Cape Peninsula University of Technology

Adoption and use of electronic healthcare information systems to support clinical care in public hospitals of the Western Cape, South Africa

By

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DECLARATION

I, Oluwamayowa Oaikhena Ogundaini, declare that the content of "**Adoption and use of electronic healthcare information systems to support clinical care in public hospitals of the Western Cape, South Africa**" represents my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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Signed Date

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DEDICATION

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ABSTRACT

In the Western Cape, South Africa, despite the prospective benefits that e-Health information systems (e-Health IS) offer to support the healthcare sector; there are limitations in terms of usability, functionality and peculiar socio-technical factors. Thus, healthcare professionals do not make the most use of the implemented e-Health IS. Unfortunately, explanations remain tentative and unclear, yet non-usage of the e-Health IS defeats the objectives of its adoption, in the sense that the plan to improve and deliver quality healthcare service in the public sector may not be achieved as envisaged. The aim of the study was to acquire explanations to the causes of the limitations regarding the adoption and, particularly, the use (or non-use) of e-Health IS by clinical staff in the public healthcare institutions in South Africa.

The choice of research approach was informed by the research problem, objectives, and the main research question. By the reasons of the subjective and socio-technical nature of the phenomenon, a deductive approach was adopted for this investigation. The nominalist ontology and interpretivist epistemology positions were taken by the researcher as a lens to conduct this research; which informed a qualitative methodology for this investigation. The purposive sampling technique was used to identify the appropriate participants from different hospital levels consisting of Hospital Administrative staff, and Clinical staff (Clinicians and Nurses) of relative experiences in their clinical units. Subsequently, the Unified Theory of Acceptance and Use of Technology (UTAUT) and content analysis technique were used to contextualize, simplify, and analysis the text data transcripts.

The findings indicate that healthcare professionals have a high level of awareness and acceptance to use implemented e-Health IS. There are positive perceptions on the expected outcomes, that e-Health IS would improve processes and enhance healthcare services delivery in the public healthcare sector. Also, findings indicate that social influence plays a vital role especially on the willingness of individuals (or groups); as the clinical staff are influenced by their colleagues despite the facilitating conditions provided by the hospital management. Further, findings indicate that it is somewhat problematic to maintain balance in running a parallel paper-electronic system in the hospital environment.

Hence, the core factors that influence successful adoption and use of e-Health IS include; willingness of an individual (or group) to accept and use a technology, the performance expectancy, social influence among professionals in the healthcare scenery and adequate facilitating conditions. In summary, it is recommended that there should be an extensive engagement inclusive of all respective stakeholders involved in the adoption processes. This would ensure that e-Health IS are designed to meet both practical organizational and clinical needs (and expectations) with respect to the hospital contexts.

Keywords: e-Health IS, Adoption, Use, Usability, Clinical staff, Public Hospitals

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LIST OF ABBREVIATIONS

Abbreviation	Description
BAS	Basic Accounting System
DHIS	District Health Information System
e-Health	Electronic Health
ECM	Electronic Content Management
FMoH	Federal Ministry of Health
HIS	Hospital Information Systems
ICT	Information and Communication Technology
IS	Information Systems
IT	Information Technology
HI	High Income
HITs	Health Information Technologies
LMI	Low Medium Income
MDGs	Millennium Development Goals
MOUs	Midwife Obstetrics Unit
NDoH	National Department of Health
NHIS	National Health Information Systems
NHLS	National Health Laboratory Services
OPD	Out-Patient Department
PACS	Picture Archiving and Communication System
RIS	Radiology Information System
UTAUT	Unified Theory of Acceptance and Use of Technology
UN	United Nations
WHO	World Health Organization

CHAPTER ONE – INTRODUCTION

1.1 Introduction

Information Technology (IT) is a significant part of Information systems (IS), in particular, because IS serves as the complementary network of interaction between technology (hardware and software), people (individual or organization) and operations used mainly for data management, processing and the use of information to deliver services (Gatero, 2010; Santhanam, Sasidharan, Yi & Park, 2013). By a network of interactions between technology and people, implications are that IS includes more than just the information and communication technology (ICT) aspect. It also includes the socio-technical relationship between human behaviour and the use of technology to carry out operations for private, societal and organizational purposes (Ammenwerth, Gräber, Herrmann, Bürkle & König, 2003; Tiihonen, 2011).

This thesis is concerned principally with electronic Health (e-Health) brand of IS as a focus area to research. To frame the context of this focus area, and a background to a research problem, information systems are introduced in section 1.1, followed by a problem statement in section 1.2, a research problem in sub-section 1.2.1, a research objective in section 1.3, main research question and sub-questions in section 1.4 and sub-section 1.4.1 respectively. Consequently, the conceptualisation of terms in section 1.5, the intended contribution of the study in section 1.6, followed by the delineation of the study in section 1.7, the ethical considerations of the study in section 1.8, a structure of the thesis in section 1.9 and the conclusion to the chapter in section 1.10.

1.1.1 The Various Applications of Information Systems

From the perspective of individuals, private use of information systems through ICT enables personalization of information specific to subjective interests. For example, the use of mobile technology such as smart phones to login into as social networking websites which requires authentication of user credentials and private customization features (Parra-Arnau, Rebollo-Monedero & Forné, 2014). Similarly, information systems have connected groups of individuals from diverse societies together for different purposes through the use of networked devices such as the internet, computers and smart mobile devices (Gubbi, Buyya, Marusic & Palaniswami, 2013).

Consequently, information systems have transformed how private and public business organizations such as academic and healthcare institutions among others; manage, process and use information to improve efficiency and enhance quality of services. In the business sector, management information systems (MIS) are more prominent. MIS help businesses to

improve the control and monitoring of financial transactions, reporting as well as decision-making amongst other purposes accurately and efficiently (Van Belle, Eccles & Nash, 2003; Chen & Cheng, 2008). An example of business MIS is the Digitot system. This system is coupled with a point-of-sale system, which uses an electronic tot type of measure and automatically updates stock levels (Van Belle, Eccles & Nash, 2003). Another example pertains to 3D barcode scanners used in retail stores to price, monitor stock levels and safeguard items respectively (Sobota, Hrozek, Korečko & Zabó, 2011).

In addition, the use of IS continues to grow prominently in the public sector especially to improve daily processes (or operations). For example, in the education sector, educators are using electronic tools such as teaching and learning information management systems. For instance, blackboard, WebCT and Moodle among others – is used to simplify access and the sharing of educational content by learners and tutors (Mlitwa, 2011; Dabbagh & Kitsantas, 2012). Similarly, in the public healthcare sector, information and communication technology (ICT) has been adopted in an increasing scale to support health and health-related fields since 1984 (Haux, 2006; Reichertz, 2006). For example, access to up-to-date clinical information from knowledge databases by healthcare professionals for evidence-based practices have become a standard practice in healthcare institutions (Ammenwerth *et al.,* 2003).

In line with this trend, there have been an escalating increase in the adoption and use of electronic health information systems (e-Health IS) in the healthcare service sector since the dawn of the 21st century (Blaya, Fraser & Holt, 2010). Arguments in support of the increasing adoption include claims that e-Health IS can improve data management in healthcare service administration (Haux, 2006). Further, e-Health IS are believed to enhance quality assurance and improve the monitoring of public health service delivery (Mudaly, Moodley, Pillay & Seebregts, 2013), mostly through the automation of patient data administration including the healthcare profile, billing information, and it simplifies the sharing of information (Cline & Luiz, 2013). Whilst there is a wealth of literature and reports alluding to e-Health IS implementation and failures, a major problem is that almost none of the written scientific work offers clear explanations to the causes of the limitations to the use of e-Health IS in the South African public healthcare sector.

1.2 The Problem Statement

Owing to the commitment of tackling healthcare challenges such as prevalent cases of HIV,TB and non-communicable diseases and as a part of the signatories' of the millennium development goals (MDGs), the South African government through the National Department of Health (NDoH), recognised the need to redress efficiencies in the public healthcare sector. Of particular focus was providing equitable access to healthcare services for all her

citizens corresponding to its national agenda for universal health coverage through the innovative use of information communication and technology (ICT).

Thus, these led to the deployment of electronic health information systems (e-Health IS) in the public healthcare institutions which include: hospital information systems (HIS) such as PCIS, CLINICOM, SINJANI, PACS and the DHIS, amongst a host of other systems. The systems were being adopted to facilitate the management, processing and reporting of the public health status and service delivery. However, the resultant outcomes in tackling the challenges have rather been below par as a result of the systems inadequacies coupled with social factors. Examples of these inadequacies include: inadequate ICT infrastructure in both urban and rural hospitals, heterogeneity of several e-Health systems, inadequate staffing and a lack of technical skills amongst healthcare practitioners, lack of access control, slowness of the systems and ultimately, technical failures as discussed in section 2.6.4.

These combined challenges have seen the decrease in e-Health IS reliability, performance, access and have resulted in limitations to the use of these e-Health IS – hospital information systems (HIS) in an already overburdened public healthcare system in South Africa (Richards & Jacquet, 2012). For instance, electronic medical records (EMRs) which are supposed to provide a comprehensive and up-to-date set of patient health (administrative and clinical) information (Klompas *et al.*, 2012), provinces such as the Western Cape, low usage of these clinical tools have been reported (Mchunu, 2013).

1.2.1 Research Problem

Despite the prospective benefits that e-Health IS offers to aid the healthcare sector with, there are limitations in terms of usability, functionality, user-skills and interoperability among systems (Mchunu, 2013). As a result, healthcare professionals in the public hospital of the Western Cape, South Africa are not making the most use of the systems. Unfortunately, explanations remain tentative and unclear, yet non-use of electronic systems defeats the objectives of its adoption in the sense that the plan to improve healthcare service delivery in the public hospitals may be delayed and the benefits not achieved as envisaged (Cline & Luiz, 2013; Mostert-Phipps *et al.*, 2013).

1.3 Research Objective

The objective of the study was to understand the reasons for low use (or non-use) of e-Health IS by clinical staff and clarify reasons for limitations in the clinical support use. The aim of the study was to acquire explanations from clinical staff, to the causes of limitations to the use (or non-use) of e-Health IS for clinical care support in terms of its functionality, usability and perceptions. The goal was to contribute additional insights on the existing body of knowledge on the use of e-Health IS in public hospitals of Western Cape, South Africa.

1.4 Research Questions

What are the causes of the limitations to the use of e-Health IS by clinical staff in public hospitals of the Western Cape, South Africa?

1.4.1 Research Sub-questions

1. What is the status of e-Health IS use in the public hospitals?
2. How do clinical staff make use of e-Health IS for clinical support?
3. How do clinical staffs' perceptions influence the use of e-Health IS?
4. How do limitations affect the use of e-Health IS by clinical staff?

1.5 Conceptualization

This section clarifies some of the key terminologies that are used in the course and context of this investigation: Public hospitals, Electronic health information systems (e-Health IS), Hospital information systems (HIS), Adoption, Use, Functionality, Usability, and Limitation.

1.5.1 Public Hospitals

Public hospitals are government established and funded healthcare institutions that provide healthcare services at a subsidized rate to the civic masses of a society (Snyders, 2013).

1.5.2 Electronic health (e-Health) Information Systems (e-Health IS)

In this study, e-Health IS are health information technologies (HITs) that enable execution and completion of daily operational activities in a hospital environment. These include tools used to manage, process and use patient information for administrative and clinical support purposes to deliver effective healthcare services (Haux, 2006; Miriovsky *et al.*, 2012). In the course of this study, e-Health IS and HITs are used interchangeably.

1.5.3 Hospital Information Systems (HIS)

Hospital information systems are the IT tools used by administrative clerks and healthcare professionals to automate patient administrative and clinical care processes within a hospital environment (Cline & Luiz, 2013).

1.5.4 Adoption (of e-Health IS)

In this study, adoption refers to the acceptance by healthcare practitioners to take up the use of HITs for providing healthcare service delivery (Lluch, 2011). It also involves processes

that include a number of activities such as decisions, assessments and evaluations of a new innovation – technology, into the functional structure of an organization (Price *et al.*, 2011)

1.5.5 Use (of e-Health IS)

"Use" can be defined as: to execute a function with an object in a particular manner for a pre-determined purpose (Oxford English Dictionary, 2013). In this study, *use* depicts the utilization of e-Health IS to support the execution of daily work activities in the hospital environment.

1.5.6 Functionality (of e-Health IS)

Functionality refers to the state, quality and extent for which a technology innovation has a practical use for its end-user groups. In the context of this study, this refers to e-Health IS fitness for its intended purpose(s) in a public healthcare institution (Meyer, 1989; Audet *et al.*, 2014).

1.5.7 Usability (of e-Health IS)

Usability refers to the ease, efficiency, and satisfaction experienced by end-user groups such as healthcare practitioners to execute their work activities with e-Health IS (Middleton *et al.*, 2013).

1.5.8 Limitation (of e-Health IS)

In this study, limitation refers to a restricting circumstance that hinders the acceptance and use of e-Health IS by clinical staff in public hospitals (Oxford English dictionary, 2013).

1.6 Intended Contribution of the Research

The intended contribution of the study was to offer additional insights to the existing body of knowledge on the usage of e-Health IS by healthcare professionals in South Africa and eventually low-medium income countries with overburdened public healthcare systems.

1.7 Delineation of the Research

The study investigated adoption with most emphasis on the acceptance and use of e-Health IS by healthcare practitioners in public hospitals. It is for this reason that only senior hospital administrative officials and clinical staff were selected, respectively, from the research population. Whilst the unified theory of acceptance and use of technology (UTAUT) theoretical framework has been modified to include additional constructs, the researcher adopted the Venkatesh, Morris, Hall *et al.* (2003) model based on its wide citation according to literature.

1.8 Ethical Considerations

Research ethical considerations are pre-requisites to ensure confidentiality and anonymity of participants in carrying out a research (Babbie, 2011a). To this effect, an ethical clearance letter was obtained from the University Ethic Review Committee and permissions from the Western Cape Department of Health were sought to approach the selected public hospitals for data collection. Thereafter, an informed consent letter requesting individual permission to collect data was sent to the prospective participants.

The consent letter informed the prospective participants of the research objectives and their wilful participation as well as how collected data will be secured. Furthermore, it clarified that participants could choose to withdraw voluntarily at any point during the session without giving reasons if ever they wished to. Consequently, the information gotten was kept anonymous and confidential of the participants. There were no misinterpretation of participants' responses; however a copy of the completed thesis would be made available to participants – on request.

1.9 Structure of the Thesis

The thesis was structured to six chapters as outlined in Figure 1:

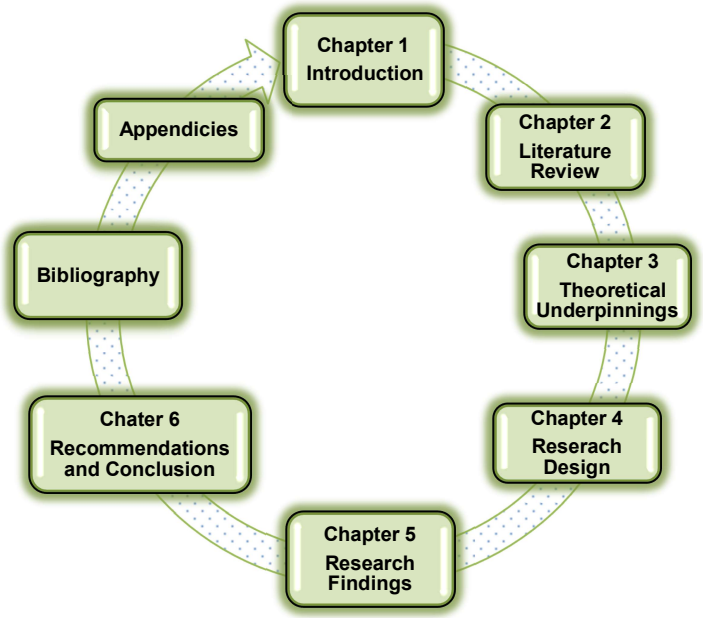

Figure 1: Structure of the Thesis

Chapter One: The background serves as an introduction to the field of information systems for the sake of this research. After, a problem statement is presented, the research problem thereafter, the research objectives and then the research questions. The definitions of key terminologies as implied in the context of this thesis are listed. The intended contribution and

delineation of the research as well as the ethical considerations for the purpose of the study were established.

Chapter Two: An in-depth review of existing literature is presented. It includes past scientific research by recognised scholar authorities in the e-Health field and the different phenomena that have been investigated. Also, the chapter compares the similarities and differences; the evaluation and assessment in terms of implementation and use of e-Health IS in the high income and low-medium income countries.

Chapter Three: This chapter discusses the use of theoretical underpinnings and presents the unified theory of acceptance and use of technology (UTAUT), as the theoretical framework that is used as a lens of analysis with regards to this study. Further, the chapter describes other theories from which UTAUT was developed, its constructs and its relevance in breaking down a complex phenomenon in other studies and its application in this thesis.

Chapter Four: This chapter represents the research design applied to this study. It provides an overview of the research approach which includes philosophical assumptions and methodology used to carry out the study. It describes the data collection processes and methods as well as the data analysis technique.

Chapter Five: This chapter presents the description of research findings. It discusses the key issues of investigation (or categories) and sub-categories from the data transcripts. The research findings are discussed (and critiqued) in relation to the theoretical framework and literature addressing the research problem

Chapter Six: This chapter outlines the recommendations based on the research objectives and findings. Also, an aftermath reflection on the research process as well as the limitations was stated, followed by possible research areas in future to conclude the thesis.

1.10 Conclusion to Chapter One

This chapter introduces the concept of information systems (IS) as defined and applied in different social contexts. The term suggests a social-technical relationship involving people, processes and information technology. It also illustrates the three major roles IS perform, which includes: management, processing and the use of data as meaningful information. Whilst there is a rapid adoption of information technology to improve different aspects of our daily activities in the society including the healthcare sector, there are limitations in terms of usability, functionality and user perceptions with respect to clinical staff that has led to low usage of implemented electronic systems referred to as e-Health IS.

The aim of the study was to explore the status of adoption but in particular, use of e-Health IS by clinical staff in the public healthcare sector in South Africa, and offer explanations thereof. Subsequently, research questions were designed to provide guidelines to investigate the phenomenon being studied. The conceptualization section defines the key terminologies used in the course of the study to give a clear definition to the terms as used throughout the thesis.

Consequently, as discussed in the structure of the thesis (Figure 1), an extensive literature review on the past and current studies relevant to the phenomenon of study is presented in the next chapter (chapter two).

CHAPTER TWO – LITERATURE REVIEW

2.1 Introduction

The aim of this study, as substantiated in the previous chapter, is to explore the status of the adoption and use of e-Health information systems by clinical staff in the public healthcare sector in South Africa, and explanations thereof. Of particular focus in this process was to understand the causes of the limitations more importantly to the use (and non-use) of e-Health IS by clinical staff in public hospitals of the Western Cape. To this effect, this chapter presents a review of literature in e-Health, e-Health Information Systems (IS) as well as related research developments and innovations in the field.

To map the status of research on the phenomenon of investigation, the chapter opens with a descriptive discussion of the concepts of electronic Health (e-Health) information systems (IS) and processes in section 2.2. This is followed by an overview of existing research on e-Health, e-Health IS and some key scholars in the field in section 2.3, then, a brief outlook at the adoption of e-Health IS in high income (HI) countries in section 2.4.

The adoption of e-Health IS in low-medium income (LMI) countries is discussed in section 2.5, followed by an overview of the South African case in section 2.6, and a conclusion to the chapter in section 2.7.

