electronically by means of email or a link to a survey from which the respondents of the study can either download or complete online. Electronic questionnaires are usually administered easily and are not restricted by locations in terms of the sample size they can reach. However, this method might not be the best fit when respondents are not guaranteed to have Internet access or do not have email addresses (Hair, 2007).

Having considered the advantages and disadvantages of questionnaire distribution as discussed above, personally administered questionnaires were deemed appropriate for this study. This method of data collection was chosen for this study because of its convenience, ability to save time and money and as well as its high response rate compared to other methods.

### **3.7. Questionnaire design**

A formal structured survey questionnaire was used to collect data for this research. According to Ross (Ross, 2005, p. 3), "a structured questionnaire, is the one where each respondent gets exposed to the same questions and system of coding responses". In addition, Hair (2007) stated that every researcher should design a questionnaire that can minimize bias in the research as much as possible, by paying attention to the three core questionnaire design principles namely, questionnaire wording, the planning of the questionnaire structure (grouping of research variable, scale, and coding), and questionnaire's appearance. The questionnaire for this study was designed with the care of all three above mentioned principles. The questionnaire consisted of both closed-ended and a few open-ended questions. It also employed a five-point Likert

scale for closed-ended questions, particularly to make the responses quantifiable when doing the analysis and achieve a more structured questionnaire. In addition, the open-ended question was also included and placed at the end of the questionnaire to capture responses that the respondents may not have been able to include in the closed-ended questions. Leedy and Ormrod (2005) stated that findings from the data collected making use of questionnaires, usually show the reading and writing skills of the participants, meaning that participants may answer what they think the study wants from them. To address this challenge, the researcher made efforts to address and/or clarify any queries that participants had before or after they had answered the questionnaire. In doing so, the researcher was careful not to interfere with the participants whilst they were answering the questionnaires to minimize any influence over the responses. The questionnaires were then collected once completed. This allowed the researcher to get quick and high response rate.

The questionnaire that was used to collect the data in this research consisted of 26 questions. These 26 questions were sub-divided into six (6) sections, labelled A to F.

### **Section A: Demographic Information**

The aim of this section was to capture basic demographic information about the participants that will allow the researcher to understand where each participant fits in the study. The questions included in this section covered factors such as age, gender, years of experience academic level completed and participant roles, of the professional staff at the hospital. Age, gender and experience (in years) are known to be useful moderating variables which may determine someone's behavioural intention to adopt and use technology (Venkatesh et al., 2003, p. 450).

### **Section B: Performance Expectancy**

This section was aimed at determining the extent to which the respondents believe that the use of e-Health systems at the hospital will improve their work performance, productivity and the quality of their service delivery.

### **Section C: Effort Expectancy**

This section was aimed at examining the extent to which the respondents believe that they will be able to easily access and use e-Health systems, based on their computer skills, computer literacy and the user-friendliness of the e-Health systems.

### **Section D: Facilitating Conditions**

The aim of this section was to determine if respondents believed that there are technical, organisational and governmental support, infrastructures or resources available to them to help in the adoption and use of e-Health systems.

### **Section E: Behavioural Intention to Use**

This section was aimed at finding out if the respondents intend to use e-Health systems more frequently and in the future.

### **Section F: Open-Ended Question**

This section was aimed at getting responses (opinions and comments) from respondents regarding other factors or challenges that may prevent them from adopting and using e-Health systems at the hospital.

## **3.8 Validity and reliability**

According to Wood et al. (2010), validity refers to the ability of the research instrument to address what it is expected to measure i.e. research questions/hypothesis or objectives. Reliability refers to the accuracy and consistency of the study instrument/s in addressing the research problem being studied. To ensure validity in this research, this study adopted a validity test method which is referred to as “judgment by a panel”. In the case of the validity test, the experts in a field are requested to give their thoughts about the study’s instrument’s validity in relation to the study questions (Leedy & Ormrod, 2005). Thus, the questionnaire for this study was given to three individuals. Firstly, an Information Systems & Technology lecturer - for overall quality and standard assessment of the document. Secondly, the questionnaire was given to a PhD candidate in the discipline of Statistics for his expert opinion. Thirdly, the questionnaire was given to one of the heads of department (doctors) at Edendale hospital. The corrections obtained from these three individuals were applied to the questionnaire before it was printed and handed to respondents.

In ensuring reliability of this study, test-retest reliability method was used, where a pilot study on 10 healthcare professionals was conducted as a pre-test of data collection instruments. “Pretesting is an important step that should be carried out, because it helps in ensuring that all kinds of errors, that can be encountered during a survey research, are reduced” (Grimm, 2010,

p. 1). It helps in removing any ambiguity or biases that may be present in the questionnaire (Bhattacharjee, 2012). The researcher also applied Cronbach's Alpha reliability test method.

### **3.9 Ethical Consideration**

Ethics refers to the correctness of actions in regards to the interests of people who become or are harmed by the work (Kafila, 2018). It is essential for researchers to abide by ethical principles while conducting their research to ensure that their study's results have not been subjectively achieved to suit their own agenda (Bhattacharjee, 2012). Therefore, the following ethics were observed in this research:

- *"Informed consent"*: Participants were given the choice to participate or not to participate in the research and were informed about the concepts being investigated.
- *"Right to privacy"*: The entire content, quality and nature of the responses obtained from the respondents were kept confidential.
- *"Transparency with participants"*: Findings were compensated for in a simple, detailed and legitimate fashion, without distorting what had been said or purposely deceiving anyone in respect to certain theories.
- *"Confidentiality/Anonymity"*: It is a good research practice to provide secrecy and anonymity, as this would prompt respondents to reply in a straightforward way (Saunders *et al.*, 2001). Therefore, no information revealing the respondents' identities was revealed in the analysis of the data or in the interpretation thereof.

In conjunction with the above, an ethical approval of this research was obtained from the ethical committee of the University of KwaZulu-Natal while an approved Gatekeeper's letter was obtained from the Department of Health Research (Appendix B), prior to undertaking the investigation. Respondents were informed of the targets of the study and their approval to willingly participate in this investigation was sought.

### **3.10 Chapter Summary**

This chapter described the research methodology and the procedures employed in collecting the data for the research. The chapter described why and how a descriptive research design was employed and motivated the use of a quantitative approach in order to achieve the research objectives. A set of pre-tested personally administered questionnaires was distributed to a realised sample of 265 respondents. The questionnaires researcher ensured the confidentiality

and anonymity of the data collected from the respondents. The last part of the chapter showed how ethical principles were applied in this study. The following chapter presents the results of the study, evaluated against actual data collected during the research, and linked to the research objectives.

## **CHAPTER 4: FINDINGS, ANALYSIS AND DISCUSSION**

### **4.1. Introduction**

The previous chapter presented the methodology that was used to carry out this research. This chapter presents and interprets the responses obtained from the students through the questionnaire survey and how the responses have been analysed in relation to the objectives of the study. This chapter also presented the descriptive statistics of the data obtained. The information collected from the questionnaires is corroborated with the literature reviewed in chapter two and collated using tables and figures (charts) as obtained from the IBM SPSS software. Furthermore, inferential statistics and their implications based on the variables tested were presented in this chapter.

### **4.2 Response rate**

Two hundred and sixty-five (265) questionnaires were distributed to the sample population of this research; however, 212 valid questionnaires were returned. This resulted in an acceptable response rate of 80% (Biersdorff, 2009; Dillman, 2011).

The following measures were taken to improve the response rate:

- The covering letter showed cooperative interest to the respondents.
- The questionnaire was written in simple (easy to understand) English language and
- The length of the questionnaire remained just enough for a study of this magnitude.

### **4.3 Handling missing data**

After data entry has been completed, it is pertinent to find out if a data set contains any missing data (Alki, 2010). Data may be missing due to the following reasons;

- when a respondent does not answer certain questions due to confidentiality reasons
- error of omission from the researcher when entering data into the statistical software
- unintentional omission of one or more questions by the respondent to the questionnaires' structure or layout (Field, 2013).