2.2 Electronic Health (e-Health) Information Systems (IS) and Processes

Electronic health, rather known as e-Health, continues to be an up-and-coming field such that different explorative studies are still being done in this area. Terms such as e-Health or e-Health or e-Health IS are interchangeably used to describe the systems, which include: telehealth, telemedicine, mobile e-Health (m-Health), hospital information systems (HIS), electronic medical records (EMRs), electronic health records (EHR) to mention a few (Mea, 2001; Blaya *et al.*, 2010). The term *e-Health* only came into use in the year 2000, and definitions of e-Health have varied with respect to its functions, stakeholders, and technology-specificity (Pagliari *et al.*, 2005).

According to Eysenbach (2001), e-Health refers to the use of ICT devices and the internet to aid public healthcare, medical informatics and business to render quality services and improve information dissemination. It provides a platform through which electronic media are used to facilitate and enhance quality assurance of the public consumers' healthcare service delivery by providers (Ball & Lillis, 2001). Moreover, with respect to medical informatics, the systems support new methods to create, keep and maintain records for hospitals as well as

improve management, accountability and security in processes (Ludwick & Doucette, 2009). In terms of business, e-health provides the opportunities for different health information technology (HIT) vendors to manufacture information systems (IS) that improve the handling of information by healthcare providers (Middleton, Bloomrosen, Dente, Hashmat, Koppel, Overhage, Payne, Rosenbloom, Weaver & Zhang, 2013). E-Health IS are information technologies that make use of developed software applications to manage, process and use information designed for administrative and clinical support functions to deliver efficient and effective healthcare services (Cline & Luiz, 2013).

However, alternative peer-reviewed scientific research emphasizes specifically on the use of inter-networked digital technologies, principally the internet, therefore distinguishing e-Health from plain medical informatics (Blaya *et al.*, 2010). In particular, the World Health Organisation suggests a more encompassing definition of e-Health as: "*the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research*" (WHO, 2005:pp 109).

The WHO definition justifies the scientific investigations done on e-Health IS to include the adoption of technology as a means to extend, assist and to enhance human activities and processes, rather than as a replacement (Oh *et al.*, 2005). Ultimately, from the WHO definition and literature, information and communication technology (ICT) can be 'used' widely in the healthcare field to support administrative, clinical and educational requirements.

2.2.1 Electronic Health (e-Health) Administrative Support Systems

Just as administrative processes are a corner-stone of most institutional undertakings, sound administration and ultimately, efficient administration systems are a basis upon which efficient healthcare service delivery can be built. The most common administrative support functions of these systems include efficiencies for collection, storage and retrieval of data through specific innovative ICT tools (Reichertz, 2006).

In terms of data collection enablers, e-Health IS tools such as patient admissions-discharge-transfer systems help administrative staff to register and update treatment progress of a patient from admission up until discharge or referral whilst minimizing errors (Blaya *et al.*, 2010). A practical example in this instance is that a hospital clerk would need to acquire, record the demographic and medical history details as well as the purpose of patients' visits to the healthcare institution (Cline & Luiz, 2013). In this process, accuracy as well as the time taken and security of each record are of paramount significance and would determine the quality of healthcare services the patient will receive from this point – henceforth. It is for

these reasons, then, that the quality of information-handling support systems, tools and processes are prioritized in this study.

The use of electronic systems helps to minimize duplication of inputs, thereby improving the accuracy of patients' data. By comparison to non-electronic processes for example, where the possibility of creating multiple records perhaps with conflicting versions of data for a particular patient is higher, a centralized electronic record can be generated for each patient (Ludwick & Doucette, 2009). Using electronic coding to identify, centralize and store all data categories into each patient record, various practitioners can easily retrieve, use and update a single file without duplicating the patient record (Blaya *et al.*, 2010). This way, the accuracy of patients' data and the efficiency of processes are enhanced as administrators work with updated records to easily direct patients to appropriate treatment points with minimized delays (Mbananga, Madale, & Becker, 2002). Further, when electronic systems are embedded with the automatic log-tracking capabilities, it becomes easier to identify and trace a trail of any amendment in a patient record.

Similarly, laboratory staff make use of a Laboratory Information Management System (LIMS) to input, store and report laboratory-specific operations (Blaya *et al.*, 2010). Some of these operations include keeping inventories of laboratory equipment, and laboratory test results (Di Bernardo & Martin, 2012). This enables earlier detection of shortage in laboratory supplies to facilitate quicker re-stock. Furthermore, one of the major advantages of the LIMS is that it grants clinicians an easier, more secure access to and quicker retrieval of laboratory test results when stored electronically by comparison to non-electronic manual methods. Thus, the system enhances cost and time efficiencies in both analysis and reporting of laboratory results, thereby contributing to the quality of patients' life-saving clinical care procedures and decision-making (Gode, Holzmuller-Laue, Rimane, Chow & Stoll, 2007).

In addition to the cost and time efficiency benefits, these administrative systems offer to the healthcare operational processes and also serve as a reliable basis upon which solid clinical healthcare support can be anchored (Klompas, McVetta, Lazarus, Eggleston, Haney, Kruskal, Yih, Daly, Oppedisano, Beagan, Lee & Kirby, 2012). A linkage between efficient healthcare administrative systems and the clinical support systems will, in turn, positively contribute towards a quest for improved healthcare service delivery.

2.2.2 Electronic Health (e-Health) Clinical Support Systems

These systems, sometimes referred to as clinical support systems (CSS), are software applications designed to manage and help healthcare professionals in decision-making as well as adherence to clinical guidelines (Marcos, Maldonado, Martínez-Salvador, Boscá & Robles, 2013). The CSS works such that patient symptoms are logged in on the system

interface, which matches it – the symptoms, to a medical knowledge database of clinical trials and uses software algorithms to generate possible recommended patient-specific treatment (Blaya *et al.*, 2010). It enables clinicians to examine and take down symptoms and medical history of his patients towards a definitive diagnosis.

Furthermore, a notable advantage is that it improves the convenience of storage and ease of retrieval of a patient's records (Bleich & Slack, 2010; Van Valkenhoef *et al.*, 2013). Thus, a doctor can recommend or administer proper treatment according to clinical guidelines, with a lower risk of adverse implications on patient's health. This way, clinicians are assisted in generating a more accurate medical report on a patient conveniently at will (Sittig & Singh, 2012). Moreover, in efficiently carrying out ward-rounds and drug administration reports, these systems assist nurses to draw conclusions on the degree of wellness – decision making of in-patients and to complement existing practice guidelines in cases of inexperience (Duan, Street & Xu, 2011).

Since the objectives of electronic healthcare (e-Health) information systems (IS) is/are to improve the quality of health care services delivery (Eyesenbach, 2001), the systems (such as electronic medical records) render assistance to both clinicians and nurses to practice evidence-based medicine, thereby confirming its value and significance. In recognition of these potentials, e-Health IS were identified and formally adopted as the most feasible way of providing the tools and knowledge base to improve health care at the 58th World Health Assembly (WHA) meeting in Palais des Nations, Geneva, in 2005 (WHO, 2005). To validate the benefits and the potential of e-Health IS usage in the healthcare sector in this study, the researcher conducted an overview of literature from renowned authors and the different studies that were academically published on e-Health IS and the research problem.

2.3 Overview of Research on e-Health IS

A host of multidisciplinary collections of resources were consulted to review the literature in the field of e-Health IS. Understanding the status of adoption and use of e-Health IS requires clarity of the concept of e-Health, e-Health IS and ultimately, leading researchers and the status of existing research in the field. For this purpose, cutting-edge research in peer-reviewed and top cited journals in the field of e-Health IS was explored in scientific databases such as Academic Search Premier, Science Direct, Science Citation Index and Google Scholar as well as non-peer reviewed publications through the Google search engine.

Key words embedded in, and which directly represent the phenomenon of the adoption and use of e-Health IS were identified and used as a basis for information search. In this process, various combinations of the terms such as e-Health, e-Health Information Systems

(IS), e-Health IS Adoption, Use of e-Health, e-Health in Public Hospitals, Healthcare Professionals and e-Health, as well as e-Health in South Africa – were used to identify the status of scientific and non-scientific research on the subject of e-Health, e-Health IS, its usefulness and usage patterns thereto, as well as related milestones and challenges at respective levels of analysis – starting from the global, to continental, national, regional, institutional and locally.

2.3.1 Status of Research in e-Health and Information Systems

The starting point was to clarify the scientific meaning of e-Health and the existing research in this field as discussed in section 2.2. At first glance, the concepts of e-Health and information systems appeared over-researched, when viewed from an uncritical eye.

As of the time of this write-up, queried from the most general search engine – Google, the 'e-Health' term search yielded a display of 789,000,000 results, of which 733,000,000 were associated with a search for 'e-Health information systems' – across both scientific and non-scientific sources. Despite the fact that non-scientific publications were of lesser interest to the scientific mandate of this scientific study, this exorbitant number of publications also show that 'e-Health' is a more encompassing word that captures all terms used to describe electronic information systems (e-Health IS). On this initial search, only the key words and no date limitations were set.

Subsequently, the number declined significantly when the search was narrowed down to a specific aspect of a research phenomenon. For example, the combination of key words including: 'Adoption', 'Use', 'e-Health Information Systems', 'Healthcare Professionals', 'Public hospitals', generated a reduced number of 4,940,000 publications. Searches were further refined to outline publications within the recent 5 year (between 2010 and 2015) period (in both scientific and non-scientific data bases).

When the same combination of keywords was queried in Google scholar (as per the scientific nature of this study), it yielded a far lower figure of 8,360 publications. Google scholar was chosen as a reference database to avoid the issue of publication duplicates across other academic databases. In effect, 5,950 of the 8,360 scientific publications had been conducted in high income (HI)[1] (such as the United States, Australia and some of

[1] High income (HI) countries refer to countries with gross national income (GNI) per capita above $12,000 (World Bank Group, 2015). The term is interchangeably used with "First world" or "developed" countries or economies.

Europe) countries. Focusing only on low-middle (LMI)[2] income countries, Figure 2 shows the percentage of scientific publications and clarifications in the passages that follow.

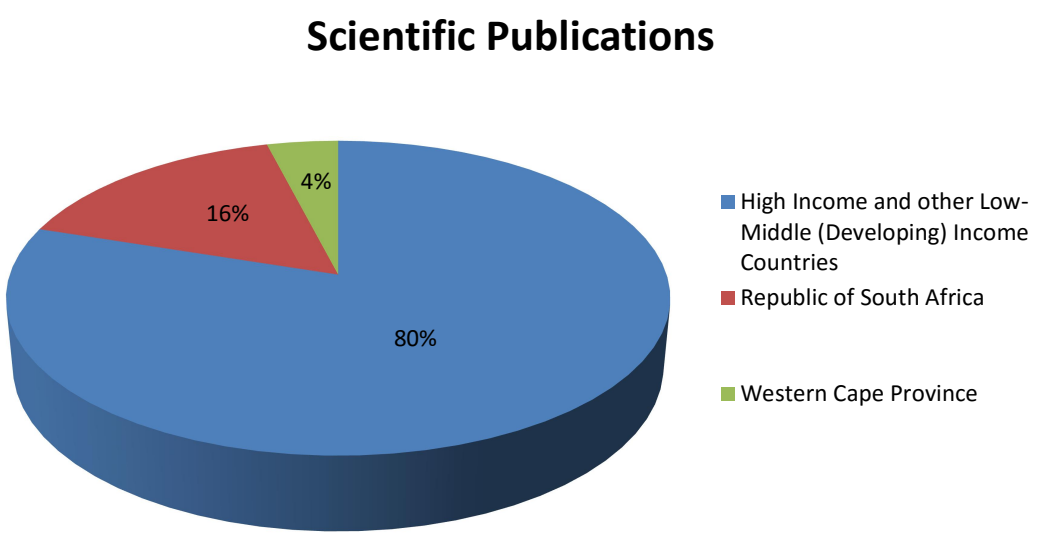

Figure 2: Status of Scientific Publication

With a slight alteration of the keywords combination to include developing and low-middle-income countries (including Africa), only 3,950 of the 8,360 scientific publications was found on Google Scholar. Only 1,320 (16%) articles on e-Health IS and healthcare professionals are published in 'South Africa'. Within this reduced number, only 333 (4%) scientific articles had been published on the local content of the 'Western Cape Province' which is the geographical area of analysis in this study. Even within this limited number of publications, there was not enough work published on the status and explanations to patterns of e-Health information systems usage by the clinical personnel in the public sector in South Africa, but more particularly, in the Western Cape Province.

Among these fewer publications, the concern is that the focus is often broader, covering general topics such as implementation benefits, factors affecting either adoption or use, and assessment studies which offer limited to no direct insight on the usage (or non-usage) of e-Health systems by clinical personnel in the public healthcare institutions in South Africa.

2.3.1.1 Lack of Adequate Insight in Existing Research

A number of studies have been published to understand the adoption particularly, the use of e-Health IS with positive implications including terms such as benefits, improvement,

[2] Low-middle income (LMI) countries refer to countries with a gross national income (GNI) less than $1000 or below $12,000 (ibid). The term (LMI) is used interchangeably with "underdeveloped" or "developing" countries or economies

enhancement, effectiveness, efficiency and commercial profit (Buntin, Burke, Hoaglin & Blummenthal, 2011). The focus of research on the potential of e-Health IS for scholars such as Ahern (2007) and Buntin *et al.* (2011) for example, have mostly been placed on the determinants of adoption, with findings suggesting the improvement of cost-effectiveness, time-efficiency, and quality enhancements as the key factors. However, emergent research suggest counter-digital divide efforts marked by calls for more coordinated, standardized and integrated e-Health IS implementations, mostly for the benefit of the under-served and difficult-to-reach population (Pagliari, 2007; Robertson, Cresswell, Takian, Petrakaki, Crowe *et al.*, 2010).

Contrary to this view, however, is a set of research that highlights the misfortunes of e-Health IS and its implementations. On this point, a number of authors argue that despite the benefits of e-Health IS, it may have undesirable effects on the vendors and users alike when not properly implemented. For instance, Heeks (2006) cited the public health services information system that failed in the Philippines because it was designed according to a western model, with no regard for the local context. The model assumed an ideal situation with the presence of skilled personnel such as software programmers and project managers, state-of-the-art infrastructure as well as the data output which were all non-existent in the Philippines context.

In another study, Adler-Milstein and Bates (2010) report a somewhat costly implemented computerised physician order entry (CPOE) in Cedars-Sinai hospital in Los Angeles that had to be, and was eventually abandoned due to stakeholder clashes. In this instance, the physicians were not consulted during the adoption processes, and when they were required to use the system, they rebelled on the basis that the system design added additional time to their work processes. This shows the importance of physicians' buy-in to system adoption, if investments are not to be wasted. In effect, the clinical personnel, including healthcare professionals such as physicians (with the assistance of nurses), are the chief driving force to a successful implementation of e-Health IS (Gagnon, Desmartis, Labrecque *et al.*, 2012).

The argument is that without the acceptance and an actual system use by healthcare professionals, the perceived potential benefits would unlikely be achieved (Li *et al.*, 2013). With respect to e-Health IS, aside from being used to manage and use data, it also provides support for remote access and delivery of distant healthcare services as well as ultimate clinical decision-making (Black, Car, Pagliari, Anandan, Cresswell *et al.*, 2011), for example, the use of tele-health devices for remote communication, retrieval of laboratory tests and radiological images between clinicians as well as to facilitate clinical procedures (Ash, Berg & Coiera, 2004; Black *et al.*, 2011).

Whilst this analysis offers a useful basis to the literature background, it does not give a full insight into the specific phenomenon of investigation - which is to understand the status of the adoption and actual use of e-Health IS by clinical staff and explanations thereto, in public hospitals in Western Cape, South Africa. Nevertheless, the wealth of published scientific evidence suggest that there are both benefits and barriers to e-Health IS implementations, especially multidisciplinary relations as reflected in relationships between stakeholders.

With respect to the benefits of multidisciplinary relations, Ammenwerth, Brender, Nykanen *et al.* (2004) argued that awareness of contributions from on-going and post-implementation evaluation studies of e-Health IS were routinely theoretical rather than practical. The subsequent contributions include: uncovering of implementation barriers, factors influencing users' expectations, improved decision-making, support for system development and procurement of appropriate technology. Consequently, the contributions are often insufficiently clear to the technical software developers, e-Health initiative drivers such as government officials and decision-makers (ibid). This can be attributed to managers and developers being unaware of the worth of evaluation studies.

Similarly, Ludwick and Doucette (2009) claim that while successful implementations of e-Health IS are championed by executives, an interdisciplinary approach is most likely to yield optimized outcomes. The interdisciplinary approach, in this regard, refers to the involvement of diverse stakeholders including end-user groups in a hospital environment on an e-Health IS implementation project (ibid). The authors argue that even though physician leadership of an e-Health IS project could be successful, a collaborative team effort is critical from the design to development, pilot to on-going and post-implementation phases. This collaborative effort is due to the fact that different individuals and end-users directly linked to the adoption of e-Health IS contribute varied perspectives according to their skills and work processes to ensure a successful project.

Again, this background clarifies different factors and conditions affecting the adoption of e-Health IS in healthcare institutions, but could not offer adequate insight on the likelihood for the adoption but particularly, use by healthcare professionals in the local context (the Western Cape, South Africa) as a focus of investigation in this study.

According to Dehling and Sunyaev (2014), patient IT health services (PHS) are information systems developed to promote to patient empowerment by granting them the support to manage health related information needs. However, PHS initiatives are not meant to incorporate requirements for health care organizations, medical professionals or care providers, but it (PHS) can be financed by individuals with the required resources (ibid). In as much as the PHS platforms are beneficial to patients, the non-involvement of relevant health bodies and healthcare professionals leave a gap, especially in terms of administration and

security of such services as well as information accuracy. Such gaps are, ultimately, detrimental to patients' health and safety.

Scientific investigations have been conducted in developing countries to find out factors that influence adoption and implementation outcomes of e-Health IS. For instance, Blaya *et al.,* (2010) evaluated the possibilities and potential outcomes of e-health IS implementations in developing countries. The findings showed that e-Health IS would improve management of administrative and clinical data as well as health information exchange (HIE) between healthcare institutions. Consequently, Fraser and Blaya (2010) reported the practical experiences from implementing e-Health IS initiatives in different developing country contexts. The authors listed the important requirements to consider in designing systems and strategies in a low-middle income environment. Parts of the requirements include: the need for a local leadership, power infrastructure, offline data management, continuous evaluation studies, and support for local developers. Similarly, Qureshi, Shah, Ullah, *et al.* (2013) investigated some of the most common infrastructural barriers of implementing e-Health IS in developing countries. These include less than adequate ICT devices and a lack of internet. Subsequently, Qureshi, Kundi, Qureshi *et al.* (2015) further investigated adoption and use issues in public health sector hospitals in developing countries. However, the investigation highlights different IT applications implemented for different purposes and use challenges hitherto identified by several scholars.

Yet again, these studies barely provide in-depth explanations to the causes of limitations or to the factors that influence adoption but particularly, the use of e-Health IS by healthcare professionals in the developing countries especially in the local context – as undertaken for this study.

Particularly in South Africa, as far back as 2000, Braa and Hedberg (2000) carried out a study on adoption strategies, software and processes to develop a district health information systems (DHIS) in Cape Town. The investigation was carried out on the Health Information System Programme (HISP) in South Africa which aimed at providing support to the emergence of a decentralised administrative structure in the health sector of South Africa. In 2003, Littlejohns, Wyatt and Garvincan (2003) carried out evaluation studies on a computerised integrated hospital information system in Limpopo, South Africa. The authors discovered reasons why e-Health IS implementation fails, thus leading to systems distrust by IT and healthcare professionals – clinical staff. The reasons were associated with complexities of healthcare processes, functionality and reliability of the systems, and failed expectations from different stakeholders ranging from the developers of the system to the hospital end-user groups.