Before the data analysis began in this study, the researcher discovered some missing data. The nature of the missing data discovered was due to the respondents not answering (omitting) certain questions in the questionnaire. Therefore, where missing data were noticed, the blank cells in IBM SPSS were coded with "999" and assigned as "missing data variables" in IBM SPSS (Field, 2013). All the missing data identified in the data set were less than 10% of the

whole data set. Therefore, as recommended by Field (2013), the “replacing missing score with mean” approach was employed. This meant that mean values within a category were used to replace all the missing data within that category.

#### 4.4 Reliability and Consistency

This study used Cronbach’s alpha as the measure of internal consistency and reliability. According to McBurney & White (2007) as cited by Andrisha (2016), reliability is considered as an important aspect in research. The production of the same results in the same conditions at different time intervals has been considered as reliability. The use of Cronbach’s alpha coefficient in testing reliability is considered as important. Cronbach’s alpha, as developed by Lee Cronbach in 1951, is used to measure internal consistency of scale (Tavakol & Dennick 2011). Internal consistency refers to the extent at which a test instrument measures what it intends to measure (Cronbach 1951). The closer the coefficient is to 1, the greater the internal consistency of the research instrument (Matkar 2012). When the coefficient (alpha value) ranges from 0.7 and above, then such a coefficient is acceptable (George & Mallery 2003, Pallant 2011). Fifteen (15) items in the questionnaire were tested for internal consistency through a reliability test in IBM SPSS and a Cronbach alpha co-efficient of 0.794 was obtained (See Table 4.1).

Table 4.1: Reliability and consistency statistics

<b>Cronbach's Alpha</b>	<b>No. of Items tested</b>
0.794	15

#### 4.5 Section A: Demographic information

Details about the respondents’ age, gender, years of experience, qualifications and their roles in the hospital, were obtained to constitute their demographic information for this study.

##### 4.5.1 Respondents’ Ages

The respondents were asked to specify their age bracket. Out of the 212 respondents that took part in this study, the findings showed that 18.4% were between the ages of 18 and 24, 29.7% were between the ages of 25 and 29 years, 22.2% were between 30 and 34 years, 15.1% were

between the ages of 35 and 39 years, and 14.6% were 40 years of age or above. No respondent was less than 18 while most of the respondents (51.9%) were between the ages of 25 and 34 (See Table 4.2).

Table 4.2: Table showing respondents' ages

		Frequency	Valid Percent
Valid	Less than 18	0	0.0
	18 – 24	39	18.4
	25 – 29	63	29.7
	30 – 34	47	22.2
	35 – 39	32	15.1
	40 and above	31	14.6
	Total	212	100

#### 4.5.2 Respondents' Genders

Females made up a higher percentage of the respondents (63.2%) while males made up 36.8%. This indicates that female professional staff were more represented in this study than male professional staff (See Figure 4.1).

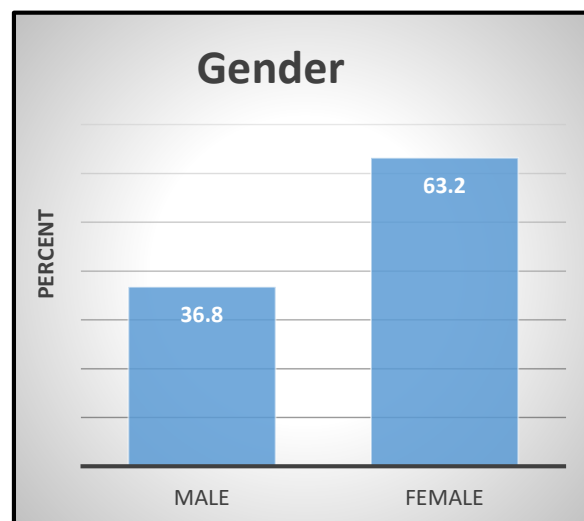


Figure 4.1: Gender of respondents

### 4.5.3 Respondents' Years of Experience

In this study, the years of experience of each health professional staff was determined. Results showed that 2.8% of the respondents have less than 1 year of experience, 30.2% have between 1 and 5 years of experience, 42% have between 6 to 10 years of experience while 25% have 11 years of experience and above. This result shows that majority of the respondents (67%) had 6 years of experience or more (See Table 4.3).

Table 4.3: Table showing respondents' years of experience

		Frequency	Valid Percent
Valid	Less than 1	6	2.8
	1 - 5 years	64	30.2
	6 - 10 years	89	42.0
	11 years and above	53	25.0
	Total	212	100

### 4.5.4 Respondents' Qualifications

The qualifications of the respondents were: Diploma, Bachelor's degree, Bachelor of Medicine (MBChB) and Master's degree. 27.4% of the respondents had a Diploma in Nursing, 46.2% had a Bachelor's degree, and 20.8% had a Bachelor of Medicine (MBChB) degree while 5.7% had a Master's degree. This shows that majority of the respondents had a Bachelor's degree or higher (See Table 4.4).

		Frequency	Valid Percent
Valid	Diploma in Nursing	58	27.4
	Bachelor's degree	98	46.2
	Bachelor of Medicine (MBChB)	44	20.8
	Master's	12	5.7
	Total	212	100

Table 4.4: Table showing respondents' qualifications

#### 4.5.5 Respondents' Roles

As indicated by the results obtained in this study, most of the respondents were nurse assistants (39.6%) while only 3.8% of the respondents were Heads of Departments. 9.4% of the respondents were Medical Doctors, 19.8% were Nurses, 12.7% were pharmacists while 14.6% were Administrative clerks (See Figure 4.2).

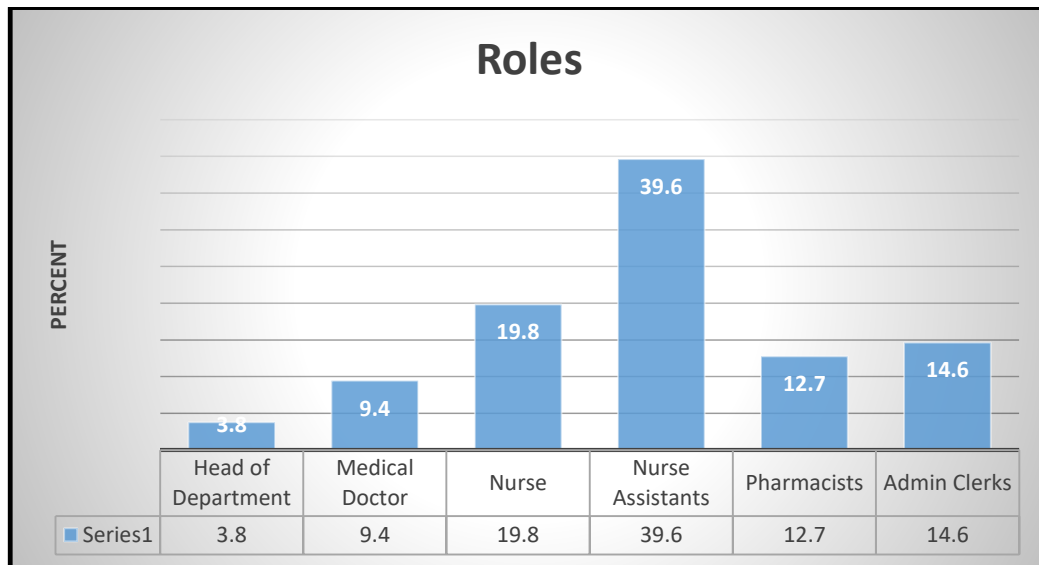


Figure 4.2: Roles of respondents

#### 4.6 Responses Based on the Constructs

In this study, four constructs (adopted from the UTAUT framework) were used to obtain responses from the respondents. These constructs are Performance Expectancy (Section B), Effort Expectancy (Section C), Facilitating Conditions (D) and Behavioural Intention to Use (Section E). The responses are shown as illustrated, based on a 5-point Likert scale of “Strongly Agree” to “Strongly Disagree”.

##### 4.6.1 Section B: Performance Expectancy (PE)

Performance expectancy refers to the degree to which an individual perceives that using a system will help him or her to attain a gain in job performance (Venkatesh et al., 2003). In this study, this section was aimed at determining the extent to which the respondents believed that the use of e-Health systems at the hospital would improve their work performance, productivity and the quality of their service delivery.

In this study's results, it was indicated that a larger percentage of the respondents (58.5%) believe that they find e-Health system useful when carrying their tasks. This result is in line

with the findings by Seebregts et al. (2015) which reported that healthcare professionals finds e-health systems to be helpful in their jobs.

Table 4.4: Performance Expectancy

Questionnaire Item`	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1
PE1: Information about e-Health is easy to access and always available.	66 31.13%	124 58.50%	6 2.83%	14 6.60%	2 0.94%
PE2: I would use the e-Health is the web is user friendly	87 41.04%	111 52.36%	1 0.47%	12 5.66%	1 0.47%
PE3: e-Health leads to strong data privacy and security compared to manual health systems	93 43.87%	106 50%	2 0.94%	9 4.25%	2 0.94%
PE4: e-Health has the ability to increase number of patients treated per given time.	89 41.98%	96 45.28%	4 1.89%	22 10.38%	1 0.47%

Figure 4.3 also indicates that most respondents gave a score of 4 on Performance Expectancy. This indicates that health workers are likely to adopt e-Health if it will improve their job performance.

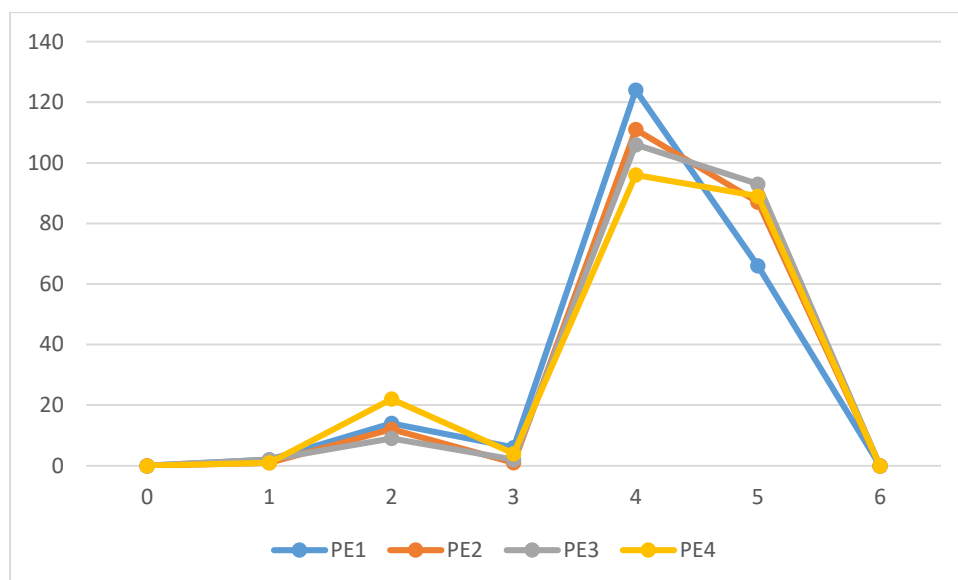


Figure 4.3: Performance Expectancy scaling results.

Furthermore, as shown in Table 4.5, a majority of the respondents (52.36%) indicated that using e-health system enables them to accomplish tasks more quickly. However, a small

percentage (5.66%) of the respondents disagreed. In support of these findings, Detmer (2003) also reported that health professionals are usually tasked with vast amount of work and they find using electronic health systems enables them to accomplish their task quickly as it allow for quick access to data.

Respondents were asked to indicate the extent to which they believe that the use of e-health system increases their productivity, compared to manual health systems. The results of the study showed that most respondents (50%) believe that the use of e-health system helps to increase their productivity. This is supported by the results obtained in the study by Angst, *et al.* (2006) which indicated that health workers trust electronic-based healthcare record systems higher to improve their productivity than that of manual (paper-based) systems.

The analysis of the responses in this study showed that most respondents (45.28%) believe that using e-Health systems might increase their chance of good incentives. Supporting this finding is the result of the study by Siedner et al. (2012). The study highlighted that using IT improve the manner in which healthcare professionals access medical information which increase their productivity thus increase their chances of receiving raise in their salaries.

#### 4.6.2 Section C: Effort Expectancy (EE)

Effort expectancy is aimed at measuring the level of ease-of-use associated with information technology. In this study, this section was aimed at examining the extent to which the respondents believed that they would be able to easily access and use e-Health systems, based on their computer skills, computer literacy and the user-friendliness of the e-Health systems.

Table 4.5: Effort Expectancy.

Questionnaire Item`	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1
EE1: e-Health is important for more accurate patient diagnosis.	45 21.23%	109 51.42%	25 11.79%	23 10.85%	10 4.72%
EE2: e-Health is important for improved patient treatment	69 32.55%	98 46.23%	8 3.77%	19 8.96%	18 8.49%
EE3: e-Health is important for improved patient education	83 39.15%	99 47%	2 0.94%	16 7.55%	12 5.66%

Based on the results of this study, most respondents (51.42%) believe that their interaction with e-health systems shall be clear and understandable. This is an important result because, as shown in the literature, if health professionals find it easy to understand and use e-health systems, then there is a high chance that they will want to keep using it (Garavand et al., 2016).

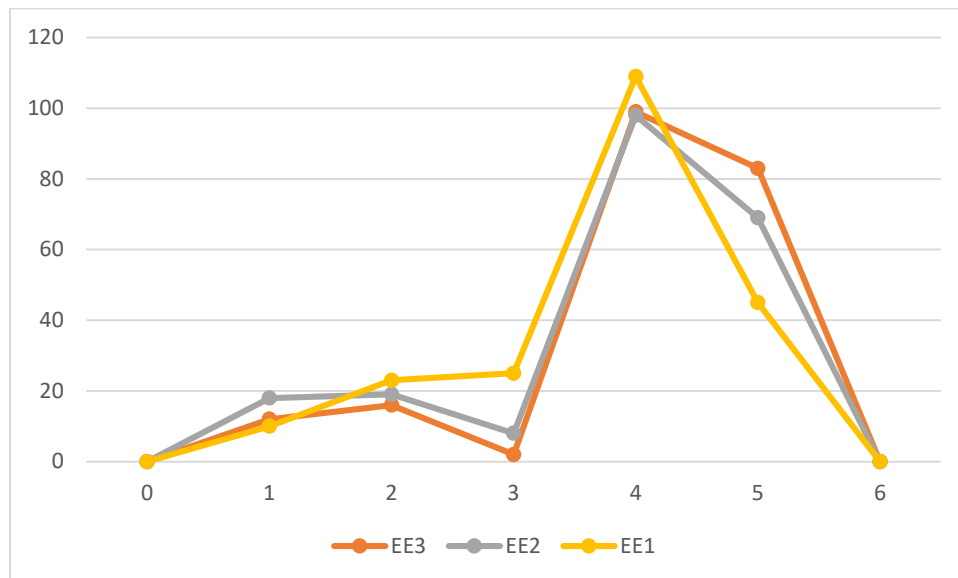


Figure 4.4: Effort Expectancy scaling results.

As seen in Figure 4.4, the results of this study showed that 46.23% of the respondents believe that if they were made to undergo a computer skills training, then this will promote the use of e-health systems. This is in line with the study by Kabashiki and Moneke (2014) which identified that healthcare professionals who were trained to have sufficient IT literacy and experience had positive characteristics on the adoption and use of new healthcare technologies such as e-Health applications.

Also, 47% of the respondents indicated that they would use e-health system if it is user friendly while only few 7% did not agree with the statement. This result indicates that the slow adoption and lack of continual use of e-health systems in hospitals may be related to the user friendliness of the systems and applications on the web.