An investigation by Ruxwana, Herselman and Conradie (2010) explored perceived factors that influence the adoption and use of ICTs as e-health solutions in Eastern Cape healthcare centres, South Africa. In the study, it was discovered that improved access to internet facilities, availability of relevant health-related information via ICT devices, ICT skills training and policies will likely improve support and maintenance of healthcare services delivery. Subsequently in 2014, Ruxwana, Herselman and Pottas (2014) developed a general quality assurance model (GQAM) to ensure successful e-Health implementations in rural hospitals in Eastern Cape Province. The study used a project management framework to explore quality assurance (QA) in IT and IS projects and hence developed a model for the rural contexts in South Africa.

Whilst there is evidence of scientific investigations on e-Health IS, it lacks relevant insight in understanding the actual status of adoption, with emphasis on the use of e-Health IS by healthcare professionals in the public hospitals. At first glimpse, it appears as if the field of e-Health in healthcare is well researched, it is clear from this general overview that the status of e-Health IS adoption and use by clinical staff are under-researched in South Africa, at least by comparison to research in high income countries.

2.4 Adoption of e-Health Information Systems (e-Health IS) in High Income Countries

The adoption of a technology refers to a process that involves the uptake of information and communication technologies which clearly encompasses acceptance and ultimately, its usage into a functional organization (Price & Lau, 2014). Acceptance means the realization and willingness, which informs perception to (or not to) use a technology (Venkatesh, Thong & Xu, 2012). Use, therefore, is closely related to adoption, in that it is informed and often preceded by adoption. Adoption, thus, holistically involves strategies such as investments in infrastructure, provision of incentives to different end-user groups, implementation and formation of policies to ultimately influence the use of technology (Lluch, 2011).

In the context of the healthcare sector, adoption of technology would be closely intertwined with the efforts towards implementation and the usage of technology tools and systems to facilitate the delivery of healthcare services (Buntin *et al.,* 2011). In high income (HI) countries, a wide range of such health information technologies (HITs), also known as e-Health IS, have been implemented (Price & Lau, 2014). Examples of implemented HITs include electronic records, online databases to facilitate access to medical journals, e-prescription systems, and video-conferencing with internet support.

However, while there are continuous adoption of e-Health IS by healthcare organizations to improve healthcare and efficiencies in the healthcare sector, usage patterns of e-Health

systems for their clinical practice remain unclear (Gagnon *et al.,* 2012). Although, adoption itself is an extensive subject matter that had (and is still solely) been investigated by several authors, nonetheless, it does not always translate to automatic implementation or actual use of such technologies in the public healthcare institutions, even in HI countries (Blumenthal & Tavenner, 2010). While *adoption*, *implementation* and *use* are terms that are closely related to each other, *usage* (or non-usage) is often associated with socio-technical considerations while taking up HITs (Lluch, 2011).

Cresswell, Bates and Sheik (2013) present ten key considerations to realize successful adoption and implementation of health information technologies (HIT). As a standard to assess e-Health IS in developed countries, these considerations were summarized into four technology lifecycle stages to simplify the complex nature of adoption, but most significantly, the implementation of e-Health IS and its overlaps (ibid).

The ten key considerations and the technology lifecycle stages are presented in Figure 3 below and elaborated in the passage that follows.

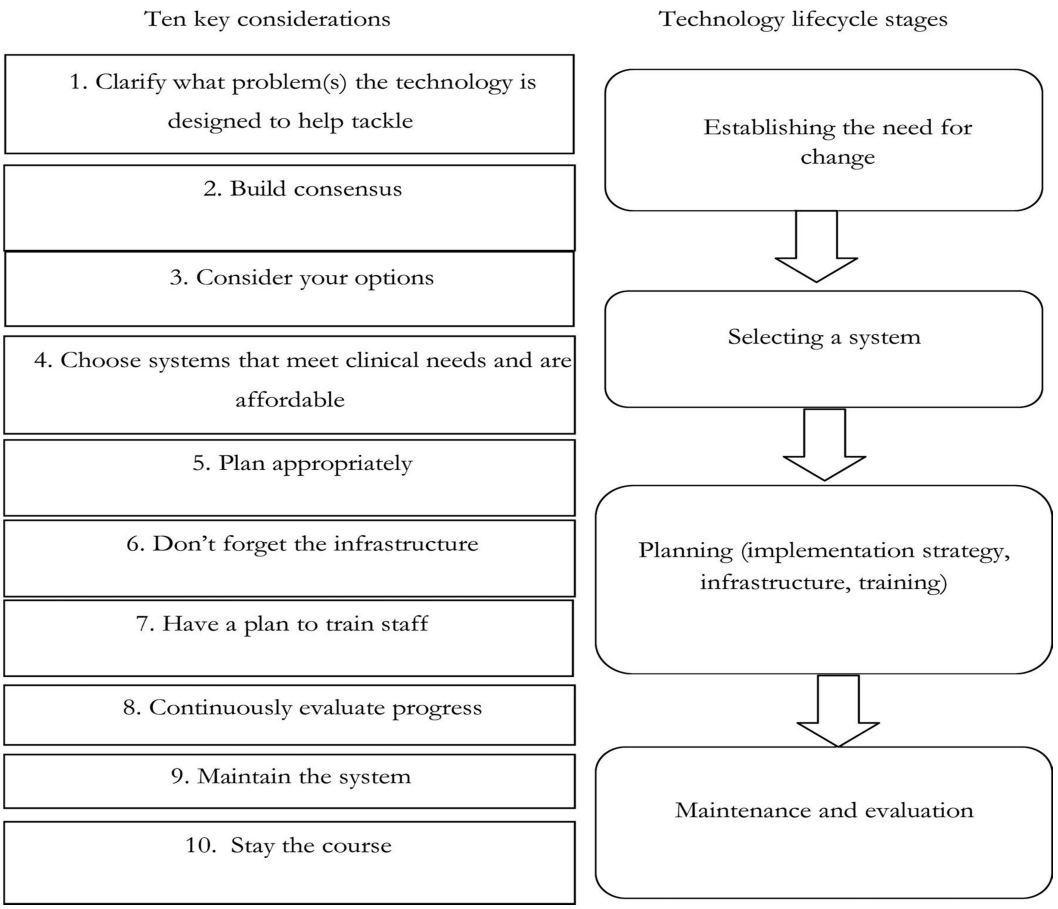

Figure 3: Ten Key Considerations for Successful Implementation of Large-Scale Health Information Technologies (Cresswell *et al.*, 2013)

The positive and meaningful usage of a newly adopted technology is a fraction of a well-conceived implementation strategy and process. As reflected in Figure 3, Cresswell *et al.* (2013) outline the four stages of a technology lifecycle – with the first phase being to establish the need for change. Based on the first phase, the second phase should be a selection of an appropriate system, even before the implementation can be decided upon. Thereafter, at the third stage, the planning (including the implementation strategy, infrastructure and training) should follow, and finally, at the fourth and final stage – should come the maintenance and evaluation. Although Cresswell *et al.* (2013) do not argue for a linear order of these four stages of the lifecycle, this is implied in the presentation and arguments. For example, the concept of a lifecycle implies an initial phase – which is usually the first phase that precedes other phases. Secondly, the presentation of the elements of the four phases, the key considerations of a successful implementation – is in sequential numerical order from 1 to 10, which implies a linear type of organisation.

The first 2 key considerations of successful implementation are presented under the first phase – the establishment of a need for change. The first key consideration is to "clarify what problem(s) such technology is designed to help tackle". This highlights the importance of assessing the existing technology (if any) and to identify problems as well as to articulate the extent to which a new technology might be required. Otherwise, it would be difficult to measure outcomes, particularly the improvements from implementing a new technology. Then follows (within the same technology lifecycle phase) the second key consideration. This is to "build consensus". It emphasizes the significance of a consensus among implementing parties. The argument is that consensus is best achieved through the formation of a strategic multidisciplinary stakeholders' group involving senior managers and end-users represented by administrative and clinical heads.

A tacit implication in this emphasis is, arguably, that stakeholder non-cooperation and divergent hierarchies can inhibit technology and systems implementations. Thus, the participation and involvement of different stakeholders would eradicate professional hierarchies and infuse a sense of co-ownership as well as commitment. It is after ensuring consensus that the third key consideration - "to consider your options", and the fourth key consideration - "choose a system that meets clinical needs and is affordable", which are located at the second phase of the technology lifecycle – 'selecting a system', which would make even more logical sense.

Once there is an established consensus on the need for a new HIT system, it is essential to commit adequate time and resources in thoroughly considering the most suitable system. The authors discovered that this aspect of system(s) selection and procurement is often

under-estimated, resulting in hasty decision-making, which might increase the failure rate of a technology implementation. For instance, while considering the possible and available options, it is important to go for a system tailored towards both organization and end-user needs as well as anticipating the possible risks. The possible risks are such that customized existing systems might not be inter-operable with a new technology (which, in most times, is commercially produced and affordable), resulting in the need to purchase new and integrated systems.

Hence, before a final decision on the most suitable system is made, it is important to base the final choice on a system that would fit both organizational purposes and clinical practice. It needs to be usable by end-users, especially healthcare professionals in terms of time-efficiency, cost-effectiveness and interoperability with other systems as they are the ultimate care givers to patients. When systems inadequately meet the preference of the intended end-user group, this, ultimately, results in failure to use the systems and unrealized outcomes. The procurement of a system that enables a degree of customization in practical is too costly hence, a cautious balance between functionality and affordability is essential.

In the third phase of the technology lifecycle – 'Planning', after a consensus has been reached and a system is finally selected, Cresswell *et al.* (2013) suggest the fifth, sixth and seventh key considerations. The fifth key consideration is to "plan appropriately", followed by the sixth consideration – "not to forget the infrastructure". The seventh consideration is to "have a plan to train staff". In planning appropriately, implementation strategies need to be tailored towards the transformation of an organization's existing systems and processes. Therefore, it is essential for the strategic group to engage extensively and decide whether to adopt an incremental transformation to allow space for reflectivity or a once and for all change across the hospital. Cresswell *et al.* (2013) suggest that running a parallel system (of paper and electronic systems) tends to duplicate processes, create inadvertent security concerns and increase medical errors, which are threats to patients' safety. In a bid to prevent errors and security concerns, securing the appropriate infrastructure is, arguably, the most important factor in the implementation of HIT systems.

Infrastructure serves as the platform on which software and other hardware operate. Examples of infrastructure include constant power supply, back-up power supply, sufficient bandwidth and appropriate storage devices. The risks associated with inappropriate infrastructure include reduction in speed of the system, regular loss of network connection and inevitable loss of data as well as damage to the system sometimes. Furthermore, users might get frustrated and develop negative attitude to use systems, resulting in the systems being under-utilized and eventually, the technology been discarded.

While planning and putting the appropriate infrastructure into place, there is a need to engage and train the staff. A set of end-users with basic computer knowledge would tend to be more comfortable with new technologies than those with a relatively low computer literacy. Cresswell *et al.* (2013) claim that for training to be effective, it is necessary for users to frequently engage and have a 'hands-on' experience. It is important for end-users to continuously use the features relevant to their work processes so that they do not forget system functions. Hence, the most effective training might be that which is tailored to individuals' work activities without undermining the possibility of learning other system features.

The last 3 key considerations are presented under the fourth phase of the technology lifecycle – 'Maintenance and Evaluation'. The eighth key consideration is "to continuously evaluate progress". After the selection of a system and cautious planning on-going, it is essential to conduct a constant evaluation of progress made thus far. Evaluation of progress gives an assessment of organizational and individual workflow processes, and it is often considered a reflection of post-implementation while planning and implementation activities take precedence (Cresswell *et al.,* 2013). It is essential to conduct evaluations in the form of pilot studies to get feedback from users in real-time in order to identify ensuing problems to make timely interventions and effect amendments. Hence, continuous evaluation of progress needs to be conducted over a persistent timeline in order not to miss materialized outcomes and the need for maintenance during and post-implementation.

The ninth key consideration is to "Maintain the system". System maintenance is essential throughout the technology lifecycle stages to ensure an uninterrupted operation during and post-implementation. According to Cresswell *et al.* (2013), system maintenance tends to be underestimated in HIT implementation, with the likelihood of future system expansion being rarely considered; this may result in unanticipated faults and implementation failure. To avoid total system implementation failure, an extra budget for future redesigning of HIT architecture such as infrastructural upgrades and personnel services needs to be considered and provided.

The tenth key consideration that Cresswell *et al.* (2013) discuss in the last phase of the technology cycle highlight the previous three phases and nine key considerations adhered to - "stay the course". In an ideal situation, it usually takes an unstipulated period of time before the outcomes manifest post-implementation and could be difficult to measure if not cautiously pre-meditated. This was attributed to the complexity of the socio-technical considerations associated to the different stakeholder needs at a healthcare organization. Nevertheless, with proper and continuous appraisals, the necessary adjustments can be tracked and effected. To track the expected outcomes – benefits in particular, the timelines set for implementation projects must be adhered to, creating enough room for the generated

data to be exploited and utilized. Hence, it is important to manage end-users' expectations to prevent disappointments in order to prevent development of negative attitudes during and post-implementation of HIT.

In conclusion, these ten key considerations serve as guidelines towards the achievement of a successful adoption including implementation leading to the use of HIT systems. For this reason, Cresswell *et al.*'s (2013) technology lifecycle stages were used to review the e-Health IS implementation and usage in the high income countries in subsequent sections (section 2.4.1; 2.4.2) and in low-middle income countries (in section 2.5 and 2.6 below).

2.4.1 Implementation of e-Health IS in High Income Countries

When effectively adopted, e-Health IS can enhance efficiencies in healthcare service delivery; hence, it is considered a key ingredient towards addressing healthcare priorities in developed countries (Lucas, 2008; Blaya *et al.,* 2010). The implementation efforts of e-Health IS should be tailored towards a country's current and future public health and healthcare priorities (Healy, 2008). For example, in order to improve citizens' health status such as managing prompt decrease in non-communicable disease and mortality rate cases, high income (HI) countries focused on making healthcare services delivery available and accessible by all. As such, all United Nations (UN) member countries have since developed the Millennium Development Goals (MDGs) (UNMDGs, 2005), a part of which is targeted towards reduction of mortality rates and other health related challenges, especially through various innovative use of ICT (Heeks, 2005). These challenges include measures to improve access to, and quality of, healthcare services for all persons, especially in low-middle income (LMI) countries.

The adoption of a national health information systems (NHIS) to facilitate this process has been a significant part of these targets among most member countries (WHO, 2008). For this reason, the e-Health IS adoption has received a great deal of attention since the first World Telecommunication Development Conference (WTDC) in Buenos Aires, Argentina, 1994 (Healy, 2008). In effect, the HI Countries have since led the way in the development of an innovative national health information systems (NHIS) (Mudaly *et al.,* 2013). The NHIS refers to a coordinated body of diverse components, that encompasses different health information procedures and applications, which enables the management, processing and the use of information, and knowledge to effectively deliver health care services to the public (Haux, 2006; Mudaly *et al.*, 2013).

The NHIS are either segregated or centralized. A segregated NHIS refers to a variety of health systems that are fragmented i.e. stand alone, to perform different purposes (WHO, 2008). Examples include patient registration systems, disease surveillance systems, and

clinical decision support systems (Haux, Ammenwerth, Herzog & Knaup, 2002). On the other hand, a centralized NHIS is a unified system designed to create and store a single shared electronic record of patient health indicators and enables healthcare providers to add or read information from other systems and institutions (WHO, 2008). Examples include the District Health Information System (DHIS) (Braa & Hedberg, 2002). These NHIS have been implemented in HI countries such as the United States of America (USA), United Kingdom (UK), Canada, Australia amongst others, with notable successes and challenges (Avgerou, 2008). Hence, insight was drawn from the UK and Australia healthcare systems to review the process of e-Health IS implementations so as to frame the context for the study of this phenomenon in the South African context as investigated in this study. The choice of these 2 high income (HI) countries was informed by their notable implementation initiatives and the practical challenges associated with these efforts.

2.4.2 Implementation of e-Health IS in the United Kingdom (UK)

As part of the literature review on this phenomenon, and in the context of the study where there is limited insight on the uptake and use of these systems by healthcare professionals in South Africa, the researcher drew insight from experiences in HI countries such as the UK - for inference purposes.

The literature suggests that implementation and management of e-health IS are mostly centralized in the UK public healthcare sector. Coiera (2009) refers to the NHIS implementation in the UK as a top-down approach. In this approach, the management of the National Health Service (NHS) under the Department of health (DH), created the National Programme for IT (NPfIT) in October 2002, which deployed a single central electronic record for healthcare consumers (Mudaly *et al.*, 2013).

The objective of the single electronic healthcare record system according to the agreement between the government and the NHS England was to improve the effectiveness, accessibility and availability to healthcare services by March 2015 (The mandate, 2015). The commitments were directed towards reduction of mortality rates to ensure consumers have positive experiences of care and the availability of healthcare services to all, irrespective of geographical location (Richards, King, Reid, Selvaraj, McNicol, Brebner & Godden, 2005). Achieving these targets required the UK healthcare practitioners to integrate ICT into their practices with the right incentives (Kouroubali, 2003), a development which was enabled by connecting all NHS staff to the NHS Network (NHS Net.) for health information exchange (HIE) over the Internet (Richards *et al.,* 2005). The connectivity initiative was meant to improve accuracy and timeliness of patient data. It was supposed to simplify communication between healthcare organizations, healthcare practitioners and consumers, as well as offering a more secure channel for patients in referral cases (Johnson, 2010).

The most prominent e-Health systems in the UK include the NHS email system, Picture Archiving and Communication System (PACS), Summary Care Record (SCR) and a Detailed Care Record (DCR), among others, and are used to facilitate widespread access to primary healthcare (Waterson, 2014). Whilst the objective of the SCR systems was to allow practitioners access to consumer electronic health information in any part of the country, the DCR system was designed to grant practitioners in a region, a comprehensive description of consumers' health history (ibid).

During SCR implementations in October, 2010, the system was earlier intended to have served up to 24 million citizens by March 2013 (Barbarito, Pinciroli, Barone, Pozzo, Ranza, Mason, Mazzola, Bonacina & Marceglia, 2013). A total of 21 million patients had been registered on the system as of January 2013, meaning that they had achieved 88% of their connectivity target over a period of 2 years and 2 months (Waterson, 2014). It can be inferred from the registration that IS implementation in the UK healthcare sector was a success. For example, practitioners can now have a quicker and safer access to up-to-date, accurate essential information. This would enable them make decisions and prevent mistakes while rendering treatment. For patients, quicker access to enhanced healthcare and easier communication to providers indicate positive implications from improved efficiency of healthcare services delivery and improved health status.

A successful systems implementation, according to Cresswell *et al.* (2013) in Figure 3, should, at the very first instance, clarify the problem a technology is designed to solve. In the case of the NHS in the UK, it identified and articulated the problem of limited access to clients' record by practitioners nationally. Ultimately, the NHS realised the need for easier access to patients' records in all parts of the country, hence the implementation of SCR in 2010. As the first step, the NHS connected its staff, including healthcare practitioners, onto a network to facilitate service delivery, which happens to be in line with Cresswell et. al.'s (2013) 1st consideration in the technology lifecycle as discussed in Figure 3. Further, the 2nd key consideration in Figure 3 - building consensus between relevant stakeholders - is paramount to implementation success. Even though e-Health IS installation and connectivity appears to reflect the 88% success rate, the fact that implementation was centralized in top-down format suggests a bureaucratic rather than a consensus approach. For this reason, as elaborated in section 2.4.1.2, acceptance and buy-in challenges by healthcare practitioners can be expected down the implementation path whilst the converse can also be expected.