#### 4.6.3 Section D: Facilitating Conditions (FC)

Facilitating conditions as a construct in UTAUT refers to the extent to which an individual perceives that organisational and technical infrastructures, required to use the intended system, are available (Ghalandari, 2012). Facilitating conditions are factors in an environment that make possible the use of e-health technologies for quality service delivery by healthcare staff. In this study, the aim of this section was to determine if respondents believed that there are

technical, organisational and governmental support, infrastructures or resources available to them to help in the adoption and use of e-Health systems.

Table 4.6: Facilitating conditions.

Questionnaire Item`	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1
FC1: I do have access to the Internet.	79 37.26%	62 29.25%	6 2.83%	53 25%	12 5.66%
FC2: Lack of ICT infrastructure such as mobile or computer devices affects utilisation of e-Health	46 21.70%	52 24.53%	11 5.19%	76 35.85%	27 12.74%
FC3: Computer Skills training can promote increased use of e-Health	59 27.83%	114 53.77%	4 1.89%	21 9.91%	14 6.60%
FC4: Government support is crucial for the adoption of e-Health in public institutions.	92 43.40%	85 40.09%	6 2.83%	26 12.26%	3 1.42%

This study's results showed that most of the respondents (37.26% and 29.25) have access to resources necessary to use e-Health, mostly the access to Internet, 6% were neutral and 25% indicated that they do not have access to resources necessary to use e-Health system (See Table 4.7). Of the about 60% that had the resources necessary to use e-Health system, it is important to note that the hospital manager and a small number of healthcare staff had access to the resources necessary to use e-Health system while at work. This means that some of the constraints for the resources necessary to use e-Health system (e.g. limitation of physical access to ICTs, high cost of accessing the Internet, and inadequate infrastructure), which are common in developing countries, will not be an issue in this study's target population (Chandrasekhar & Ghosh, 2001).

Also, based on the figure below (Figure 4.5), more respondents indicated that they were not computer literate for the use of e-health. This implies that they do not have the required computer skills and competencies expected of them to make use of e-health systems. This is an unusual finding though, as the majority of the respondents in this study were millennials.

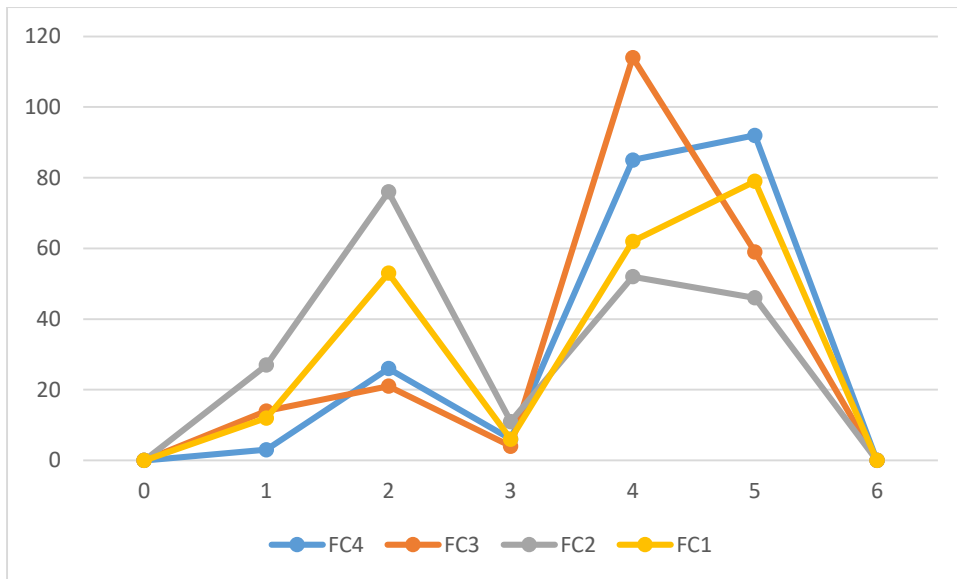


Figure 4.5: Facilitating Conditions scaling results.

In another result obtained in this study, 53.77% of the respondents believe that the lack of ICT infrastructure affects the use of e-Health systems. Larum (2011) stated that many countries in Africa lack technological infrastructure needed for the implementation of e-Health systems, hence cannot promote e-Health programs in their public healthcare institutions. Therefore, the availability of ICT infrastructure is an important factor in the adoption and use of e-Health systems.

Most of the respondents in this study (43%) indicated that government support is crucial for the adoption of e-Health in public institutions. According to Da et al. (2015), most of the e-Health systems at public hospitals lack integration and proper continuity policies. Therefore, the availability and functionality of the infrastructure needed for e-Health systems can be improved if there is support from the government (Fossey et al., 2002; Department of Health, 2012). Also, a large percentage (40%) of the healthcare professionals that were surveyed in this study believe that it is necessary for the hospital management to be involved or interested in the adoption and use of e-Health systems (See Figure 4.14). This is supported by Qureshi et al. (2013) which states that management plays a significant role in supporting e-Health to ensure its success, and this includes, providing the required guidance, during the designing stage, the selection and implementation as well as the sustainability of the whole e-Health program. Technological readiness in the organisation when implementing e-Health is influenced by management's support for the project (Chau & Hu, 2001). Moreover, the readiness of management to accept change significantly influences e-Health user's participation and willingness to adopt the e-Health system.

#### 4.6.4 Section E: Behavioural Intention to Use (BI)

Behavioural intention refers to the extent to which someone has conscious plans to undertake or not undertake a specified task in the future (Davis, 1989). In the context of this study, this construct was used to investigate the intention and willingness of healthcare staff to adopt and use e-health systems more frequently and in the future.

Table 4.7: Behavioural Intention.

Questionnaire Item`	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1
BI1: I would use the e-Health is the web is user friendly	93 43.87%	109 51.42%	2 0.94%	5 2.36%	3 1.42%
BI2: I predict I would use e-Health system in the next months.	96 45.28%	111 52.36%	1 0.47%	3 1.42%	1 0.47%

Most respondents plan to use e-Health systems in the future (Figure 4.6).

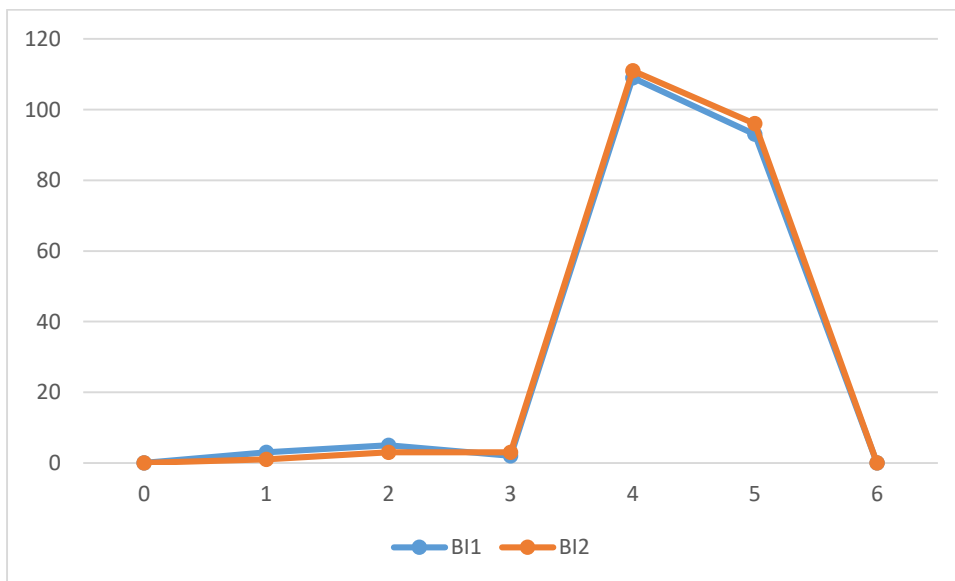


Figure 4.6: Behavioural Intention scaling results.

Based on the responses obtained in this study, most of the respondents (about 90%) indicated that they intend to use e-Health systems in the future (See Figure 4.6). Only about 3% of the respondents indicated otherwise and the other 13% were undecided. Furthermore, about 95% of the respondents indicated that, if given the chance, they intend to use e-Health systems more frequently.

## 4.7 Normality Test

It is important to justify the use of certain statistical analysis that will be carried out on a data set. To know the statistical analysis needed for this study's data set, the normality of the data was determined (i.e., the distributed nature of the data). This was done using normality tests. In the case where the data collected follows a normal distribution, the appropriate tests are parametric tests (e.g., ANOVA and T-tests) (Laerd, 2013). However, where the data collected does not follow a normal distribution, then the appropriate tests are non-parametric tests (e.g., Chi-Square test, Mann-Whitney U test or Kruskal-Wallis test).

The Kolmogorov Smirnov and Shapiro-Wilk tests were used in IBM SPSS to test the normality of the data set of this study. The following hypotheses were used for the test:

**H<sub>0</sub>:** The data set follows a normal distribution.

**H<sub>1</sub>:** The data set does not follow a normal distribution.

(where **H<sub>0</sub>** is the null hypothesis and **H<sub>1</sub>** is the alternative hypothesis)

In order to determine that a data set is *normally distributed*, a significance value  $> 0.05$  must be obtained (Laerd, 2013; Pallant, 2013). If the significance value is  $< 0.05$ , then the data set is *not normally distributed*. In this study, the significance value obtained, after conducting the Kolmogorov Smirnov and Shapiro-Wilk test, was 0.000. Based on this significance value (0.000), the null hypothesis ( $H_0$ ) was therefore rejected, meaning that the data set obtained in this study did not follow a normal distribution. Hence, non-parametric tests were appropriate. The non-parametric tests that were conducted in this study were chi-square tests.

## 4.8 Chi-square Tests

In order to determine if there were significant relationships between the categorical variables of this study, cross tabulations (cross tabs) were done. "A cross tabulation is a joint frequency distribution of cases based on two or more categorical variables" (Michael, 2001). Each variable's categories were represented in the rows and columns of the cross tabulations (Kent, 2017). When cross tabulating variables, it is possible to conduct chi-square tests which help to produce inferential statistics by comparing two categorical variables. The inferential statistics obtained using the chi-square tests were used to infer or judge whether the relationships found between two variables are reliable or have been obtained by chance. In a chi-square test result, a value of "p" (also known as Asymp. Sig. or Asymptotic Significance) obtained *must be less than 0.05* ( $p < 0.05$ ) before it can be stated that there is a statistical significant relationship

between the two tested variables, else, there is no statistically significant relationship between them (Bryman, 2001).

#### 4.8.1 Chi-square tests between PE and BI

In this study, the performance expectancy (PE) construct was made up of 6 variables denoted as PE-1, PE-2, PE-3, and PE-4 while the behavioural intention construct was made up of 2 variables denoted as BI-1 and BI-2. A chi-square test conducted between performance expectancy (PE) and behavioural intention to use e-health systems produced values of  $p < 0.05$  (See Table 4.5). This result indicates that there is a statistically significant relationship between the healthcare professionals' performance expectancy of e-health systems and their behavioural intention to use e-Health systems.

Table 4.8. 1: Chi-square test between PE and BI

		PE-1	PE-2	PE-3	PE-4
BI-1	Chi-square value	75.514	61.169	59.895	38.086
	Asymp. Sig. (p-value)	0.000	0.000	0.000	0.001
BI-2	Chi-square value	61.381	60.968	57.655	43.927
	Asymp. Sig. (p-value)	0.000	0.000	0.000	0.000

This result is in line with the findings obtained by Vassanadumrongdee and Kittipongvises (2018) and Bawack and Kamdjoug (2018) where it was shown that performance expectancy was largely linked with the actual use and adoption intention of the e-Health among healthcare professionals. If healthcare professionals expect that e-Health system will improve their work performance through visualization of patient records and by presenting a more detailed reporting of healthcare information (Kruse et al., 2018), then they will most likely intend to use the e-Health systems. Also, based on the UTAUT model, performance expectancy or PE has a direct relevance to the adoption and use of e-health systems for improved service delivery. Therefore, if a healthcare staff perceives that the use of e-health will positively enhance the health services delivered, they may be favourably disposed to using it. "The influence of performance expectancy on behavioural intention will be moderated by gender and age, such that the effect will be stronger for men and particularly for younger men" (Venkatesh et al., 2003, p. 450).

#### 4.8.2 Chi-square tests between EE and BI

In this study, the effort expectancy (EE) construct was made up of 3 variables denoted as EE-1, EE-2, and EE3 while the behavioural intention construct was made up of 2 variables denoted as BI-1 and BI-2. A chi-square test conducted between effort expectancy (EE) and behavioural intention (BI) to use e-health system produced values of  $p < 0.05$  (See Table 4.9). This result indicates that there is a significant relationship between the healthcare professionals' effort expectancy of e-health systems and their behavioural intention to use e-health systems. Previous studies by Enaizan et al. (2020), Shiferaw and Mehari (2019) and Hoque and Sorwar (2017) also showed that if healthcare professionals know that an e-Health system will be easy to use and will not require too much effort, then they will intend to use it.

Table 4. 8: Chi-square test between EE and BI

		EE-1	EE-2	EE-3
BI1	Chi-square value	227.076	138.016	357.71
	Asymp. Sig. (p-value)	0.000	0.000	0.000
BI2	Chi-square value	175.925	143.078	6.855
	Asymp. Sig. (p-value)	0.000	0.000	0.220

In this research, effort expectancy was deemed to have a direct link to the intention to use e-Health systems for improved quality service delivery by healthcare professionals. This is because the use of e-health for improved quality service delivery by healthcare staff is likely to be influenced by how easy or complex it is to utilize the e-health systems within the shortest time possible. Hence, if healthcare staff realize that it is rather easier to use e-health systems for improved quality service delivery, than doing things manually (i.e., paper-based administration), they may be inclined towards using the e-health systems. Furthermore, based on the literature (Lucas, 1981;Thong et al., 1996;Boonstra & Broekhuis, 2010), “the influence of effort expectancy on behavioural intention will be moderated by gender, age, and experience, such that the effect will be stronger for women, particularly younger women, and particularly at early stages of experience” (Venkatesh et al., 2003, p. 450).

#### 4.8.3 Chi-square tests between FC and BI

In this study, the facilitating conditions (FC) construct was made up of 9 variables denoted as FC-1, FC-2, FC-3, and FC-4 while the behavioural intention construct was made up of 2 variables denoted as BI-1 and BI-2. A chi-square test conducted between facilitating conditions and behavioural intention to use e-health system produced values of  $p < 0.05$  (See Table 4.10).

Table 4.9: Chi-square test between FC and BI

		<b>FC-1</b>	<b>FC-2</b>	<b>FC-3</b>	<b>FC-4</b>
<b>BI-1</b>	<b>Chi-square value</b>	33.847	37.689	37.206	28.552
	<b>Asymp. Sig. (p-value)</b>	0.006	0.002	0.002	0.027
<b>BI-2</b>	<b>Chi-square value</b>	55.886	55.615	36.679	43.704
	<b>Asymp. Sig. (p-value)</b>	0.000	0.000	0.002	0.000

This result indicates that there is a significant relationship between the facilitating conditions surrounding the use of e-health systems and the behavioural intention of healthcare professionals to use e-health systems. This result is supported by the results of previous studies by Hossain et al. (2019), Bawack and Kamdjoug (2018) Sichone (2017) which showed that healthcare professionals intentions to adopt and use e-Health systems will be strongly influenced by their perceptions and knowledge of whether the government or hospital management will support the implementation of the e-health systems by providing adequate technical infrastructure, training programs and technical support. The effective use of e-health, for quality service delivery by healthcare professionals, hinges on the availability of organizational resources (materials, support staff and management staff) and appropriate technical infrastructure for its optimum performance.

#### 4.8.4 Chi-square tests between Years of Experience and BI

The result of a chi-square test between Years of Experience and Behavioural intention to use e-Health systems showed p values greater than 0.05 (See Table 4.11). This implies that there is no statistically significant relationship between the number of years of experience of healthcare professionals and their intention to use e-Health systems. This is contrary to the results of the study by Alanazi (2020) which showed no significant relationship between the years of experience working as a healthcare professional and their intention to use e-Health systems.