In line with the 3rd key consideration of systems implementation in Figure 3, considering system options and, ultimately, using such insight to choose a system that meets clinical needs (ensuring that such system is affordable) – the 4th key consideration, is vital to a successful implementation. In this regard, it is not clear in the literature how the NHS considered other alternative options. As it emerges under the challenges in section 2.4.1.2

however, the evidence points to the contrary. Instead of spending time to verify the needs of the end-users and comparing solutions that address their specific needs, the NPfIT began implementing the SCR based on the central estimations of what the administrative and clinical functions in the UK health system should and could be. The expectation from central implementers was that healthcare practitioners would have a quicker access to and up-to-date information about patients to enhance timely decision-making, and ultimately, improve their operations and service delivery.

Whilst the 88% connectivity rate seems high, it should be seen in the light of the intended projections. Specifically, 88% implies a deficit of 12%, which suggests that there were likely challenges, as the percentage figures also imply installation and connectivity of users without reference to usage (and non-usage) patterns.

2.4.2.1 Challenges of e-Health IS Implementation in the UK

The main point emerging from the review of literature is that the UK, as one of the high income countries, has made efforts, albeit with notable challenges, to implement e-Health systems in the public healthcare sector. Although a track record of e-Health IS practice is evident, there are clear challenges that depict the complexity of e-Health IS implementation, even in the developed country context.

While connectivity alone does not imply full implementation of the system, a seamless application of the system to facilitate pre-determined healthcare service delivery is necessary to determine success rate. In this respect, usage challenges were more pronounced in implementation studies in the UK. For example, there were functionality challenges in implemented systems to the extent that they could not be used for all intended purposes, resulting in low usage (Waterson, 2014).

To illustrate the complexity in implementing e-Health IS – evaluations of the UK process indicate that both the SCR and DCR systems were actually designed without adherence to local requirements and were hardly compliant to established standards. Although the UK case is cited for inferential purposes only, insight from the UK experience can create a comparative context for the South African case under investigation in this study.

According to the preceding passages above, the biggest factor contributing to low systems usage in the UK public health sector was a lack of SCR synchronization with other related systems i.e. inter-operability (Johnson, 2010), thus making it difficult to use the systems for clinical support purposes. For example, the system did not fit the usual workflow, thus limiting its use to only administrative functions. Implications of systems that do not fit clinical support by healthcare practitioners suggest that there was a lack of extensive involvement of end-users in the approach employed by the NPfIT for the SCR implementations. The

argument is that the 2nd key consideration by Cresswell *et al.* (2013) in Figure 3 – to 'build consensus', was inadequately addressed during the implementation processes.

Furthermore, according to Figure 3, the 5th consideration is to 'Plan appropriately' to achieve a high implementation success rate, otherwise there is a possibility of failure to use the systems. In the UK case, there appears to have been a hasty decision during system considerations and a lack of cautious selection of a suitable system on the path of the NPfIT. Consequently, the SCR did not fit healthcare practitioners' clinical activities, thereby resulting in low usage of the system. On this basis, it was argued that the original benefits of the systems were not realized. To this effect, the latest report of the National Audit Office (NAO) alludes that 98% of the perceived objectives of these implementations were yet to be realized as expected by the NPfIT within the NHS in the UK – during the time of writing this work (Waterson, 2014). A notable lesson for countries implementing e-Health IS is that extensively involving end-users to get feedback during and post-implementation would likely increase success rate of system implementation projects and lessen impending challenges.

The technology lifecycle by Cresswell *et al.* (2013) in Figure 3 was used as a lens to assess the implementation efforts by the UK. Whilst the progress report showed implementation success in terms of installation and connectivity in section 2.4.1.1, there were subsequent challenges. These challenges observed, in the case of the UK, reflect the complexities that accompany health information technologies (HITs) implementation, leaving one to wonder how e-Health system implementations are unfolding and managed in the low-middle income countries such as South Africa. Using a single case such as that of the UK, may be too limited to make a conclusive inference on implementations in high income countries. For this reason, the implementation of e-Health IS in Australia, a country with both first world development characteristics and some equivalence to the South African economic conditions is reviewed in section 2.4.1.3.

2.4.3 Implementation of e-Health IS in Australia

As argued in preceding sections, the 1st key consideration, according to Cresswell *et al.* (2013) (Figure 3), is to clarify the problem a system is designed to solve. In line with this argument, the Council of Australian Governments (COAG) identified a problem of limited efficiency in the Australian public healthcare sector and resolved that it was necessary to enhance healthcare services delivery. As the 2nd key consideration in Figure 3 further suggests, a need to build a consensus among the different stakeholders, a consensus was reached among the healthcare decision-makers in Australia to establish the National e-Health Transition Authority (NEHTA) in July 2005 (Pearce & Haikerwal, 2010). The fact that NEHTA was jointly funded by the COAG and all State and Territory Governments to ensure that it successfully carried out its national mandate suggest a sense of consensus, reflected

in collaboration among various institutions that administer the national public healthcare sector in Australia.

For this reason, the Australian National Healthcare Information System (NHIS), according to Coiera (2009), can be described as a middle-out approach type of NHIS engineering. It advocates for an encompassing involvement of health providers, the IT industry and end-users, resulting in the development of a common set of national goals (Mudaly *et al.*, 2013), a collaboration which was paralleled by the formation of a multi-disciplinary stakeholders to achieve the set national goals of enhancing healthcare services delivery to Australians.

In the case of enhancing healthcare service delivery, a consensus was also reached among the collaborating national and regional institutions on a path towards solutions. In this case the NHIS was mandated to devise measures to clarify and enhance healthcare services through the adoption and use of e-Health solutions (Pearce & Haikerwal, 2010). After a consensus is achieved, the 3rd characteristic of systems implementation in Figure 3 that Cresswell *et al.* (2013) recommend implementers to consider the options - on the system choice (still implying that such considerations are made collaboratively and inclusive of all relevant stakeholders).

At this point, the COAG seems to have operated in line with the first 3 key considerations of the systems implementation framework. When considering system options, however, the 4th key characteristic advises decision-makers to ensure that the sought system meets clinical needs, and that it is affordable. Under these considerations, the COAG facilitated the development of the national e-Health initiative that would oversee the adoption and implementation of the appropriate e-Health system in Australia in 2010. The e-Health system was branded as Personally Controlled Electronic Health Record (PCEHR), to be rolled out in the country by July of 2012 (NEHTA Strategic Plan, 2012).

The 5th key consideration for a successful system implementation in Figure 3 is to plan appropriately. Subsequently, NEHTA stayed committed towards a continuous plan to develop and evolve the national infrastructure for e-Health IS support in Australia (NEHTA Strategic Plan, 2012). As a result of this level of discipline, the plans by NETHA were achieved through the Australian Government's commitment through substantial financial investments into the healthcare system, and the focus on developing an e-Health IS enterprise architecture (EA) frameworks supported by national as well as international standards (Anderson, 2007). An evident lesson for countries in the process of implementing e-Health IS successfully, therefore, is that paying attention to the planning process may increase system implementation success prospects.

According to Cresswell *et al.* (2013), the 6th key consideration is arguably the most vital factor to achieve a successful systems implementation, which is providing the right

infrastructure. The availability of huge financial funds ultimately, creates the opportunities to procure the appropriate infrastructure that support the current setting and future expansion in the healthcare sector as well as personnel skills to come up with frameworks and standards that meet national and local needs. Serving as guidelines, the standards adopted include: the open group architectural framework (TOGAF) and service-oriented architecture (SOA). They were designed to guide compliance and inter-operability of e-health IS and to support long-term transition strategies within the existing frameworks (Mudaly *et al.*, 2013; Aung & Whittaker, 2013).

The latest NEHTA scorecard report suggests that there have been evident progress in the installation and connectivity of the PCEHR systems across all healthcare institutions in Australia (NEHTA, 2013). According to the 8th key consideration in Figure 3, however, it is necessary for implementers to constantly conduct an evaluation of progress. In line with this guideline, the Australian scorecard report served as an evaluation feedback on PCEHR implementation across Australia. The scorecard showed a significant increase in the number of organizations registered and assumed to be using the PCEHR system; from 3,039 on 22nd May to 4,502 as at 10th July in 2013, an increase of almost 50% in 3 months.

The scorecard helped the implementers to evaluate the rate of implementation and to measure the situation at healthcare institutions connected to the PCEHR. It was discovered that, there was a low level of use by consumers hence the implementers resolved to develop strategies that would prompt PCEHR usage to get optimum benefits (NEHTA, 2013). As at 31st July of 2013, a total of 612,391 users had registered for an e-Health record. The Departmental milestone of 500,000 registrations by July of 2013 had been reached and exceeded (ibid). This was an increase of almost 250% since the previous month (May 2013) scorecard. The growth rate as of 31st July was over one-third of the projected total of 1.5 million citizens set for the end of the 2014 financial year.

The growth rate was mainly attributed to the Aspen-assisted registration program funded by the Department of Health and Ageing. The program initiated strategies and incentives to prompt the adoption of PCEHR amongst healthcare providers as well as consumers so that they could gain maximum service benefit. A lesson that can be learnt by low-middle income countries on the significance of evaluation is that continuous assessment studies should be carried out to enable implementers determine level of completion and success rates relative to the timeline of HITs implementation projects. Similar to the UK case, the Australian government appears committed to achieving a successful implementation of e-Health IS across the country, yet the process was not immune to operational challenges.

2.4.3.1 Challenges of e-Health IS Implementation in Australia

Irrespective of milestones on the implementation of e-Health IS in Australia, complexity is also reported, with system inter-operability problems experienced by physicians, resulting into low system usage (Sprivulis, Walker, Johnston *et al.*, 2007; Xu, Sorwar & Croll, 2013). For example, the choice of a system with minimal consideration for its integration with existing technology facilities seems to discount the needs of the user. Another essential factor towards a successful system implementation, according to the 5th key consideration (Figure 3), however – is to 'Plan appropriately'. Such a lapse in planning when choosing the PCEHR would either result in minimal or non-utilization of the system, which was the case in Australia (Xu *et al.*, 2013).

As observed in the case of Australia, despite a relative adherence to some of the key considerations presented in Figure 3, implementers did not fully deliberate on all possible scenarios during the choice of a system, a lapse which compromised usability, and ultimately the acceptance of the PCEHR system by healthcare practitioners. A lesson for countries implementing e-Health IS tools thus, is that inclusive considerations of the interests of all stakeholders should be prioritized when planning the implementation of a new technology solution.

Background insight from developments in the UK and the Australian healthcare systems in this section maps the context of e-Health IS adoption and implementation.

In summary, an analysis reflects the complexity in e-Health IS implementations as reflected in mixed outcomes in both countries. In the UK for example, the government realized the inadequacies in accessing patients' health information by healthcare practitioners. To tackle this problem, the NPfIT, through the UK NHS, decided to deploy a centralized electronic record across the country's healthcare institutions. There was a reported 88% success implementation rate in terms of installation and connectivity of the summary care record (SCR) system with implications of improvements in time-effectiveness and easier access to health information. However, functionality challenges impeded systems usage by healthcare practitioners.

Similarly in Australia, at first glance, the analysis suggests a successful implementation rate in terms of installation and connectivity across healthcare institutions to the PCEHR. On careful observation, however, implementation challenges reflected by a low level of usage as reported by the NEHTA score card paints a complex scenario. Explanations point to a lack of integration of the new system with other e-Health systems in Australia.

To further understand the status of adoption, implementation and use of e-Health information systems, insight from the UK and Australia is further compared with implementation developments in selected African countries such as Rwanda, Kenya, and South Africa.

2.5 Adoption of e-Health IS in Low-Medium Income Countries

Despite the international (foreign) aid, the poverty and healthcare challenges in low-medium income (LMI) countries call for major redress efforts. For example, the majority cases of Human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (HIV/AIDS) epidemics occur in LMI countries (Mamlin, Biondich, Wolfe, Fraser, Jazayeri, Allen, Miranda & Tierney, 2006). Particularly, African countries have made the least progress in reducing the risks of neonatal deaths (28%) compared with countries in East Asia (65%) (Dickson, Simen-Kapeu, Kinney, Huicho, Vesel, Lackritz *et al.*, 2014). Scientific literature and policy documents by the international healthcare support structures such as the World Health Organisation (WHO) suggest that the most feasible solution to redressing healthcare challenges is through the adoption of health information technologies (HITs) (Nuq & Aubert, 2013).

A paradox, according to the literature however, is that while notable efforts are forthcoming, a wide adoption of e-Health systems still ranges from minimal to non-existent in a number of LMI countries, mostly due to varying socio-economic, political and technology infrastructural development circumstances (Adebesin, Kotzé, van Greunen & Foster, 2013). Nevertheless, several of these LMI countries are signatories to the UN Millennium Development Goals (UNMDG) that advocate a commitment to implement HITs to redress disease occurrences and improve healthcare services delivery (Mudaly *et al.*, 2013). Notable implementations include the Rwanda health management information system (R-HMIS) in Rwanda, Open Medical Record System (OpenMRS) in Kenya, hospital information systems in Nigeria and the District Health Information System (DHIS) in South Africa.

In the context of the study where there is limited insight on the uptake and use of these systems by healthcare professionals in Western Cape, South Africa, the researcher drew insight from experiences of different low-medium (LMI) countries. To contextualize e-Health IS adoption particularly; use in the context of this study in South Africa, Rwanda's efforts to implement health information technologies to improve healthcare service delivery to her citizens is discussed in the section 2.5.1.

2.5.1 The Case of Rwanda

Rwanda is an east-central African country that was plagued with political crises resulting in a war and genocide of more than 1 million people between April and July, 1994 (Government of Rwanda, 2014). These tragic events contributed to the deterioration of infrastructure and services, including the health system. According to the 4th and latest Rwanda Population and Housing Census (RPHC4) in 2012, the population of Rwanda was estimated at 10.54 million. Statistics show that 83% of this population live in the rural areas, with high poverty

and a desperate rate of healthcare related challenges – due to a legacy of the past civil wars (Frasier, May & Wanchoo, 2008).

In terms of the public healthcare challenges, a total of 79,465 deaths occurred in the Rwandan population due to various diseases during the year preceding the 2012 census (NISR, 2012). It implies that more than 217 persons (derived from 79,465/365) die of Malaria, HIV/AIDS, Tuberculosis (TB), maternal and childhood related diseases daily in Rwanda. HIV/AIDS related healthcare challenges account for a significant part of this mortality rate, with only 13,000 of the 37,000 reported cases in 2007, existed by 2012.

Further, whilst a reduction of the mortality rate ranks high in the UN Millennium Development Goals (UNMDGs), the infant Mortality Rate (IMR) remained as high as 48.6% rate (and around 50% during the first year of life) in Rwanda (ibid). It is on this basis that the Government of Rwanda urgently initiated efforts to improve the public healthcare sector, including healthcare services delivery in the country. In line with the 1st key consideration by Cresswell *et al.* (2013) in Figure 3, it is critical at first, to clarify the problem a system is designed to solve. The Rwandese Government realized a lack of access to healthcare services post-1994 Genocide. Hence, efforts were initiated to improve healthcare services delivery in the public sector by building a responsive national health information system (NHIS) including the implementation of e-Health IS by 1999 (Musango, Makaka, Muhongerwa & Kalisa, 2013).

2.5.1.1 Implementation of e-Health IS in Rwanda

The Rwandan Government's acceptance of ICT initiatives and tools was great. According Cresswell et al. (2013) in Figure 3, the 2nd key consideration after a problem has been identified is to build consensus to achieve a successful e-Health IS implementation. Through the Ministry of Health (MoH), the government applied a collaborative approach across all stakeholders in the commitment to reform the population's health status. The main objective of the stakeholders was tailored to ensure a successful e-health IS implementation that addresses the need to provide equitable access to healthcare services for all citizens post 1994 war and genocide in Rwanda (Gerber, Olazabal, Brown & Pablos-Mendez, 2010). The collaboration of stakeholders indicates a consensus which led to the introduction of the health insurance scheme in 1999 and the use of the mutual health organizations (MHOs)[3] towards achieving universal health coverage (UHC) for all citizens (Franco, Diop, Burgert, Kelley, Makinen, Simpara & Tidiane, 2008).

[3] MHOs are voluntary organizations that provide health insurance services to their members. They are usually owned, designed and managed by the communities they serve (Franco, Diop, Burgert, Kelley, Makinen, Simpara & Tidiane, 2008).

Once a consensus is reached, the 3rd key consideration of the systems implementation framework in Figure 3 by Cresswell *et al.* (2013) suggests that the collaboration of all stakeholders and implementers are to consider the options - on the system choice. While considering system options, the 4th key consideration recommends that decision-makers should ensure that the sought after systems meet clinical needs and that it is affordable. In line with these considerations, Rwanda's MoH Nationwide e-Health IS initiative included the implementation of a national inter-operable electronic health information system (Gerber, Olazabal, Brown & Pablos-Mendez, 2010). An example of an e-Health systems initiative is the Rwanda Health Management Information System (R-HMIS) (Mudaly *et al.*, 2013).

R-HMIS is a modular web-based software package built on the District Health Information System open source software (DHIS-2) implemented by MoH in 1997 (Frasier, May & Wanchoo, 2008). It is the main tool used for collection, validation, analysis, and presentation of aggregate statistical data for the health sector. The use of R-HMIS was enhanced the management, processing and the utilization of healthcare information across the country. By 2012, the primary health care utilization rate of out-patients through data surveillance was reported to be approximately 0.8 visits per inhabitant (i.e. 8,331,011 visits/ 10,537,222) (Rwanda Ministry of Health, 2012). Other health information sub-systems on the R-HMIS platform include: SISCom, a quarterly tuberculosis (TB), infant and child death audit reporting system. The implementation of R-HMIS simplified the housing of large data sets from Hospitals, Health Centres and private health facilities monthly reports.

Another example of an e-health IS initiative is Rwanda's Treatment and Research AIDS Centre network (TRACnet) deployment in 2004 to support the rapid extension of HIV/AIDS clinical services in all hospitals and health centres in the country (Frasier *et al.*, 2008). TRACnet is a dynamic phone and web-based information management solution that collects, stores, retrieves, and disseminates critical support programs and drug information related to HIV/AIDS care and treatment to patients (Rwanda Ministry of Health, 2012). Aggregated data is reported on a monthly or bi-weekly basis into a repository managed by the Central Government (Frasier *et al.*, 2008). Under the leadership of the MoH in association with the Treatment and Research AIDS Centre (TRAC)[4], TRACnet has increased the efficiency of Rwanda's HIV/AIDS program management and has enhanced the government's capacity to monitor the quality of patient care to infected patients. The TRACnet system was reported to have a satisfactory completeness of 90% and timeliness of 62% (Rwanda Ministry of Health, 2012).

[4] TRAC changed its title to TRACplus to reflect the changes expanded to encapsulate malaria and tuberculosis as part of its broader mandate, and plans to later include other conditions (Frasier, May & Wanchoo, 2008).

A significant progress in quicker access and improved services delivery of public healthcare services has, in turn, become evident. In 2012 for example, health facilities received a total of 8,331,011 out-patients out of the total population. The increase was linked to improved accessibility of financial support for citizens through the use of a community based health insurance (CBHI) program (Mutuelles de Santé)[5] by 2006. The CBHI program utilizes a web-based database to collect and store private information, which is used to determine the financial viability of the patient to cater for their healthcare services. Between 2011 and 2012, the average adhesion rate to CBHI program in the country had risen to 90.7%. By introducing CBHI across the country, the Ministry of Health helped to ensure equitable access to quality health services for the population of Rwanda (Rwanda Ministry of Health, 2012).