Table 4.10: Chi-square test between Years of Experience and BI

		<b>BI-1</b>	<b>BI-2</b>
<b>Years of Experience</b>	<b>Chi-square value</b>	6.855	0.346
	<b>Asymp. Sig. (p-value)</b>	0.220	0.844

#### 4.8.5 Chi-square tests between Age and BI

Age differences have been observed to have an important role or influence on the acceptance and use of health-related technologies. This is because, “a person’s physical and psychological activity changes with their age increasing, which will affect the individual’s health condition and decision making in turn” (Zhao et al., 2018a). A chi-square test conducted between age and behavioural intention to use e-health system produced values of  $p < 0.05$  (See Table 4.9).

Table 4.8. 2: Chi-square test between Years of Experience and BI

		<b>BI-1</b>	<b>BI-2</b>
<b>Age</b>	<b>Chi-square value</b>	101.072	104.784
	<b>Asymp. Sig. (p-value)</b>	0.000	0.000

This implies that the age range of the healthcare professionals is most likely to determine their intention to adopt and use e-Health systems. This finding is in line with a previous research by Venkatesh et al. (2011b) and a recent research by Zhao et al. (2018a) which both discovered that younger and future healthcare professionals are more willing to adopt and use e-Health systems compared to older generation doctors. In this study, the healthcare professionals between the ages of 18 and 34 years are more likely to intend to use e-Health systems.

#### 4.9 Chapter Summery

This chapter presented the results of the data that was collected from the respondents. In this chapter, descriptive statistics and inferential statistics were used to make meaning of the data and discussions were made based on the literature pertaining to the results obtained. Furthermore, significant relationships between certain variables were obtained using chi-square tests, presented in this chapter and aligned to the literature. The next chapter presents further discussions of the results obtained and hoe they have answered the research questions of this study.



## **CHAPTER 5: SUMMARIES, CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Introduction**

This chapter presents the summary of the results (obtained in the previous chapter) in alignment with the research objectives, the conclusion of the study and summaries of each chapter of this dissertation. The study also presents some of the researcher's recommendations to the various stakeholders required to make the implementation, adoption and use of e-Health systems successful. Thereafter, the chapter concludes by presenting suggestions for future research in the area of e-Health systems.

### **5.2 Achieving the research objectives**

This section presents how the research questions have been answered and how the research objectives have been achieved. In this study, the research objectives were to:

1. To determine the extent to which the performance expectancy of an e-Health system may influence its adoption and use at public hospitals
2. To determine the extent to which the effort expectancy of an e-Health system may influence its adoption and use at public hospitals
3. To determine the facilitating conditions that may influence the adoption and use of an e-Health system at public hospitals
4. To determine the roles of gender, age and experience in the adoption and use of e-Health systems at public hospitals

#### **5.2.1 Influence of performance expectancy of e-Health system on its adoption and use**

This study investigated the influence of the performance expectancy of an e-Health system by healthcare professionals, on their decision to adopt and use the system. As described in chapter 4, performance expectancy refers to the extent to which healthcare professionals believe that using an e-Health system would improve their productivity, quality of service delivery and work performance in the hospital. Based on the results of this study as presented in chapter 4, healthcare professionals expect an e-Health system to achieve an accurate patient diagnosis, improve patients' education regarding their health, produce quality health-related information, improve the quality of safety of healthcare centres and ensure stronger data privacy & security compared to manual health systems.

Another result of this study showed that there is a statistically significant relationship between the healthcare professionals' performance expectancy of e-health systems and their behavioural intention to use e-Health systems. This, therefore, implies that healthcare professionals are willing to adopt and use an e-Health system if they are assured that an e-Health system can achieve an accurate patient diagnosis, improve patients' education regarding their health, produce quality health-related information, improve the quality of safety of healthcare centres and ensure stronger data privacy & security compared to manual health systems.

### **5.2.2 Influence of effort expectancy of an e-Health system on its adoption and use**

The second objective of this study was to determine the extent to which the effort expectancy of an e-Health system may influence its adoption and use at public hospitals. In this study, effort expectancy is the extent to which healthcare professionals believe that they would be able to easily access and use an e-Health system, based on their computer skills, computer literacy and the user-friendliness of the e-Health system. From the results obtained, healthcare professionals indicated that e-Health systems are easy to access and use. Also, healthcare professionals expect that their level of computer literacy and skills is sufficient to use the e-Health system. In a further analysis of their responses, it was obtained that healthcare professionals would use an e-health system if it can be accessed on the web. Therefore, it is important for the developers of e-Health systems to bear this in mind. A chi-square test (as shown in chapter 4) also revealed that the use of e-health for improved quality service delivery by healthcare staff is likely to be influenced by how easy or complex it is to utilise the e-health systems. Hence, if healthcare professionals are confident that the e-health system is easy to use and requires little technical effort, then they will most likely adopt and use it.

### **5.2.3 Influence of facilitating conditions on the adoption and use of an e-Health system**

This study investigated the influence that the availability of technical, organisation and environmental factors has on the adoption and use of e-Health systems for quality service delivery. Factors such as access to the Internet, cost of Internet, presence of ICT infrastructure, presence of computer skills training, government support and involvement of hospital management are crucial to healthcare professionals in order to be able to adopt and use e-Health systems. In this study, healthcare professionals indicated that it is necessary for all these factors to be available in order for them to be able to adopt and use e-Health systems. Although most of the healthcare professionals already have access to the Internet, they require more computer skills training as they believe that this will promote their use of the e-Health systems. Also,

healthcare professionals want the hospital management and the government to be involved in the implementation and administration of e-Health systems in public hospitals.

The results of a chi-square test in this study imply that the degree to which healthcare professionals believe that these factors (facilitating conditions) exist to support the effective use of e-health systems may determine if they will adopt and use the e-Health systems. However, if there are no facilitating conditions in place, the e-Health system will not be adopted and used.

#### **5.2.4 Roles of gender, age and experience in the adoption and use of e-Health systems at public hospitals**

The fourth objective of this research was to determine if the unique demographic traits of the healthcare professionals surveyed had any influence on their intentions to adopt and use e-Health systems. The data obtained regarding the gender of the healthcare professionals were not internally reliable enough to ascertain its influence on the other variables. This is because there was a very low representation of the male gender in the survey (See Figure 4.1).

Regarding the influence of age differences on health care professionals' intention to adopt and use e-Health systems, a chi-square test revealed that the older the healthcare professionals, the lesser they intend to adopt and use e-Health systems, while younger and future healthcare professionals, especially those between the ages of 18 and 34 years (millennials), are more willing to adopt and use e-Health systems.

However, based on the result of a chi-square test conducted in his study, it was discovered that the number of years of experience that healthcare professionals have amassed while working in public hospitals does not have any influence on their decision to adopt and use e-Health systems. Therefore, based on this study's results, the most important demographic trait that is useful for decision-makers when implementing e-Health systems is age.

### **5.3 Summary of the chapters**

Chapter 1 of this study presented a general discussion of the concept of using information and communications technology (ICT) in healthcare institutions. The chapter further narrowed down this discussion by explaining more about two terminologies - mobile health and e-Health. The benefits of e-Health were highlighted in this chapter. Some of the benefits of e-Health presented in this chapter are; giving patients access to quality healthcare services, providing healthcare providers with the ability to make informed decisions, access to medical knowledge

databases and best practices. Also, the chapter showed the major challenges facing the healthcare institutions in South Africa, such as insufficient healthcare facilities, high cost of healthcare services and lack of professional health care practitioners. The chapter presented how some of these challenges may have hindered the adoption of e-Health systems in most healthcare institutions. Furthermore, chapter 1 presented the motivation for this research and the research problem that was being investigated in this study. In order to investigate this research problem, the researcher came up with four research questions, from which the study's objectives were formulated. These were presented in chapter 1. Additionally, a brief description of the research methodology that was adopted in this study was presented in this chapter. This description showed the target population that was chosen, the sample size and the sampling strategy that was used to obtain the required sample. At the end of the chapter, the limitation to the study was presented alongside the summary outline per chapter.

Chapter 2 presented a detailed discussion about past and current literature relating to the concept of e-Health and its associated forms such as Electronic Health Records (EHR), Hospital Information System (HIS), Telemedicine and Mobile Health (m-Health). The chapter highlighted the benefits of adopting e-Health and the state of the public health institutions in South Africa. Based on the state of public health institutions in South Africa, some challenges that face the public health sector were presented. The chapter presented the state of e-Health implementation in South Africa and gave a detailed argument into some of the factors which may have been responsible for the deplorable state of the e-Health implementations. Some of these factors relate to the digital infrastructure in the African market, e-Health standards, applications and tools to support the delivery of healthcare, development and deployment of electronic systems, digital skills and human capacity. Furthermore, the chapter presented arguments from other studies in the literature that have been underpinned by different research frameworks like the Technology Adoption theoretical models and the Unified Theory of Acceptance and Use of Technology (UTAUT). The chapter further presented how the UTAUT framework had been applied in other studies and how it would be applied in this research.

Chapter 3 described in detail the research methods that were adopted in this research. This study employed a descriptive research design approach (due to the popular and already existing nature of the e-Health concept) and a quantitative approach (due to the types of statistics that were required). The chapter also described how and why the quantitative approach was used. In this study, the target population was obtained from Edendale public hospital located in Pietermaritzburg, KwaZulu-Natal province. The reason for choosing this population and the

units of analysis required was presented in the chapter. Furthermore, the chapter described the sampling process, including the sample size of the study, how the sample size was obtained and how the sample population was selected. The choice of data collection was further described, and the reason for selecting a survey questionnaire as the form of data collection. Moreover, the chapter presented the questionnaire content, and a brief description of each of the sections in the questionnaire was shown. At the end of the chapter, the UTAUT framework used in this study was presented, and the different constructs were explained in accordance with the research questions and objectives. Each of the constructs that were used in this study was explained and discussed in the context of the research. Afterwards, the chapter presented how ethical principles were observed before, during and after conducting the research.

Chapter 4 started by presenting the response rate of participants of the research and how all the missing data were handled. Thereafter, the chapter presented how the questionnaire items were tested for internal validity and consistency using reliability tests. The sections that followed presented the descriptive statistics of all respondents in this study, including their demographic information and the responses based on the UTAUT constructs. The responses from the UTAUT constructs were cross-tabulated to produce chi-square test results which showed statistically significant relationships between some of the variables within the constructs used. The results analysed in this chapter were interpreted and discussed with reference to the literature.

Chapter 5 presented a summarised discussion of the results analysed and interpreted in chapter 4. The chapter specifically showed how each research objective was achieved based on the data obtained in this study and with reference to the literature. Furthermore, the chapter presented a summary of all the chapters in the dissertation, a conclusion of the study, some recommendations based on the findings of the study and some suggestions for future research.

#### **5.4 Conclusion of the study**

This research investigated the factors that affect the adoption and use of e-Health systems in South African public hospitals. In order to achieve this aim, this study was underpinned by the UTAUT framework. Some of the constructs in the UTAUT framework were used while a few others were left out. The reasons for this have been discussed and presented in chapter 2. For the research aim to be achieved, research questions need to be answered. The research questions used in this study were made to align with some of the variables in the UTAUT framework such as performance expectancy, effort expectancy, facilitating conditions,

behavioural intention, age, gender and years of experience. The first research question centred on the influence that the performance expectancy of an e-Health system has on its adoption and use by healthcare professionals. The second question was about the influence that the effort expectancy of an e-Health system has on its adoption and use by healthcare professionals. The third research question was about the influence that the presence of facilitating conditions has on the adoption and use of an e-Health system by healthcare professionals. The fourth question was aimed at determining whether age, gender or years of experience have any influence on the adoption and use of an e-Health system by healthcare professionals at public hospitals.

A descriptive approach was employed in this study, and questionnaires were used to obtain data from healthcare professionals. The data collected was analysed with the use of the IBM SPSS software. During the analysis of the data, the results obtained were based on the descriptive and inferential statistics produced. Based on this study's results, the healthcare professionals expect an e-health system to produce an accurate patient diagnosis, improve patients' education regarding their health, ensure stronger data privacy and security and improve the quality of safety of healthcare centres. Healthcare professionals indicated that if these expectations are met by an e-Health system, then they will adopt and use it. Also, healthcare professionals indicated that if an e-Health system is web-friendly and easy to access and use, then they will adopt and use it. The study showed that the presence of facilitating conditions (such as access to the Internet and at a low cost, adequate ICT infrastructure, relevant computer skills training, government support and involvement of the hospital management) would encourage healthcare professionals to adopt and use an e-Health system.

Furthermore, the results of this study showed that most of the healthcare professionals intend to use e-Health systems in the future and more frequently. Chi-square tests conducted in this study produced results which showed that the intention of healthcare professionals to adopt and use an e-Health system is statistically related with their expectations (regarding its implementation) in terms of performance, effort and facilitating conditions. Moreover, other results of this study showed that the ages of healthcare professionals and the digital generation they belong to also influence their intention to adopt and use e-Health systems. Also, it was observed that the years of experience of a healthcare professional has no statistically significant influence on their intention to adopt and use an e-Health system.

## **5.5 Recommendations based on the findings of the study**

Based on this study's results, the following have been recommended:

### **5.5.1 To developers of e-Health information systems**

It has been observed from the responses of the healthcare professionals in this study that a key to successful adoption and use of an e-Health system is the ease-of-use and web friendliness associated with the system. Therefore, developers of the e-Health systems are urged to adopt industry standards relating to ease-of-use and usability of information systems when designing e-Health systems. Also, making the e-Health systems accessible via the web will make it possible for much more healthcare professionals to access the system regardless of their location or whether or not they have a sophisticated mobile device. Moreover, during this era of cloud computing, the computing and storage required by an e-Health system can be made available via cloud service providers, thereby reducing the need for healthcare professionals to purchase or depend on sophisticated mobile devices. Furthermore, while developing the e-Health system, developers need to consider the interoperability of the systems for possible reuse and extension to other health institutions (Booty & Ansell, 2019). There should also be help menus and functionalities within the system that can direct the end-users (healthcare professionals) to achieve certain work tasks.

### **5.5.2 To hospital management**

In order to enhance the implementation of an e-Health Strategy, the hospital managements should consider increasing its human resources capacity significantly, by recruiting healthcare professionals that possess the technical insights, expertise, capability and interests to provide strategic leadership in the public health institutions (Bloom *et al.*, 2017). Having such capable tech-savvy healthcare professionals would be useful in addressing the issues raised in this study which may affect the adoption and use of e-Health systems. For instance, heads of hospital management can ensure that adequate ICT infrastructure has been put in place by the government and also ensure that healthcare professionals are constantly being trained on how to access and use e-Health systems in an effective, efficient and secure manner. The hospital management should create roles for technical support staff in their institutions that will timeously respond to any queries or issues regarding the smooth operation of the e-Health systems. It is also recommended that hospital management should take a firm stance in providing the necessary resources for the adoption and continuous use of e-health systems and

also encourage innovation among their staff. This will increase the open-mindedness of the staff to willingly submit to the use of e-Health systems.

### **5.5.3 To the government**

The literature and the results of this study have shown that the interest and involvement of the government in digital health are very important in order to realise the benefits that come with using e-Health systems. By developing a national digital health strategy like that of Kenya and Ghana, health services delivery will be improved (Shuvo *et al.*, 2015). Also, standards, guidelines, legislations and appropriate technical and service delivery solutions can be provided by the government towards supporting the implementation of the e-Health strategies. For instance, South African Medical Association (2015) reported that for successful implementation of an eHealth strategy, technical standards are required to ensure national and international compatibility, interoperability, open architecture, modularity and capacity for an upgrade. Furthermore, the researcher recommends that government and policymakers collectively and cooperatively establish policies that enforce adoption and use of e-Health in public hospitals. Moreover, the government and policymakers can work together in reducing the cost of the Internet, which will essentially provide an opportunity to increase the number of healthcare professionals using e-Health in public institutions. As shown in the results of this study, the importance of government support in the adoption and use of e-Health systems cannot be overemphasised as the public institutions cannot be able to effectively function without the support of the government.