Another essential factor of achieving a successful systems implementation is presented as the 8th key consideration in Figure 3 (Cresswell *et al.*, 2013). It recommends implementers to continuously evaluate progress of the implementation process. For instance, the TRACnet systems report demonstrate evidences of evaluation during and post-implementation as well as use progress of the TRACnet system. However, it is evident from the satisfactory completeness of 90% and timeliness of 62% that there are challenges that deterred optimized usage, as reported in the case of high income (HI) countries in section 2.4.1.2 and 2.4.1.3.

2.5.1.2 Challenges of e-Health IS Implementation and Use in Rwanda

As realized in HI countries, e-Health IS implementation is significant but also difficult, with complexity levels varying in different country contexts and, ultimately, affecting system usage. In the case of Rwanda, the objective, as of 2004, was to have connected all 748 facilities the TRACnet system by 2012, yet only 337 had been linked to the system over an 8 year period, due to local development challenges (Rwanda Ministry of Health, 2012). While the system reflects a positive development towards the objectives to improve public health and service delivery, shortcomings deterred efficiencies post-implementation.

In particular, implemented systems were not designed to easily pass information/data from one system to another (Frasier, May & Wanchoo, 2008; Pavalam, Jawahar & Akorli, 2010). For example, TRACnet is only integrated with a drug procurement system (CAMERWA) but not with other e-Health IS such as medical records, surveillance, and laboratory test results (Frasier et al, 2008). In Figure 3, the 5th key consideration to achieve a successful HIT implementation by Cresswell *et al.* (2013), is to plan appropriately during and post-implementation to prevent a likelihood of system non-usage. Subsequently, the lack of

[5] Mutuelles de Santé means 'Mutual Health Insurance Scheme' in French.

integration between the TRACnet and other medical e-Health systems resulted in limited data entries, duplication, loss of critical information, missed opportunities for timely intervention and ultimately, loss of investments. These challenges were associated with non-adherence to design standards and the interoperability guide of e-Health IS (Adebesin *et al.*, 2013). The practical implication is that healthcare professionals who are supposed to use these e-Health IS in the public healthcare institutions would tend to develop negative perceptions that may eventually lead to low usage or ultimately, discard the system.

Similarly, Fuchia – an electronic medical record system for the collection, storage and follow-up data for HIV patients, usability had a major usage challenge (Frasier *et al.*, 2008). The system posed flexibility and adaptation challenges as all changes to its code had to be made by the original developers, thus the forms were fixed and could not be edited (ibid). Again, this challenge could be associated with lack of standards guiding the design of e-health IS to include and adhere to local conditions. As a result, the implementation and usage of the system had to be suspended in 2007 due to a lack of data accuracy, insufficient reporting and clinical tools (Frasier *et al.*, 2008).

The 6th key consideration by Cresswell *et al.* (2013) in Figure 3 argues the importance of securing the appropriate infrastructure. In the case of Rwanda, implemented systems often lacked security features necessary to protect patient confidentiality, which risks patient information (Frasier et al, 2008). Thus, the implication is that an unauthorised person can compromise the safety of large amounts of patient records since these records are available electronically and lack access control (Garson & Adams, 2008).

According to Cresswell *et al.* (2013) in Figure 3, the 10th key considerations is to stay the course. If implementers had detected the usage challenges at an earlier stage of the Fuchia implementation, a timely intervention to re-evaluate the system might have been possible rather than a total suspension and ultimately loss of investments.

It is clear in this short discussion that low-medium income (LMI) countries such as Rwanda accept (and is attempting to adopt) e-Health IS as a vehicle to improve its healthcare service delivery. However, it emerges that successful HIT implementation is difficult to achieve, as discussed in the cases of high income countries in section 2.4.1.2 and 2.4.1.4. In the case of Rwanda, a lack of inter-operability of e-health systems, lack of cautious planning and security concerns affected the implementation of e-Health IS.

To further assess and understand the adoption status of e-Health IS in related LMI countries, implementation efforts in a country with slightly different conditions to those of Rwanda, which is Kenya, are explored in the section 2.5.2 to compare with the conditions of the context of this study – Western Cape, South Africa.

2.5.2 The Case of Kenya

In Kenya, the population is currently estimated at 44.61 million, which is more than four times larger than that of Rwanda (World Population Review, 2014). Unlike the Rwandan long legacy of political instability, Kenya has enjoyed a fairly peaceful political climate in its post-colonial history. As a developing country, nevertheless, Kenya is also dealing with a high unemployment rate, poverty and infrastructural underdevelopment. The rural population was last estimated at 76.02% in 2011 (Trade Economics, 2014) while the unemployment rate increased from 12.70% in 2006 to 40% in 2011 (Kenya Natural Bureau of Statistics, 2013; Trade Economics, 2014).

Access to healthcare services remains a challenge for the majority of the poor, and its development is a priority factor for the state. Kenya continues to face health threats characterised by ravaging HIV/AIDS pandemics, spread of infectious diseases and malaria, high levels of infant mortality and maternal mortality, low levels of life expectancy and deteriorating (Gatero, 2011). HIV/Aids, in particular, represents one of the greatest public health challenge of redress, with over 1.6 million Kenyans reported to be living with HIV in 2011 (UNAIDS, 2011). In the same light, a high mother-to-child HIV/AIDS transmission and high maternal as well as infant mortality rates remain a major healthcare challenge in Kenya (UNAIDS, 2011). In line with the 1st key consideration by Cresswell *et al.* (2013) in Figure 3, which is to clarify the problem(s) which a system is designed to solve, the Kenyan Ministry of Health (MoH) identified the problem of lack of access to healthcare services and the need to address this problem. Hence, the Kenyan Government set out to create easier access to healthcare services for her citizens through the implementation of e-Health IS tools.

2.5.2.1 Implementation of e-Health IS in Kenya

After identifying the problem in the Kenya public healthcare sector, the 2nd key consideration in Figure 3 presents a need to build consensus among the different stakeholders. In this process, the government and the private sector collaborated to develop regulatory strategies to build a progressive system in the country (Makori, MiphMusoke & Gilbert, 2013). These strategies include the following policy frameworks: the Kenya ICT policy (2006), Kenya Communications Act (2009), strategic plan for health information systems (HIS) (2009-2014), and National standards and guidelines for creating electronic medical records (EMR) in 2010.

Consequently, these regulatory developments were synchronized with the national e-health policies, the national ICT policies, and in full consultation with healthcare workers and the users, in an attempt to develop a sustainable client-centred health system that is accessible to all Kenyans (Juma, Nahason, Apollo, Gregory & Patrick, 2012). The attempt by the

government and private health sector to include stakeholders in the implementation of e-Health IS suggests a consensus was reached to address and build the healthcare sector.

After a consensus was reached, the 3rd key consideration, according to Figure 3, was set in motion by the Kenyan MoH, which was to consider system options while also, adhering to the 4th key consideration – choosing a system that meets clinical needs which is affordable. To this effect, the Kenyan MoH started the nationwide deployment of an electronic system, the Open Medical Record System (OpenMRS) in 2006 (Mamlin *et al.*, 2006), to combat HIV/AIDS and mother-to-child transmission (Seebregts, Mamlin, Biondich, Frasier, Wolfe, Jazayeri, Allen, Mirander, Baker, Musinguzi , Kayiwa, Fourie, Lesh, Kanter, Yiannoutsos & Bailey, 2009). Of note is the computer-generated reminder feature on the OpenMRS, which helped healthcare practitioners to improve adherence to clinical guidelines to perform CD4[6] blood tests and other clinical activities – which are essential to monitoring the health and treatment of patients with HIV and AIDS (Were *et al.*, 2011).

Another example is the improvement on AMPATH[7] Medical Record System (AMRS) whose implementation was aimed to cover all MoH healthcare facilities (Tierney *et al.*, 2010). A positive impact on limited cases of implementation is cited. For example, accurately documented patient information became more secure and easily communicated among healthcare practitioners, with positive spin-offs on the diagnoses and treatment processes of infected individuals across the country (Seebregts *et al.*, 2009; Juma *et al.*, 2012). The bottom line is that regardless of ICT to evidently improve the quality and safety of healthcare service delivery in Kenya, the implementation of e-Health IS was accompanied by a multitude of use challenges, as observed in high income countries and the case of Rwanda in section 2.5.1.2.

2.5.2.2 Challenges of e-Health IS Implementation and Use in Kenya

As observed in the Rwanda context, the complexities associated with achieving a successful implementation of e-Health IS also manifest in the Kenyan context. Firstly, there was no adherence to standards, coupled with discrepancies and integration between the e-Health IS and ICT policies (Were *et al.*, 2011). For example, a healthcare professional such as a family health worker might need to share health information with specialists for decision-making or in referral cases. A lack of coherent e-Health IS being used by different practitioners hinders easier, faster and accurate information access and sharing (Makori, MiphMusoke & Gilbert, 2013). This causes a backlog in the decision making processes and professional isolation of healthcare staff in seeking expert opinions in the healthcare field.

[6] CD4 are lymphocytes- a type of white blood cell (AIDSMEDS, 2014).

[7] AMPATH - Academic Model for Providing Access to Healthcare

According to the 5th key consideration by Cresswell *et al.* (2013) in Figure 3, it is essential to plan appropriately. As a result of cautious planning, resolutions should either go with an incremental transformation or once and for all across the hospital. The challenge with the modest implementation progress of the OpenMRS seems related to resource limitations (Karuri, Waiganjo & Manya, 2013). For example, foreign aid seems to be the only source of funding for all reported implementation cases. The implementers of OpenMRS in Kenya might be constrained to run a parallel system (paper-based and electronic systems) due to the availability of funds. Subsequently, a parallel system tends to duplicate processes and increase medical errors, which are threats to patients' safety (Cresswell *et al.*, 2013).

The technology lifecycle phases in Figure 3 present the 7th key consideration – have a plan to train staff. A shortage of human resource capacity, both in the healthcare profession and inadequate ICT Skills, is also cited as a challenge in the implementation of e-Health IS in Kenya. For example, Healthcare providers are overworked and overwhelmed, and given man's characteristic of not being perfect, these type of environments heighten probability of making errors – with life threatening consequences (Mamlin & Biondich, 2005). Moreover, there seems to be inadequate ICT skills personnel in the public healthcare sector, such information technology (IT) maintenance staff that would train health practitioners (Pavalam, Jawahar & Akorli, 2010). The implications of inadequate staff training during and post-implementation of e-Health IS poses security risks to electronic patient information from both internal and external threats. These are due to lack of access control, which is a major aspect of every system that handles sensitive data and records of the public masses.

It is clear in this passage that Kenya has a fair share of socio-economic underdevelopment, healthcare challenges and intended national priorities. Similar to the Rwandan case (and to that of the high income countries), the Kenyan government was receptive to the adoption of e-Health IS to improve access to healthcare services. A deliberate effort to implement e-Health IS includes: policy frameworks, partnerships between the government, the private sector and the international development agencies such as USAID.

Nevertheless, the adoption processes of e-Health IS are complex, as claimed by Cresswell *et al.* (2013), yet with socio-economic under-development challenges in African countries, it makes an already complex process even harder with respect to achieving a successful implementation as observed in Rwanda and Kenya. Notable challenges of implementation in this respect include a lack of appropriate infrastructural base upon which solid systems can be built, financial resources to support the development and procurements. Furthermore, lack of ICT skills and personnel resources to operate and maintain implemented systems, a lack of adherence to local standards and deficiency in quality assurance.

To further assess and understand the contexts of developing countries on their efforts to achieve a successful e-Health IS implementation in African countries, it is only fair to consider Nigeria, which is the most populated black country in the African continent before exploring a conclusive in the section 2.5.3.

2.5.3 The Case of Nigeria

According to the Nigerian National Bureau of Statistics (2012), Nigeria had a total of 166.2 million people, with projections putting the figure at 173.6 million people as of 2014, making her the largest populated country on the African continent (World Population Review, 2014). Nigeria has faced political and economic instability including a civil war, military coup and dictatorships before democracy in 1999 (Benson, 2011). Under this legacy, there has been an increase in the unemployment rate from an estimated 21% to 24% in 2011 (National Bureau of Statistics, 2014), and an estimated poverty rate of 46% in the country (World Bank Group, 2014).

Healthcare services fall short of international standards, resulting into an inadequate state of health care infrastructure, shortage of medical professionals and high risk of non-communicable and re-emerging infectious diseases (Adeleke, Lawal, Adio & Adebisi, 2014). Statistics show that almost half of the country lives below $1, which makes healthcare services relatively unaffordable, hence, an increase in disease outbreaks and high mortality rate. For example, an estimated 3.5 to 3.8 million people are living with the HIV/AIDS virus, which makes Nigeria the third worst affected country in the world (UNICEF, 2009). An increasing number of children are infected with HIV, through mother-to-child-transmission, yet less than 1% of pregnant mothers have access to counselling, testing and treatment.

A recurring task facing every democratic elected regime since 1999 is to rebuild the social institutions and the healthcare sector. Consequently, in response to mitigate the healthcare challenges plaguing the country, the Nigerian Government joined United Nations' Countries as a signatory to the United Nations (UN) Millennium Development Goals (UNMDGs) (2000-2015) (Berger & Adedeji, 2013).

2.5.3.1 Implementation of e-Health IS in Nigeria

The Nigerian government took up the adoption of health information technology as an enabler to advance healthcare services delivery in realizing the UNMDGs as a cue from high income countries. According to Cresswell *et al.* (2013) in Figure 3, the 1st key consideration to achieve a successful e-Health IS implementation is to clarify a problem which a system is designed solve. The Nigerian government realized a collapse and burden of diseases in the nation's public healthcare sector. This prompted the need to rebuild and redress the nation's healthcare challenges through the implementation of e-Health IS.

After the clarifying the problem, the 2nd key consideration in Figure 3 is to build consensus between all relevant stakeholders to guarantee successful implementation. The Nigerian Government through the Federal Ministry of Health (FMoH) planned to develop, adopt and implement policies that will strengthen the national healthcare system for effective, accessible and affordable service delivery in partnership with several stakeholders (Federal Ministry of Health, 2013).

To achieve a consensus, the government attempted to harmonize the different stakeholders involved in National health information management. The first National Conference on Health Information Technology (HIT) was organized by the FMoH held in November 2011 (Adeleke, Erinle, Ndana *et al.*, 2014). The conference focused on deploying a centralized national health data management system to review the country's e-Health strategies and capacity building. This indicates an attempt by the Nigerian government to facilitate a form of agreement between different end-user groups and organizations (private and public) that would be involved in the implementation processes.

By 2011, the Nigerian government started developing a 5-year strategic plan on the successful implementation of health information systems across the country (Adeleke, *et al.*, 2014). After the consensus is reached, the 3rd characteristic in Figure 3 that Cresswell *et al.* (2013) recommends to implementers to consider available options - on the system choice such that all stakeholders deliberate extensively on how the new system complements existing systems. The 4th key consideration, according to Cresswell *et al.* (2013), is to choose a system/s that meet clinical needs (and affordable). The intended goal of the FMoH was to provide an operational National Health Management Information System (NHMIS) across Nigeria (Adeleke, *et al.*, 2014). The NHMIS would serve as a management tool to enhance decision-making from national to local levels to improve public healthcare services delivery. Furthermore, to promote the HITs by August 2013, the National Council on Health approved the implementation of electronic health records (EHRs) across the thirty-six states in Nigeria (ibid).

2.5.3.2 Challenges of e-Health IS Implementation in Nigeria

With the exception of efforts by private institutions and academic hospitals in Nigeria, there is minimal to invisible progress in terms of the adoption of health information technologies (HITs) from national to local levels in Nigeria in the public healthcare sector (Idowu, Cornford & Bastin, 2008). In effect, implementations of e-Health IS were estimated to be less than 5% of any form of hospital information technology in Nigerian healthcare facilities as at 2010 (Benson, 2011). Reasons, as stated by authors, include infrastructural under-development especially irregular power supply, a lack of government policy on e-Health adoption, (WHO 2009; Benson, 2011), over-dependence on paper-based/manual systems, management

incapacity, and inadequate human resources and IT skills (Mursu *et al.*, 2000; Ajuwon, 2006; Adeleke, Lawal, Adio & Adebisi, 2014). Unfortunately, the reasons stated above appear to still hamper the status of health information technologies implementation and use in present day Nigeria.

While healthcare professionals generally admit the efficacy of adopting e-Health IS tools in the Nigerian public healthcare system to improve services delivery, Adeleke *et al.* (2014) argues that there are inadequacies pertaining to clinical documentation which give rise to setbacks as regards the meaningful use, rendering the existing e-Health IS inapt for work processes. Furthermore, inappropriate confidentiality and security measures to safeguard patient information and records in the public health sector are acknowledged (Adewale, 2004; Berger & Adedeji, 2013). However, such critical and ethical subjects are hardly addressed in the limited cases of e-Health IS implementation in Nigeria (Hassan *et al.*, 2013). Despite the identification of the national healthcare challenges in the public sector by the Nigerian government, there are yet to be evident developments towards putting in place adequate infrastructure for a successful e-Health IS implementations.

A discussion of literature in this section 2.5 confirms the acceptance of ICT as a vehicle for innovative advancements of the national healthcare information systems by low-medium income countries. Clearly, e-Health IS are the most commonly adopted innovations – both in the high and low-medium income countries, with implementations structured according to country-specific healthcare challenges and priorities. However, the implementation and usage of e-Health IS remains an extremely complex exercise due to varying country-specific socio-economic, political and technical development backdrops.

Whilst South Africa remains the context of this study, the implementation efforts of low-medium income contexts of African countries, as discussed in the cases of Rwanda, Kenya and Nigeria, had to be reviewed for a clearer vantage point on the phenomenon of study. In a strong political commitment to improve public services for all citizens in the Republic of South Africa, the aim of this study remained to explore, in more detail, the status of e-Health IS implemented to facilitate healthcare services delivery for South African citizens.

2.6 The Case of South Africa (SA)

Due to the legacy of apartheid, South Africa is facing major socio-economic development challenges, including a high unemployment[8], poverty, and a multitude of service (including healthcare services) delivery challenges and related political protests (Chopra, Lawn, Sanders, Barron, AbdoolKArim *et al.*, 2009; Coovadia, Jewkes, Baron *et al.*, 2009).

[8] SA unemployment rate increased from 24.1% in the last quarter of 2013, to 25.2% in the first quarter of 2014 and poverty rate is estimated at 56.6% (Statistics South Africa, 2014b).

2.6.1 The SA Socio-Economic Development Context

Out of a population of 52.98 million, 19.64 million of SA's population (36.15%) live in rural areas, while 13.6% reside in urban informal settlements under conditions of extreme poverty (Statistics South Africa, 2014a). With a growing rate of unemployment, this portrays a harder status quo for the majority of poor citizens to access and afford basic necessities, including basic healthcare. As a result, the majority of citizens (mostly, black South Africans) are facing an increase in health risks, with high mortality threat, as a result of inadequate access to basic healthcare services (Coleman & Coleman, 2013).

For instance, the HIV statistics in South Africa increased from 4,000,000 cases in 2002, to approximately 5,260,000 in 2013 (Statistics South Africa, 2013). HIV weakens the immune system, making the body vulnerable to opportunistic infections such as TB. Tuberculosis infection in South Africa is rated as the third highest in the world, after India and China, recording 993 infections per 100,000 in 2011, thereby contributing to high maternal and infant mortality rates in South Africa. Whilst South Africa is committed to reducing infant deaths to less than 20 deaths per 1, 000 births (2%) as part of the MDGs target, the rate was triple the target, with almost 6% of all infants and babies dying of AIDS-related illnesses and other communicable diseases within a week of being born (Cullinan, 2013).