## **5.6 Suggestion of areas for future research**

As shown in the literature, the trend of adopting and using information and communication technology in healthcare delivery changes periodically. Also, because of the constantly changing nature of the information and communication technology landscape, new changes may be discovered regarding what influences healthcare professionals to adopt and use e-Health systems. Hence, it is suggested that future research should focus on investigating other factors that may influence the adoption and use of e-Health systems besides from the ones that have been investigated in this study. Using another theoretical framework to underpin this study may be advised in this regard. This study only surveyed healthcare professionals in a public hospital, future research may focus on a target population consisting of healthcare professionals in both public and private hospitals to have a much better view of both sectors. In addition, a future study may consider investigating the views of patients regarding the use

of e-Health systems to deliver healthcare services and the factors that may influence them to adopt and use the e-Health systems.

## **5.7 Chapter Summery**

This chapter presented the conclusions of the study in relation to how the research objectives have been met and also gave summaries of each chapter of this dissertation. Furthermore, the researcher used this chapter to offer recommendations to the developers of e-Health systems, the heads of hospital management and the government. Thereafter, suggestions for future research in the area of e-Health systems were presented based on the limitations of this study.

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# APPENDIX

## Appendix A: Ethical Clearance Letter



11 June 2018

Mr Sifiso Liberty Ndlanzi (210521077)  
School of Management, IT & Governance  
Westville Campus

Dear Mr Ndlanzi,

Protocol Reference Number : **HSS/0354/018M**

Project title: Challenges affecting e-Health adoption in South African Public Hospitals : A case of Edendale Hospital

### Approval Notification – Expedited Application

With regards to your response received on 01 June 2018 to our letter of 08 May 2018, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

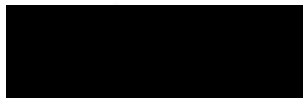
Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

**PLEASE NOTE:** Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully



Professor Shenuka Singh (Chair)

/ms

Cc Supervisor: Ajayi Nurudeen  
cc Academic Leader Research: Professor Isabel Martins  
cc School Administrators: Ms Angela Pearce

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Humanities & Social Sciences Research Ethics Committee

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Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

## Appendix B: KZN Department of Health Research Approval Letter



**health**  
Department:  
Health  
PROVINCE OF KWAZULU-NATAL

**DIRECTORATE:**

Physical Address: 330 Langaibalee Street, Pietermaritzburg  
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Health Research & Knowledge  
Management

HRKM Ref: 189/18  
NHRD Ref: KZ\_201805\_017

Date: 30 May 2018  
Dear Mr SL Ndlanzi

### Approval of research

1. The research proposal titled '**Challenges Affecting e-Health Adoption in South African Public Hospitals: A Case of Edendale hospital**' was reviewed by the KwaZulu-Natal Department of Health.

The proposal is hereby **approved** for research to be undertaken at Edendale Hospital

2. You are requested to take note of the following:
  - a. Make the necessary arrangement with the identified facility before commencing with your research project.
  - b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.
3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to [hrkm@kznhealth.gov.za](mailto:hrkm@kznhealth.gov.za)

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

  
Dr E Lutge

Chairperson, Health Research Committee

Date: 01/06/18

## Appendix C: QUESTIONNAIRE



### Challenges Affecting e-Health Adoption in South African Public Hospitals: A Case of Edendale Hospital

**Researcher:** Ndlanzi Sifiso L.

**Supervisor:** Ajayi Nurudeen

Discipline of Information Systems & Technology  
College of Law and Management Studies  
University of KwaZulu-Natal

- Please kindly complete this questionnaire.
- Please note that there is no correct/incorrect answer.
- Please note that participation in the study is voluntary.
- Please sign the letter of informed consent, giving me permission to use your responses for this research project.
- Please kindly take note of the instructions before answering any question(s).

**GENERAL INSTRUCTION:** In all the sections, kindly provide your response by making a tick ✓ in the appropriate box and fill in the gaps in the case of open-ended questions.

#### SECTION A: DEMOGRAPHIC INFORMATION

1.	<b>Age:</b>	<input type="checkbox"/> Less than 18	<input type="checkbox"/> 18 – 24	<input type="checkbox"/> 25 – 29	<input type="checkbox"/> 30 – 34
		<input type="checkbox"/> 35 – 39	<input type="checkbox"/> 40 and above		

2.	<b>Gender:</b>	<input type="checkbox"/> Female	<input type="checkbox"/> Male
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3.	<b>Years of experience:</b>	<input type="checkbox"/> Less than 1 year	<input type="checkbox"/> 1 – 5 years	<input type="checkbox"/> 6 – 10 yrs	<input type="checkbox"/> 11yrs & above
		Others (please specify):			

4.	<b>Qualifications:</b>	<input type="checkbox"/> Diploma in Nursing	<input type="checkbox"/> Bachelor's degree	<input type="checkbox"/> Bachelor of Medicine (MBChB)
		<input type="checkbox"/> Masters	Others (please specify):	

5.	<b>Participant Role:</b>	<input type="checkbox"/> Head of Department	<input type="checkbox"/> Medical Doctor	<input type="checkbox"/> Nurse
		<input type="checkbox"/> Nurse Assistants	<input type="checkbox"/> Pharmacists	<input type="checkbox"/> Admin Clerks

**SECTION B: Performance Expectancy**

Please indicate the extent to which you agree with the following statements:

		(5) Strongly Agree	(4) Agree	(3) Neutral	(2) Disagree	(1) Strongly Disagree
1.	Information about e-Health is easy to access and always available.					
2.	I would use the e-Health is the web is user friendly					
3.	e-Health leads to strong data privacy and security compared to manual health systems					
4.	e-Health has the ability to increase number of patients treated per given time.					

**SECTION C: Effort Expectancy**

Please indicate the extent to which you agree with the following statements:

		(5) Strongly Agree	(4) Agree	(3) Neutral	(2) Disagree	(1) Strongly Disagree
1.	e-Health is important for more accurate patient diagnosis.					
2.	e-Health is important for improved patient treatment					
3.	e-Health is important for improved patient education					

**SECTION D: Facilitating Conditions**

Please indicate the extent to which you agree with the following statements:

		(5) Strongly Agree	(4) Agree	(3) Neutral	(2) Disagree	(1) Strongly Disagree
1.	I do have access to the Internet					
2.	Lack of ICT infrastructure such as mobile or computer devices affects utilisation of e-Health					
3.	Computer Skills training can promote increased use of e-Health					
4.	Government support is crucial for the adoption of e-Health in public institutions					

**SECTION E: Behavioural Intention to Use**

Please indicate the extent to which you agree with the following statements:

		(5) Strongly Agree	(4) Agree	(3) Neutral	(2) Disagree	(1) Strongly Disagree
1.	I would use the e-Health is the web is user friendly					
2.	I predict I would use e-Health system in the next months.					

**SECTION F**

What other factors/challenges may prevent you from adopting and using e-Health systems at this hospital?

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**THANK YOU SO MUCH FOR YOUR TIME!**

## Appendix D: Certificate of Authenticity

072 462 3731  
[masithembekafile@gmail.com](mailto:masithembekafile@gmail.com)  
BluePrint Proofreading & Editing

### *Certificate of Authenticity*

**CERTIFICATE: COB130120 (SLN)**

20 January 2021

To whom it may concern,

This is to certify that “**Challenges affecting e-Health adoption in South African public hospitals: A case of Edendale hospital**” by SIFISO LIBERTY NDLANZI, has been professionally edited at BluePrint Proofreading and Editing Services for Students and Professionals by Miss. Masithembe Kafile.

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