In the midst of these socio-economic developmental challenges stands an under-equipped healthcare system that is over-stretched in efforts to address these challenges. For example, Coleman, Herselman and Pottas (2012) pointed out that there was a widespread shortage of doctors in rural hospitals in the North West Province of SA. This is an average ratio of 1 doctor to 18,000 patients for rural hospitals as compared to 1 doctor to 9,000 patients in urban hospitals. Yet again, in October 2013, the Health Minister, Aaron Motsoaledi, said that the country was facing chronic shortages of specialists in the public health sector as most of them felt it was not worth practicing professionally in South Africa (Buthelezi, 2013).

The NDoH assessment showed that doctors were leaving the country or did not want to work in the public sector. Another example is the complaint of doctors as regards working over-time. A 26-year-old doctor who practiced as an intern at Tygerberg Hospital in Cape Town mentioned this when he worked excessive overtime (Serrao, 2014). He alleged that doctors were subjected to unlimited and unregulated working hours, sometimes between 24 and 36 hours per single shift, without adequate rest. The working hours were discovered to be draining doctors, and subsequently being susceptible to a greater chance of making mistakes while at work, putting their lives and patients' at risks.

In the wake of these developments, the healthcare priorities in SA include: combating of non-communicable diseases such as cancers, heart diseases, and diabetes, as well as communicable diseases such as HIV/AIDS, Tuberculosis (TB), infant and maternal mortality

rates (Zyl & Pennanen, n.d.). With a policy resolve to improve service delivery and universal access to basic healthcare to (and for) all South Africans, the challenge is to innovatively apply ICT, including the adoption of e-Health IS to effectively achieve the national healthcare service delivery objectives. According to the 1st key consideration by Cresswell *et al.* (2013), it is important to clarify the problem that a system would be designed to solve. The SA government identified the nation's healthcare challenges and inadequate access to basic healthcare services in post-apartheid (1994), hence, it initiated moves towards improving healthcare service delivery through the implementation of HITs.

2.6.2 Adoption of e-Health IS in SA

Post-apartheid South Africa is a democracy in transition, with a clear development agenda to reverse the social inequality, major under-development among the majority of its population, and to improve service-delivery, and ultimately the quality of life of all her citizens (National Health Act, 2004; Naledi *et al.*, 2011). A commitment to the redress of the legacy of apartheid, including the delivery of basic services such as quality healthcare to all citizens through universal health coverage, is a major priority in the country's national development agenda. As a signatory to the Millennium Development Goals then, South Africa's acceptance also subscribed to the view of ICT as a vehicle to redress of healthcare development challenges (Braa & Hedberg, 2000; Ammenwerth *et al.*, 2003). In this quest, the National Department of Health (NDoH) declared and initiated the Health Information Systems Programme (HISP)[9] in 1994 (Ngoma *et al.*, 2012).

After a problem is clarified, as done by the SA government in section 2.6.1, Cresswell *et al.* (2013) suggest a 2nd key consideration – to 'build consensus'. It can be inferred that the collaboration of the HISP and various departments of health within the country indicates a form of agreement between the different stakeholders involved in systems implementation processes.

In line with the 3rd key consideration in Figure 3, the eventual goal of the collaboration was to consider a system option that would facilitate accurate, secure and timely collection, storage and reporting of data for effective healthcare services delivery in South Africa (Braa & Hedberg, 2000; Jacucci *et al.*, 2006). While considering system options, Cresswell *et al.* (2013) recommend a 4th key consideration, that implementers should choose a system that meet clinical needs and is affordable. Additional features considered include: electronic reporting, easier communication between healthcare institutions across provinces up to the

[9] The Health Information Systems Programme (HISP) is a research and development programme that started with the democratic era in SA, which focused on developing standards for primary health care while developing a district-based health information system (DHIS) (Ngoma *et al.*, 2012; Snyders, 2013).

national level and a standardised data quality through the reporting system for submitting data to the NDoH - a major priority in this respect (English *et al.*, 2011).

Emphasis was also placed on reducing data duplication, safeguarding confidentiality and preventing unauthorized access to clients electronic healthcare information (Cline & Luiz, 2013). Subsequently, the HISP supported the National and Provincial Health Departments by encouraging the use of health and management information systems (HMIS) especially in primary healthcare (PHC) services and other related fields (Ngoma *et al.*, 2012). Examples of HMIS include the OpenMRS and a District Health Information System (DHIS). Hence, the DHIS has been implemented. The DHIS is a free and open-source software that serves as an electronic repository for managing, processing and reporting public health, first implemented between 1998 and 1999 (Braa & Hedberg, 2000; English *et al.*, 2011). It is currently being used to monitor health indicators across all the public healthcare facilities in the 9 provinces, albeit, in varying scales, due to infrastructural, socio-economic and technological development levels between the urban and rural areas of South Africa (English *et al.*, 2011; Snyders, 2013).

The 5th key consideration by Cresswell *et al.* (2013) in Figure 3 argues on the need to 'Plan Appropriately' during and post-implementation of e-Health IS. In a quest to improve healthcare service-delivery, an e-Health strategy was developed by the NDoH in 2012. It was developed as a guide for implementation of ICT to plan the transformation of healthcare services in South Africa especially for the effective delivery on the signed national health sector's Negotiated Service Delivery Agreement (NSDA)[10] (2010-2014) (National eHealth Strategy, 2012).

2.6.3 Implementation and use of e-Health IS in SA

One of the pre-requisites of achieving a successful implementation of HITs was presented as the 8th key consideration by Cresswell *et al.* (2013) in Figure 3. It is essential to conduct a continuous evaluation during and post-implementation of e-Health IS. For instance, the argument is supported with the reports on the assessment of DHIS usage by the SA government. There have been gradual implementations of e-Health IS solutions at national and provincial institutions in South Africa. The number of public healthcare data items or values collected and captured as routine data records in the DHIS increased from around 2.5 million in 2001 to 10.6 million in 2009 (i.e. over 400%) as well as data-capturing and processing officers who increased from 465 in 2001 to 1,180 in 2010 (i.e. around 250%) nationally (Snyders, 2013). As of December 2013, the DHIS had contained routine data

[10] Negotiated Service Delivery Agreement (NSDA) is a document proposing that a framework should be created for the development of a comprehensive and integrated monitoring and evaluation system with emphasis on improving data quality (English *et al.*, 2011).

representing over 1.4 billion patient encounters nationally. Not only does the report express installation of the DHIS in South Africa, it also provides figures relating to human capacity development and indicator figures to facilitate resource allocation within a period.

A couple of e-Health IS implementations have been reported, specific to certain provinces. In recognition of its provincial need for example, the Northern Province of SA started to implement an integrated computerised Hospital Information Systems (HIS), the patient care information system (PCIS) in its 42 hospitals to improve health system management in general, beyond patient care – in 1998 (Mbananga *et al.,* 2002). The clerks used and acknowledged that PCIS improved their work of patient admissions, especially in the areas of retrieving patients' records up until discharge and checking the accuracy of the information provided by the patients on subsequent visits (ibid).

Furthermore, there are cases of e-Health IS applications used for data management, process and reporting in hospitals in South Africa. These include a combination of the CLINICOM and SINJANI systems, MEDITECH, MEDICOM, DELTA 9 in parallel with paper-based and manual systems while the primary healthcare information System (PHCIS) is being utilised in the clinics in the Western Cape Province (Mchunu, 2013; Snyders, 2013). Nonetheless, in the few cases where these e-Health IS had been implemented, there were feedbacks of improvements in the completion of daily tasks. Other remarkable improvements include reduction in patients' waiting time, improved legibility of prescriptions, faster access and retrieval of patient information and reduction in the loss of results. These were the positive usage outcomes of e-Health IS adoption compared to when it was majorly the paper-based system as well as an old electronic system which became obsolete at the beginning of the 21st millennium (Mchunu, 2013).

In addition, systems such as the picture archiving and communication system (PACS) have also been implemented to support clinical functions, in the SA public healthcare sector. PACS are clinical information systems used for the acquisition, archival, and post-processing distribution of digital medical images ages such as CT scan, ultrasounds, x-rays to mention but a few (Black *et al.*, 2011). The system is being used by clinicians and radiologists to enable easy communication of radiological and scanned results between multiple users at the same time in different locations (ibid). According to Nyathi, Chirwa and van der Merwe (2010), PACS has helped radiographers to improve overall efficiency of clinical processes in the radiology departments in hospitals in terms of enhancing diagnosis and decision-making processes. In other words, the implementation of the PACS to manage radiographic images further reinforces the argument of the 4th key consideration as discussed in section 2.6.2.

In efforts to improve the quality of maternal care services in South Africa, the Basic Antenatal Care Information System (BACIS) Program was introduced by the South African

Medical Research Council in 2011. It is a computerized clinical support system developed and deployed at 3 clinics in Tshwane Health District in Gauteng Province to address concerns associated with compliance to clinical guidelines in ante-natal care (Horner *et al.*, 2013). The BACIS Program aids decision-making by utilizing patient-specific information captured during antenatal visits to perform: scheduling of maternity care, identification of patients for referral and risk classifications (ibid). There were notable improvements in compliance with the guidelines for maternity care and the Basic antenatal care checklist (BANC) in terms of improved bookings[11] reported on the detailed activities carried out at antenatal care. However, the program was conducted on a small scale and therefore, the ensuing results could not be generalized except when performed on a larger scale.

Despite the successes and positive perceptions reported on e-Health system implementation and usage in the public hospitals across South Africa provinces, yet resulting complexities deprive both users and patients the maximum benefits and outcomes, thus resulting in challenges and drawbacks in redressing healthcare challenges as well as achieving the motives for adoption.

2.6.4 Challenges of e-Health IS Implementation and Use in SA

While logical pathways have been laid down to cautiously plan and direct implementation processes, the 6th key consideration in Figure 3 – providing the appropriate infrastructure is arguably the most important factor underpinning the success of e-Health IS implementation. The implementations of e-Health IS fall short in data aggregation and reporting components, with negative implications on the data quality in the healthcare sector (Snyders, 2013). Explanations are that not all hospitals and clinics have computers and web-based versions of DHIS available in all the provinces (ibid). As a result of inadequate computer units, data had to be imported manually from various levels to produce a less than accurate national report (Garrib *et al.*, 2008; Snyders, 2013). For example, an assessment of the health information systems of South Africa reported that surveillance reports generated at the national level are not timely, neither are they complete; this therefore raised concerns about the quality of routinely collected data in the South African healthcare system (Statistics South Africa, 2009). To further buttress this growing concern, it was discovered in the routine health data for PMTCT (prevention of mother to child HIV transmission) submitted to the DHIS in 3 districts of Kwazulu-Natal that 50% of data elements were incomplete, and 87% were not accurate (Snyders, 2013).

To further buttress the importance of infrastructure in e-Health IS implementation, challenges included a lack of basic amenities such as electricity, and the internet, which makes e-Health

[11] Booking refers to the first and the most antenatal visit of a pregnancy (Horner *et al.*, 2013).

IS solutions difficult to access (Blaya *et al.*, 2010; Coleman *et al.*, 2011). As a result, ICT infrastructure in both urban and rural hospitals are not integrated to work together across hospitals to allow healthcare professionals to gain the optimum benefits of e-Health IS applications (Coleman *et al.*, 2011).

Consequently, the heterogeneity of implemented e-Health IS have inhibited inter-operability between and has caused a drop in system efficiencies due to conflicting operational standards (Adebesin *et al.*, 2013). For example, the PHCIS users in clinics can only read data but cannot make any form of alterations in the CLINICOM system, meaning that they cannot update data in the central system (ibid). As a result, sharing of data between CLINICOM and PHCIS systems is limited as users of these systems are not able to freely share data between their systems (Mchunu, 2013). Such inadequacies of connectivity inhibit access, communication and ultimately, the success rate of HIT implementations in the SA public healthcare facilities (Mostert-Phipps, Pottas & Korpela, 2013).

According to Cresswell *et al.* (2013) in Figure 3, the 7th key consideration to achieve a successful systems implementation is to comprehensively train staff to enhance user skills. The problem of inadequate staffing and a lack of technical skills amongst healthcare practitioners has been a growing challenge in SA's public health institutions (Mbananga *et al.*, 2002; Mchunu, 2013). The system usage complexity seems to be based on the computer literacy of some users even though there are a few who are comfortable in using the systems. For example, lack of computer skills to use the PCIS caused nurses to discharge patients on the paper-system, thereby caused a backlog in updating information to the PCIS hence, the systems are grossly under-utilized (Mbananga *et al.*, 2002). The resulting outcome was failure to continue using the PCIS tools but rather, resolved to the predominant use of paper-based systems which is perceived to be more comfortable by healthcare practitioners. Consequently, this increased the workload of the already overburdened low number of staff who struggle with redressing the pressing health challenges and burden of diseases (BoD) (Cline & Luiz, 2013).

Likewise, security measures as regards patient information remain inadequate in e-Health systems implementations. Complaints are that there is no protocol or guidance on how to safeguard patient confidentiality in the use of these systems (Cline & Luiz, 2013). For example, once a staff logs on to certain systems, the user has complete access to a patient's information irrespective of his/her specialization in the hospital (ibid). Loopholes in access control measures on the CLINICOM system have also been cited as perilous security threats (Mchunu, 2013). For example, observations by Mchunu (2013) indicated that users share their login accounts while some still retain their credentials and privileges based on their previous positions because their access profiles were not amended. This interferes with

the accuracy of the system logs trails, hence a false reflection of who accessed the system and for what purpose.

Furthermore, since clinical support systems such as the BACIS have been costly to implement at the initial stage, one would expect a higher rate of utilization in healthcare centres that have acquired them if a return on investment is to be attained (Horner *et al.*, 2013). Unfortunately, the BACIS is reported to be grossly under-utilized in implementing institutions. For example, instead of using the system to support clinical functions and also for administrative purposes, it is being used only for administrative in a number of institutions (Coleman *et al.*, 2011; Cline & Luiz, 2013).

In terms of systems usability, the functionality of systems such as CLINICOM has also proven inadequate, mostly due to computer network congestion, slowness of the system and technical failures. This has seen the decrease in reliability, with negative implications on the system by the users (Mchunu, 2013; Mostert-Phipps *et al.*, 2013). As a result, healthcare professionals such as doctors and nurses do not use the systems for clinical duties (Coleman *et al.*, 2011). Instead, healthcare professionals feel they are left with no option but the use of paper-based systems to complete their clinical activities (Cline & Luiz, 2013). The same deficiencies also inhibit the functionality of the PACS, with frequent system downtime that limit access to, and use of, the system. For example, system downtime often disrupts interactions and issues of urgency between clinicians and radiologists, such that it even delays the laboratories from where the results are being processes (Black *et al.*, 2011).

At first glance, it seemed as if both high and low-medium income countries made decisive and evident steps to achieve a successful implementation of e-Health information systems according to Cresswell *et al.* (2013) in Figure 3. Whilst the use of e-Health IS were intended to simplify processes to improve the efficiencies of service delivery in the public healthcare sectors, the complexities associated with systems implementation were major drawbacks causing otherwise. Report of evidences show that some of them have, unfortunately, impeded workflow of healthcare practitioners in an already overburdened public healthcare system (Mostert-Phipps *et al.*, 2013). Arguably, this can be associated with a lack of cautious planning and adherence to mitigate imminent challenges that might result in low use and ultimately, systems implementation failure. Of major concern is the fact that despite the reported implementation and use challenges, there are only a few published scientific studies on the use of e-Health IS by healthcare professionals despite being listed as a part of the e-health strategy of the NDoH in South Africa (Horner *et al.*, 2013).

2.7 Conclusion to Chapter Two

The aim of this thesis was to explore the status of adoption particularly the use of e-Health IS by clinical staff in the public healthcare sector in South Africa, and explanations thereof. Of particular focus was to understand the causes of limitations to the adoption but more importantly, use (and non-use) of e-Health IS by clinical staff in public hospitals of the Western Cape.

While the researcher sought to do a background check on the phenomenon of study, it was discovered that there was shortage of scientific publications compared to a massive number of non-scientific publications, justifying why e-Health is deemed as an up and coming field by Eysenbach (2001). This chapter enumerated the cases of adoption but in particular, implementation and use in several contexts and argued from these background towards the research problem with emphasis on the low usage of electronic health information systems (e-Health IS) in the public healthcare sector in South Africa.

The technology lifecycle in Figure 3 was used as a lens to assess the implementation of e-Health IS in the healthcare system of high and low-medium countries, so as to draw from experiences while the background focus remains South Africa – the context of this study.

High income countries such as the United Kingdom (UK) and Australia, have been leading the way in the innovative use of ICT tools to improve healthcare services delivery. However, the accounts of systems implementation and use by healthcare professionals in these countries unveiled that the implementation exercise is complex. The discussion was followed by e-Health IS implementation efforts in low-medium income countries in the midst of socio-economic, political and technical constraints. These constraints include poverty, a lack of funding, shortage of human resources (healthcare professionals), civil unrest, infrastructural barriers, lack of systems integration, inadequate planning.

The next chapter, Chapter 3 discusses and motivates for the theoretical underpinning used to break down the complexities and relationships of acceptance and use of e-health IS by clinical staff in the public hospitals in South Africa.

CHAPTER THREE – THEORETICAL UNDERPINNINGS

3.1 Introduction

Subsequent to the literature review, this chapter explores a theoretical underpinning and stance to simplify the investigation to contextualize the research phenomenon and to aid the analysis of the phenomenon of investigation. In essence, the chapter presents a suitable theory and a motivation for its selection as used in this study.

The chapter is structured into 6 sections. Following the introduction in section 3.1, the chapter opens with a reflection on the meaning of a theory, significance and its various uses in a scientific study – in section 3.2. This is followed by an overview of the most common theories used in information systems (IS) research – particularly around the healthcare information systems domain as the central theme of this thesis is presented in section 3.3. The Gartner's hype cycle is presented in section 3.4, followed by the Unified Theory of Acceptance and Use of Technology (UTAUT), which emerged as the most viable option for purposes of this study, outlined in considerable detail in section 3.5, the use of UTAUT in similar studies in section 3.6. The actual application of the UTAUT theory is then presented in section 3.7, ending with a conclusion of the chapter in section 3.8.

3.2 Uses of Theory in Research

A theory can be defined as a set of interconnected key constructs and propositions that logically describe, analyse and offer explanations to as well as predict events or behaviours by hypothesizing relationships among variables of a contextual phenomenon (Pettigrew & Mckechnie, 2001; Gregor, 2002). Thus, theories refer to a systematic presentation of ideas and patterns that shape the occurrence of a phenomenon in a certain field of inquiry (Holmberg, Moore & Peters, 2007). The interconnected key constructs and propositions are concepts and its relationships that enable the researcher to simplify the complex structure of a phenomenon (Bhattacherjee, 2012). For instance, key constructs provide explanations to why certain things happen the way they do, how organisations or societies operate or why people react the way they do (Reeves, Albert, Kuper &Hodges *et al.*, 2008). A variable can be defined as the measurable representation of characteristics or abstract constructs in a theory (Creswell, 2008).

In a conclusive summary, theories can be classified as either assisting to understand or providing explanation, as well as testing and even the prediction of a phenomenon. Theories are used in various ways. A theory can be used as a valuable guideline and a basis for a theoretical framework with boundary conditions (Walsham, 1995). Theories assist a researcher to shape scientific research, help to delineate the scope of research, and

influence other features as emerged from a phenomenon (Holmberg *et al.*, 2007). It can also be used as a tool for iterative research process in data collection and analysis (ibid). Furthermore, theories can be used as analytical devices or as elements of validation (Mlitwa, 2011).

Theories vary in the extent in which they are conceptually developed and empirically tested; therefore, they are understood in a subjective range of settings as well as contexts where scientific laws apply universally (Glanz, 2014). Subsequently, theories are abstract in nature and not content – or topic specific. They reflect general ideas, yet each employ distinctive terminologies to articulate the key aspects of a phenomenon (ibid). However, theories may not always provide adequate explanations. Depending on how it is applied, often based on a specifically defined set of constructs and propositions, there may be omissions of other important meanings in the concepts of a theory, which may be significantly limiting when taken out of context (Bhattacherjee, 2012).

Theories are constructed from two main perspectives of scientific approaches to enquiry, which are the inductive (as discussed in section 3.2.1) and deductive (discussed in section 3.2.2) forms of reasoning (Gregor, 2002).

3.2.1 The Inductive Theoretical Approach

The Inductive reasoning is a theoretical approach that is founded on observing recurrent patterns and social behaviours or events (Tedre, 2006). It allows the researcher to give nomothetic explanations (Bhattacherjee, 2012). For instance in this study, the researcher attempts to acquire explanations to the causes of a set of situations or events rather than a specific situation. Therefore, this approach is dependent on the interpretive abilities of the researcher (ibid).

However, an inductive theoretical approach takes a position where a researcher draws on experiences and observations which is socially constructed to inform new theories as it emerges from the collected data (Walsham, 1995; Gregor, 2006). The most ideal example of the inductive approach to enquiry is represented by the grounded theory because the theory is deeply rooted in empirical observations from new sets of data to derive a theory (Bhattacherjee, 2012). Since the researcher sought to adopt a theoretical lens, an inductive theoretical approach is rarely suitable for the purpose of this study. It is for this reason that instead, a deductive theoretical approach is discussed in section 3.2.2.

3.2.2 The Deductive Theoretical Approach

Deductive reasoning is a theoretical approach that explores a phenomenon or a particular field of study through empirical studies to formulate and or test hypotheses as well as to describe or predict patterns (Constantinides, Chiasson & Introna, 2012).

A deductive theoretical approach is often driven by previous theories, assumptions or hypothesis. Hence, it tends to be aligned with positivism but can also be adopted in the interpretivism space (Hyde, 2000). Deductive theoretical approach can support both the natural sciences as well as the social science aspects of how knowledge exists and is studied (Saunders, Lewis & Thornhill, 2009). Under this approach, the researcher usually aims to carry out tests or validate the concepts and patterns known from theory using new set of empirical data building on existing theories (Hsieh & Shannon, 2005).

Whilst description and predictions require hypotheses and correlations, explanations require the understanding of cause-effect relationships of a social phenomenon. A deductive approach with the aid of an existing theory would be an effective tool to break down complexities surrounding healthcare practitioners' behavioural attitudes towards the use of e-Health IS in a healthcare institution. Therefore, the choice of a theory was based on the research questions, assumptions and the objectives of the study as it is important that existing theory matches with reality.

Since the objective was to understand and acquire explanations to the causes of limitations to the use of e-Health IS by clinicians in public hospitals through a theoretical lens, a deductive approach was appropriate for this study. Hence, a researcher draws on a theory to articulate assumptions and claims upon which, further conclusions can be based.

3.3 Theories in Health Information Systems Research

Whilst Information Systems – the complementary relationship between people, technology and processes, have been greatly researched over the years, its acceptance and use have been represented with theories consisting of individual and social behaviour influencing factors that emerge from sociology and psychology disciplines (Wills *et al.*, 2008). Theories are selected based on how they fit as well as consistency of their assumptions with the research problem (Creswell, 2007; Bhattacherjee, 2012). Examples of relevant theories that have been used in health information technology research field include the Technology Acceptance Model (TAM) (Bagozzi, 2007; Jimoh *et al.*, 2012), DeLone and McLean (D&M) IS Success Model (Häyrinen *et al.*, 2008), Task Technology Fit (TTF) (Tsiknakis & Kouroubali, 2009), Diffusion of Innovation (DOI) (Buntin *et al.*, 2011), Clinical adoption meta-model (CAMM) (Price & Lau, 2014),.

With more revisions on the earlier versions of adoption and diffusion theories, the Unified Theory of Acceptance and Use of Technology (UTAUT) have since emerged and grown in prominence in the discipline after 2003 (Venkatesh, Sykes & Zhang, 2011). Overall, an individual (or group) according to the UTAUT assumptions, accepts a technology innovation believed to be useful to accomplish and improve work productivity (Venkatesh *et al.*, 2012). The researcher relates this belief to the phase(s) on the Gartner's Hype Cycle – which explains why people tend to accept (or not accept) a new technology innovation. Thus, the Gartner's Hype Cycle is concisely discussed with respect to its implications on the adoption and use of a new technology (in section 3.4) and applied (in Chapter 5 – sub-section 5.3.2).

3.4 Gartner's Hype Cycle

The Gartner's hype cycle, established in 1995 illustrates the expected progression of a new technology innovation through a timeline of overenthusiasm and ultimately, to its eventual maturity (understanding its relevance and output) (Linden & Fenn, 2003).

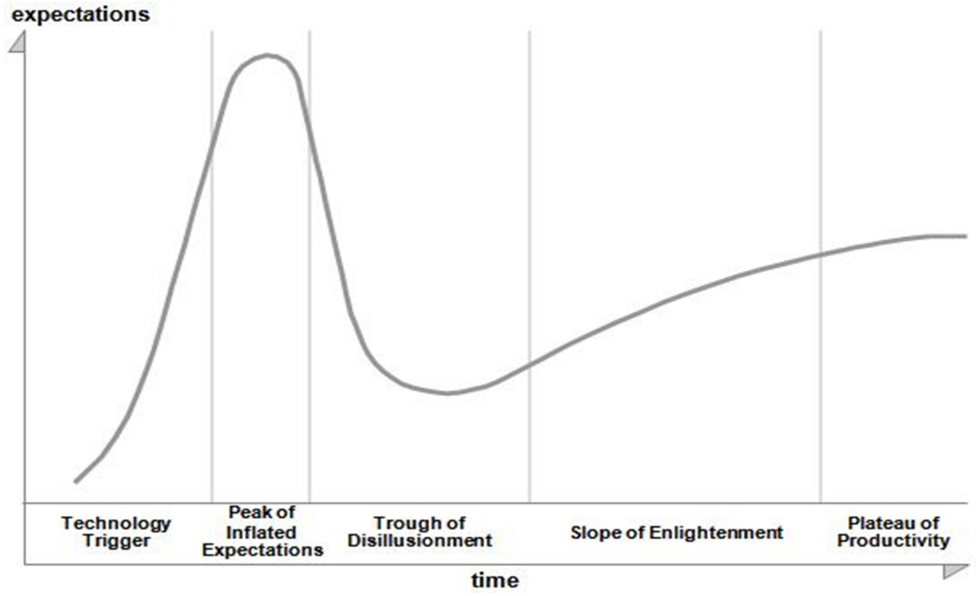

Figure 4: Gartner's hype cycle graph

The Gartner's hype cycle is a graph used to illustrate the emergence through to the adoption stage; the maturity level and ultimately, the impact of a new technology innovation (Gubbi *et al.*, 2013). The Gartner's Hype Cycle comprises of 5 distinct stages; technology trigger, peak of inflated expectations, trough of disillusionment, slope of enlightenment and plateau of productivity.

3.4.1 Technology Trigger

In the first stage of the hype cycle, the technology trigger phase refers to a breakthrough in technology advancement (Linden & Fenn, 2003). At this point, the design phase would have

been approved and the software developers come up with the prototype of a new technology innovation for adoption by interested organisations. The trigger often occurs as a result of media publicity, a leak or a statement release by the software organization without the actual release of the innovation into the market space. Subsequently, there is public awareness of the new technology with expectations from end-users (individual or organizations).

3.4.2 Peak of Inflated Expectation

From the technology trigger, users have expectations which influence their perceptions and the resulting outcomes with respect to adopting a new technology which results to the peak of inflated expectation (Linden & Fenn, 2003). At this point, an individual (or organization) is saddled with the initial decision to choose and adopt a particular system, as there are several vendors with different innovation but same market space. After a system is chosen and implemented, the inflated expectations of the users about a technology innovation begin to descend into a trough of disillusionment stage, as a result of limitations to use or deflated expectations.

3.4.3 Trough of Disillusionment

In the trough of disillusionment phase, the usage of a particular new innovation by users yields experiences with respect to positive or unfavourable outcomes (such as inhibitions) in work processes (Sanderson, 2007). For instance, when the outcomes (or experience) don't meet the users' expectations with time; the systems are eventually discredited and failure sometimes ultimately result to discarding the technology (Michaelson, 2014).

In essence, end-users (individual or organization) experiences (and outcomes) influence the acceptance and continuous use of an innovation either positively or negatively – to the point that ample decisions are ultimately taken on the subsequent implementations of a new technology innovation. Consequently, the organizations progressively ascend to the slope of enlightenment.

3.4.4 Slope of Enlightenment

In this phase, the individuals (or organizations) and the technology vendors alike become informed about the pros and cons associated with the adoption and use of a new technology innovation (Linden & Fenn, 2003). Due to the experiences of end-users in the trough of disillusionment, vendors and organizations become more enlightened and take extra precautions by conducting pilot studies, to improve on the technology innovation (Mwanyika, Lubinski, Anderson, *et al.*, 2011). As a result, there is an evolving and improved understanding of the technology's benefits as well as its applicability to work processes by the end-users as they progressively approach the plateau of productivity.

3.4.5 Plateau of Productivity

The Plateau of productivity stage is the stage where the optimum benefits of the technology are realized and accepted (Linden & Fenn, 2003). The technology innovation is increasingly embedded to enable real life solutions as the technology matures. The ultimate level of the Plateau is dependent on the technology broad applicability or benefits of a particular technology hence having its own hype cycle. While a technology attains full maturity and supports several users, the initial hype ultimately fades. In essence, the new methods of implementing and continuously maintaining the technology is seldom communicated to the public by the same media frenzy responsible for the technology trigger.

Hence, the researcher draws on both the Gartner's Hype Cycle and the UTAUT to interpret the transcripts data (in section 5.3 and 5.4), towards a better understanding of the rationale for the adoption (or non-adoption) and use of e-Health IS in the study.

3.5 The Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT was modelled by Venkatesh *et al.* (2003) from eight existing theories that relate to technology acceptance and use. The UTAUT incorporates eight theories that predict events that instigate intention and behaviour of individual or organization, into a more holistic model to understand factors that either enable or hinder technology acceptance and use (Hennington & Janz, 2007). The syntheses of these theories into a unified model make up for the peer criticism, boundary conditions as well as fundamental key propositions unlike when independently applied to information systems studies. The eight theories are based on the assumptions that users' beliefs and attitudes influence the adoption and usage of a technology (Aggelidis & Chatzoglou, 2009).

These eight theories include: Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). This theory is grounded in social psychology and, therefore, is regarded as a foundational theory for learning human attitude and behaviour (Oye, Iahad & Rahim *et al.*, 2014). The Technology Acceptance model (TAM) is regarded as the first theory developed specifically for IS context. TAM is an IS theory that models how and when users make decisions to accept and use technology. TAM was presented by Davis (1989) as an extension of TRA and elaborated on two main determinants – perceived usefulness and perceived ease of use that influences the use of a new technology. It is worth mentioning that the original TAM from 1989 has been further extended to TAM 2, with the inclusion of subjective norm as a predictor especially where system use was mandatory (Venkatesh & Davis, 2000). Later, TAM 2 was extended to include trust and perceived risk on system use in TAM 3 in 2008 (Lee *et al.*, 2012).

Theory of Planned Behaviour (TPB) (Ajzen, 1991) emerged as an extension of TRA with perceived behavioural control from Social Cognitive Theory (SCT) as an additional construct. In 1991, Thompson *et al.* introduced an alternative to TRA and TPB, the Model of PC Utilization (MPCU) (Thompson *et al.*, 1991). Then, the Motivational Model (MM) was also introduced by Davis *et al.* (1992). The motivational model is regarded as an integral aspect engaged in the IS context to acquire explanations to understand the adoption of a new technology.

Innovation diffusion theory (IDT) was developed by Everett Rogers in 1962 based on several past diffusion theoretical studies (Bhattacherjee, 2012). The theory assumes that in a social context, an individual (or group) of adopters learn about the potential benefits of a new innovation through communication channels over a timeline. A combination of Technology Acceptance and Theory of Planned Behaviour models (C-TAM-TPB) was developed, which combined the predictive elements of TPB with the concept of perceived usefulness from TAM (Taylor & Todd, 1995). The last theory under consideration was the Social Cognitive Theory (SCT) by Bandura, which is a theory of human behaviour, extended within computer utilization context (Compeau & Higgins, 1995).

3.5.1 The relevance of the UTAUT in this study

The UTAUT was adopted for this study because it was originally developed to explain employee acceptance and use of technologies in an organization, and it is widely cited as the most comprehensive model for investigating technology usage phenomenon (Venkatesh *et al.*, 2011; Venkatesh *et al.*, 2012). Since usage is significantly considered as a means to improve individual or organization performance and hence productivity, it is, therefore, an important factor in measuring IS adoption success or failure (Aggelidis & Chatzoglou, 2009).

The UTAUT provides a useful lens through which the researcher can evaluate the probable successes or failures of a new technology and the likely factors that would mostly improve its adoption and use in the public healthcare sector (Venkatesh *et al.*, 2003; Williams *et al.*, 2011). For instance, UTAUT helps to determine the questions to ask when evaluating the factors (and causes) that influence clinical staff decision to accept (or not accept) a new technology into clinical practice. The questions are asked in an attempt to find out the extent which clinical staff considers the practicability of the use of e-Health IS and their willingness to change established practices. Also, the researcher wanted to know, how their responses are driven either by organizational management or their colleagues or professional organization bodies as opposed to personal beliefs. Also, it is important to know how the lack of confidence or the reliability of a new technology affects the present status of the work processes of healthcare professionals.

The UTAUT provides a simplified path towards understanding the above concerns and how individuals would embrace a new technology or the choice of using it, as it suits their daily work activities. It is for this reason that UTAUT was selected as the most suitable theory to understand the causes of limitations to adoption and particularly, the use of e-Health IS by clinical staff in the public hospitals in the Western Cape, South Africa.

3.5.2 The constructs of the UTAUT

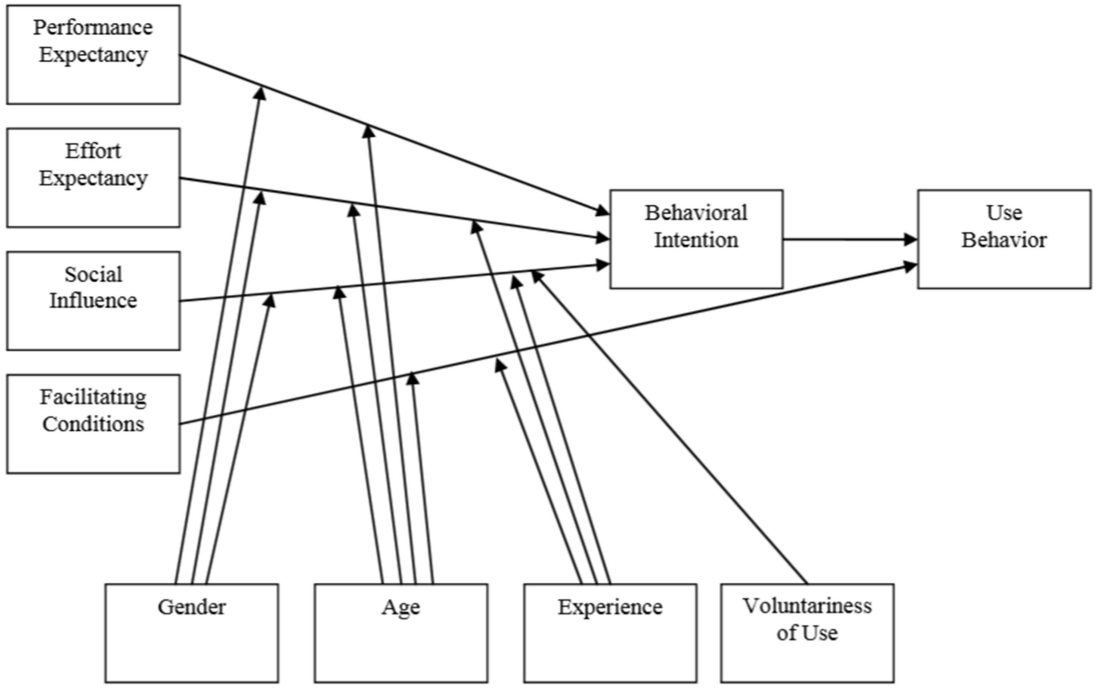

Figure 5: Unified Theory of Acceptance and Use of Technology (Venkatesh *et al.*, 2003:447)

In UTAUT, the three key constructs acknowledged to influence behavioural intention are performance expectancy, effort expectancy, and social influence while facilitating conditions and behavioural intention directly influences the use of a technology (Hennington & Janz, 2007). Simultaneously, these key constructs are subjective to moderating variables which includes: gender, age, experience and voluntariness of use (Venkatesh *et al.*, 2011). In the context of this investigation, intention was defined as the degree to which an individual has formulated the consciousness to perform (or not to perform) a specific behaviour – 'Use' of a technology (Veer, Peeters, Brabers *et al.*, 2015). The constructs of UTAUT are discussed in sections 3.5.2.1-3.5.2.4

3.5.2.1 Performance Expectancy

Performance expectancy is defined as the extent to which an individual believes that utilising a system is useful for their work, will help speed up work, accomplish their work, and

improve productivity as well as enhance their decision making process (Venkatesh *et al.*, 2003; Hennington & Janz, 2007). As elaborated in detail under the application of the UTAUT theory for this study in section 3.7, the essence of the performance expectancy construct, in particular, is that it brought forth the human perceptual aspects of adoption and the use of e-Health IS in the public healthcare sector. The root constructs of performance expectancy include perceived usefulness, extrinsic motivation, job-fit, relative advantage, and outcome expectations (Venkatesh *et al.*, 2003).

Perceived usefulness originated from the TAM and C-TAM-TPB and is defined as the degree to which an individual determines that using a certain system would increase their efficiency and job performance (Davis, 1989). As elaborated in more detail under the application of the UTAUT in section 3.7, the belief that a technology innovation increases the efficiency and job performance of a user impacts on its performance expectancy. Extrinsic motivation originated from MM and is defined as the perception that an individual will perform an activity because it is presumed to be influential in realizing a valued outcome separate from the aforementioned activity (Hennington & Janz, 2007). A technology innovation that yields a rewarding and exceptional valued outcome such as reduction in process time influences the expectation of the user to accept and use the system.

Similarly, Job-fit, which originates from the MPCU is defined as the manner in which the capabilities of a system would enhance an individual's job performance (ibid). In this regard, when a technology innovation is suitable for work processes, the performance expectation from the end-users tends to increase (Ifinedo, 2012). The aspect of job-fitness in the context of this study is elaborated in detail under section 3.7.

Another key construct under performance expectancy in UTAUT is that of relative advantage. It originates from IDT and is defined as the extent to which an innovation is assumed to be better than its antecedent. This assumption is based on the perception that a new technology innovation makes tasks/processes easier, faster and more productive than it used to be. It works with, and supplements perceptions on outcome expectations. In effect, outcome expectations are yet other constructs within the 'Performance Expectancy' concept as derived from SCT. Outcome expectancy is further classified into performance and personal outcomes. Personal outcomes deal with a sense of individual accomplishments such as enhanced productivity and improved level of professionalism from system usage.

The relevance in this study is that performance outcomes address job-related outcomes such as promotions and incentives, which are a fraction of success or failure in the use of task enhancing tools and systems in fields such as healthcare service delivery (this is elaborated in more detail under the application of the ATAUT theory in section 3.7). The moderating factors that have effects on the relationship between performance expectancy

and behavioural intention are gender and age (Venkatesh *et al.*, 2003). The application of the root constructs of performance expectancy and the moderating factors in this study are discussed in section 3.7.1.

3.5.2.2 Effort Expectancy

Effort expectancy is defined as the magnitude of ease associated with the utilization of a system (Venkatesh *et al.*, 2003). The effort expectancy construct explains the views on the exertion level that accompany the use of e-Health IS in the public healthcare institutions and as such, elaborated in detail in section 3.7.

The root constructs of effort expectancy is perceived ease of use, ease of use and complexity (Hennington & Janz, 2007). Perceived ease of use originates from TAM, and defined as the extent to which an individual perceives that using a certain system would be effortless (Davis, 1989). This construct implies a relatively low difficulty level in the usage of a system as perceived by the user while operating the system on a daily basis and easily finding the system easy to use. Similarly, simplicity or ease of use originates from IDT and defined as the extent to which a technology innovation is assumed as easy to use. This can be likened to the perceived ease of use originating from TAM.

Moreover, complexity originates from the Model of PC Utilization. It is defined as the degree to which a technology innovation is perceived as relatively challenging to understand and use. Thus, complexity points to the perception of the users about the stress level in comprehending how to use a system. The root constructs of 'Effort Expectancy' is elaborated in more detail under the application of the ATAUT theory in section 3.7.

The moderating factors that have effects on the relationship between effort expectancy and behavioural intention relationship are gender, age, and experience in the UTAUT model (Venkatesh *et al.*, 2003). The application of the root constructs of effort expectancy and its moderating factors are discussed in section 3.7.2.

3.5.2.3 Social Influence

Social influence is defined as the extent to which an individual perceives that important others believe he or she should use a new technology innovation (Venkatesh *et al.*, 2003). The social influence determinant and its root constructs reflect the notions of an individual's behavioural intention as influenced by their perceptions of the manner in which other people label him/her as a user of e-Health IS in the public hospitals. The application of social influence to this study is further broken down in section 3.7.

The basis of social influence includes subjective norm, social factors and image (Venkatesh *et al.*, 2003). Subjective norm originated from TRA, TAM, TPB and C-TAM-TPB and is

defined as an individual's perception that significant people expect him/her to or not to perform a particular behaviour (Venkatesh & Davis, 2000). It discloses that important others positively influence the user to actually use a system for their daily activities. Subsequently, it aims at presenting the influence of social factors on the users of the system in a public hospital environment.

Social factors, as key root constructs of 'Social Influence', were drawn from the MPCU. It is defined as an individual's internalization of a group's subjective culture and interpersonal agreements shaped in a particular social situation. It discloses the importance of peers and the organization management in assisting and supporting a user in actually using a system for their daily work activities.

In addition to social factors, image is another root construct that originates from IDT and is defined as the extent to which the use of a technology innovation is assumed to enhance an individual's persona or status in his/her social environment (Hennington & Janz, 2007). Furthermore, image connotes that users feel a higher sense of prestige from using the system than other individuals who do not use the system in the public hospital context. This is elaborated in more detail under the application of the UTAUT in this study in section 3.7.

The moderating factors that have effects on the relationship between social influence and behavioural intention are gender, age, experience and voluntariness in the UTAUT model (Venkatesh *et al.*, 2003). The application of the root constructs of social influence and its moderating factors were discussed in section 3.7.3.

3.5.2.4 Facilitating Conditions

Facilitating conditions are defined as the organizational plan and technical infrastructure that exists to directly support an individual to use of a technology innovation (Venkatesh *et al.*, 2003). The facilitating condition construct discloses the measures put in place by an organization including technical and personnel aspects to influence the use of e-Health IS in the public hospitals. This was further discussed in the application of UTAUT in this study, in section 3.7.

The basis of this key construct includes perceived behavioural control, facilitating conditions, and compatibility (Hennington & Janz, 2007). Perceived behavioural control is adapted from the TRA, TPB and C-TAM-TPB. It "*reflects perceptions of internal and external constraints on behaviour and encompasses self-efficacy, resource facilitating conditions, and technology facilitating conditions*" (Hennington & Janz, 2007: pp 63). Facilitating conditions originate from the MPCU. They are "*objective factors in the environment that observers agree make an act easy to do, including the provision of computer support*" (ibid). Compatibility originated

from IDT and is defined as the extent to which a technology innovation is perceived as consistent with needs, existing values and experiences for potential users.

This root constructs of facilitating conditions point out the provision of resources to be put in place by the organization such as software, hardware, IT personnel support and well-suited systems, to serve as catalysts in acceptance and use of a technology innovation. This is further elaborated in the application of UTAUT in this study in section 3.7.

The moderating factors that have effects on the relationship between facilitating conditions and use behaviour are age and experience in the UTAUT model (Hennington & Janz, 2007). The application of the root constructs of facilitating conditions and its moderating factors in this study are discussed in section 3.7.4.

3.6 The Use of UTAUT in Similar Studies

The UTAUT has been successfully applied in several IS research in the health field, including organizational adoption of new technologies in terms of social as well as human behavioural intention to use.

The study by Schaper & Pervan (2005) extended technology acceptance and use studies to present a more holistic understanding of the complexities of IS implementation success and how IS can be enhanced in the health sector. The findings indicated that both quantitative and qualitative methods support the UTAUT research model. The case study demonstrated qualitative support for the research model in providing rich information on additional factors that may influence allied health therapists' ICT acceptance and use decisions. These factors include altruism, individual commitment to the organisation and motivation, as contributing to the acceptance and use of a new system. Potential moderating variables such as job title or position, age and computer skills provided further evidence of the robustness of the UTAUT model and validated the importance of moderating factors.

An investigation by Wills, El-Gayar, Bennett & Benett *et al.* (2008) used UTAUT to examine healthcare professionals' acceptance and use of electronic medical records. The objective was to leverage the UTAUT as an evaluation model to investigate the acceptance and use of EMRs. The study showed that the UTAUT provided explanations to health professionals' acceptance and use of electronic medical records (EMR). Whilst there is an emergent recognition and demand for EMR, assessing the factors influencing adoption was a critical step toward defining success or failure of EMR initiatives. Subsequently, the findings indicated that UTAUT provided a rational assessment of health professionals' acceptance and use of EMR, with social influence as the most significant determinant of behavioural intention particularly amongst women (gender). The conclusion suggested that EMR

adoption and use could, potentially, be enhanced by strategic planning and management of the factors that contribute to individual and organizational social influence.

In another successful use of the UTAUT theory, Cohen, Bancilhon & Jones, (2013) explored the adoption of e-prescribing systems into physician practice. These were perceived as being slow despite the potential of such systems to improve the quality of the prescribing process. The findings show that performance expectancy is the most important factor that influences the acceptance and use of a technology. Physicians are convinced about the performance advantages of e-prescribing. E-prescribing systems must, therefore, be designed to bring direct benefits to the physician in the form of improved productivity, value and a more effective prescription process. This is important in ensuring trust and, consequently, increasing the perceptions of e-prescribing's usefulness without impacting negatively on the physician's ability to interact with patients.

The study provided a useful theoretical contribution by modifying UTAUT to include trust as a salient belief in technology acceptance. Physicians must feel comfortable using the technology to perform their daily work activities reliably and to meet their expectations. Lack of trust of the e-prescribing system as a result of cross-checking and repetition will increase effort and decrease productivity benefits. The inference revealed new inter-relationships such that performance expectancy and facilitating conditions are the key constructs that were most directly related to acceptance whilst effort expectancy and a newly incorporated construct – trust, have important indirect effects on use.

The similarity of the context of the studies (mentioned above) validates the relevance of the UTAUT for this study. For this reason, the UTAUT was applied as a theoretical framework and a lens through which the causes of limitations to the use of e-Health IS by clinical staff in public hospitals was investigated.

3.7 The Application of UTAUT in this study

In this study, UTAUT was applied to understand and acquire explanations of acceptance and use of e-Health IS by clinical staff in the public hospitals in the Western Cape, South Africa. The UTAUT theory presents extensive components which predicts that when an individual develops an intention to act – they are willing without limitations (Oye *et al.*, 2014).

3.7.1 Performance Expectancy

Under the performance expectancy concept, the assumption is that the clinical staff would accept a system they anticipate to assist in effectively executing their daily work activities. The key constructs of the 'Performance Expectancy' assumption is the 'Perceived Usefulness'. In the context of this study, the clinical staff would – under ideal circumstances,

expect the use of the e-Health IS to enhance their job performance, as observed through perceive usefulness.

Hence, under ideal circumstances, the implementation of the e-Health IS in a hospital is likely to be based on the assumption that it will directly benefit clinical staff, especially through enhanced productivity in their work activities, which validates extrinsic motivation and job-fit respectively.

On this basis, the e-Health IS would be viewed favourably in comparison to its antecedent systems - a positive outcome expectation which would further influence its acceptance and use. In essence, outcome expectations would relate to the increase in job efficiency and quality of clinical staff such that it might provide the possibility of incentives such as professional rewards and a relative high level of job satisfaction. Hence, under ideal circumstances, performance expectancy would positively influence the intention of clinical staff to accept and use e-Health IS in the public hospital environment. This assumption was used to contextualize, analyse and understand the status-quo in the use of e-Health IS in the observed healthcare institution/s in chapter 5.

In effect, behavioural intention is clearly paramount in decisions to adopt and use an e-Health IS in a public health institution. Gender serves as a moderating factor of performance expectancy, effort expectancy and social influence and their relationships to behavioural intention. The moderation by gender is strongly based around gender stereotypes and the social differences between men and women. With medical practitioners, however, it is assumed that there will be no gender differences among clinical staff due to their profession as regards the use of e-Health IS (Venkatesh *et al.*, 2011). This expectation is based on the assumption that all health professionals have the sole duty of saving lives and delivering quality healthcare services regardless of gender.

Similar to gender, age is also expected to moderate all UTAUT key construct relationships to behavioural intention to use a technology. In this regard, the effects of age are likely to be reflected in the culture, belief, opinions and reception of e-Health IS, often negatively by the older generation of healthcare professionals (Venkatesh *et al.*, 2011). However, positive reflections are expected to manifest mostly among the younger doctors as they are likely to feel more comfortable with using health information technologies. This is due to their daily interaction with different electronic systems outside of the hospitals by comparison to the older doctors who are already used to paper/manual systems. Obviously, where there are positive perceptions on the ‘ease of use’ (effort expectancy) of the system (in addition to the held performance enhancing perceptions) among doctors, they are likely to accept and use a technology – regardless of their age group.

3.7.2 Effort Expectancy

Likewise, effort expectancy is a key concept influencing behavioural intention to use e-Health IS. The concept of 'Perceived Ease of Use' is a major construct of effort expectancy. For example, positive perceptions on 'effort expectancy' suggest an expectation that a technology can be used with minimal effort and complexity. The assumption is that it should be easy to use. In the context of this study, where there is lower effort expectancy (very easy to use) of the adopted e-Health system, usage can be expected to be high. Conversely, where the effort expectancy (not easy to use), and therefore, requiring extensive learning (training) and understanding to utilize e-Health IS by clinical staff, usage of the systems is likely to be minimal because of an already overwhelming schedule. In this case, the complexity root construct would then be validated. For instance, provoking features on the interface of the e-Health IS such as consistent irrelevant alert messages that need to be dismissed and redundant repetition of processes several times (Cohen et al., 2013). When e-Health IS are perceived to be less complicated to use, there would be a likelihood of higher adoption by clinical staff.

However, experience is a moderator between effort expectancy, social influence and facilitating conditions and their relationships to behavioural intention. An individual that uses the system would have been through the rigors that come with system usage largely because as clinical staff accumulates years in experience, challenges that existed at early stages of adoption and the need to consult peer opinions tend to decline. Clearly, as clinical staff accumulate experience, the effort on e-Health IS usage is likely to reduce due to ease of use.

In an ideal situation where perceptions about the prospective benefits and little or no effort on e-Health IS usage are positive, user satisfaction on system usage as well as usage itself is expected to be very high. This argument was used to contextualize user perceptions towards the acceptance and use of the e-Health IS under the findings in chapter 5. However, peer consultations amongst clinical staff (social influence), especially those that have become acquainted with the system, play a crucial role is shaping perceptions about the usefulness, the ease of use as well as the acceptance and use of a technology.

3.7.3 Social Influence

Social influence is another key concept that influences the behavioural intention to use e-Health IS. The core constructs of social influence are the concepts of social factors, subjective norm and image. Social factors such as peer consultations and the involvement of professional organization bodies would make clinical staff consider adopting e-Health IS for their clinical practice. For instance, clinical staff are likely to seek, consider and weigh

perceptions of their colleagues in other departments or even at different health institutions as a precaution or source of learning and support for use of e-Health IS for their daily activities. Hence, this could serve as a major driver or deterrent of acceptance and use of e-Health IS.

Under subjective norms, a technical expert in a managerial or administrative position in a hospital (technocrat) might unilaterally make a decision on the adoption of an e-Health IS without the consultations of clinical staff. This could result in the acceptance or rejection of system usage. In terms of image, system usage might serve as a status booster for clinical staff using e-Health IS over their peers that do not utilise or are less competent regarding system use. Lack of utilization or low competency can be attributable to either anxiety, lack of knowledge or/and the fear of technology related devices (technophobia) for some clinical staff. Consequently, the assumption was that technocrats and technophobes would likely impact the perceptions (positive or negative) of clinical staff on the acceptance and use of e-Health IS.

Similarly, another form of social influence could be by duress. Depending on organizational policies, clinical staff might be pressurised into adopting e-Health IS for use; however, this can either result in a positive or negative influence on system acceptance and usage. This argument was used to contextualize social influence towards the acceptance and use of the e-Health IS, as discussed in chapter 5.

While social influence plays an important role in influencing behavioural intention of clinical staff on system usage, voluntariness is likely to serve as a moderator. For example, while doctors are the ultimate decision-makers as regards patient care, they tend to function with the most autonomy among clinical staff in a healthcare setting (Venkatesh *et al.*, 2011). Thus, pressure from organizational management and their peers are least likely to influence doctors' decisions to adopt and use e-Health IS.

Hence, in an ideal situation, clinical staff might develop positive perceptions as a result of social influence and ultimately influence their choice (voluntariness) to use e-Health IS, while forced influence and technophobia may result in either positive or negative implications towards system use. In additional to the organizational management role in decision- making as regards e-Health IS adoption, they are also meant to provide the enabling means (facilitating conditions), beforehand, to facilitate acceptance and use of e-Health IS.

3.7.4 Facilitating Conditions

The core constructs of 'Facilitating Conditions' are perceived behavioural control, facilitating conditions, and compatibility. Facilitating conditions entail the resources and an enabling environment expected to be available to drive clinical staff behavioural intention to use e-Health IS in the public healthcare institutions. These resources would include the appropriate

hardware, software and technical support (and training), which ought to be provided by the management of the hospitals to influence clinical staff to adopt e-Health IS. The organization's management in this study was represented by the hospital administrative officer or manager in charge of overseeing the systems operation of e-Health IS in the public hospitals where this investigation was conducted.

In the context of this study, the compatibility concept encompasses electronic systems that are suitable and offer consistency with needs lacking in existing work processes; these are liable to influence positive perceptions about the use of e-Health IS. Similarly, perceived behavioural control would positively influence the behavioural intention if clinical staff are provided with the knowledge resources (training) necessary, to acquire skills to facilitate the ease of use of e-Health IS. Therefore, under ideal circumstances where adequate facilitating conditions are provided for clinical staff, this should positively influence the acceptance and system usage otherwise, the converse is implied under less than suitable conditions. This argument was used to contextualize facilitating conditions towards the acceptance and use of the e-Health IS under the findings in chapter 5.

Whilst experience would have been accumulated by clinical staff over time, from the era of manual processes to pilot studies and the actual roll-out of e-Health IS in public hospitals, challenges would tend to decline. The assumptions are that where adequate facilitating conditions are provided by the organization management, experience would also count in realising a successful use of e-Health IS.

In retrospect, performance expectancy increases with positive perceptions about the prospective benefits and ease of use (Effort Expectancy) of e-Health IS usage, regardless of gender and even age group of clinical staff. Furthermore, positive opinions from colleagues (Social Influence) about usage experiences are likely to play a major role in positively influencing clinical staff behavioural intention and their willingness to adopt and use e-Health IS. Otherwise, when there are negative perceptions about job performance expectations and complexities in using e-Health IS due to undesirable outcome experiences from social factors and forced influence, there is less likelihood of acceptance and use by clinical staff. These arguments were used to contextualize user perceptions through the UTAUT towards realizing the research objectives and to answer the questions in chapter 5 (Findings).

3.8 Conclusion to Chapter Three

This chapter presented theories and their usage within the IS discipline, especially the health IS field – in particular, the unified theory of acceptance and use of technology (UTAUT) as an analytical lens to investigate acceptance and use of e-health IS in the public health sector. The aim of this chapter was to present a theory – UTAUT, applied to understand and acquire explanations on the causes of the limitations to the use of e-Health IS by clinical staff

in public hospitals, introduce theories, and discuss how theories are used in health IS discipline.

Health IS theories such as the Technology Acceptance Model (TAM), DeLone and McLean (D&M) IS Success Model, Task Technology Fit (TTF), were a few examples of theories' focus for this study. However, UTAUT was selected as the most suitable because it comprises of eight theories synthesized to predict and analyze behaviour and attitudes of individuals/organizations to adopt and use technology.

The key concepts of UTAUT include: performance expectancy, effort expectancy, social influence and facilitating conditions as discussed, followed by instances of how these key concepts are applied in IS contexts. Afterwards, similar studies where the UTAUT had been used successfully for different objectives, as elaborated in section 3.4.5 and the application of UTAUT in this thesis was fully elaborated. With the theoretical framework having been mapped, the methodology and techniques used to conduct the enquiry in the thesis are presented in the chapter (chapter 4).

CHAPTER FOUR – RESEARCH DESIGN

4.1 Introduction

This section provides the fundamental guidelines and systematic order of the activities employed by the researcher to address the research question (and sub-questions). It also clarifies the choice of the research approach and the methodology that describes how the researcher collected and analysed the data in this study.

The chapter introduces the research design adopted in this study in section 4.2, followed by the research approach and research philosophies in sections 4.3 and 4.4 respectively. Then, it outlines the research methodology used by the researcher to realize the objectives of this study in section 4.5, the procedures used for data collection in section 4.6 and selection criteria for the research sample size in section 4.7. Subsequently, the tools and procedures used for analysing collected data are discussed in section 4.8 and lastly, a conclusion to the chapter in section 4.9.

4.2 Research Design

Research can be defined as a systematic process of inquiry that involves collecting, analysing and interpreting data (information), and subsequently supporting or refuting knowledge claims such as theories (Creswell, 2003; Ellis & Levy, 2008). In this line of argument, the systematic concept clearly suggests a formal process of going about to investigate, which implies vigorous, methodical and replicable steps and guidelines of carrying out an enquiry. Again, the methodical assumption suggests a regime of specific methods, often referred to as scientific methods – to inform and determine a research process (Neuman, 2011; Orlikowski & Baroudi, 1991). The 'methodical' concept also suggests the significance of identifying, selecting and even designing the most appropriate methods and techniques upon which a specific research project and process of enquiry – can be based (Crotty, 1998; Walsham, 2006; Creswell, 2007). Therefore, a research design can be defined as the strategic and detailed planning as well as the execution of a study (Babbie & Mouton, 2001). It serves as a framework with procedures on how the research process is conducted i.e. a guide to what is being observed and how it is analysed (ibid).

Hence, the research was designed according to the purpose which the objective set out to achieve. A research could be for the following reasons: either to explore (exploratory research), to describe (descriptive research) and/or explain (explanatory) a phenomenon (Neuman, 2011). Types of research are discussed in sections 4.2.1 to 4.2.3.

4.2.1 Exploratory Research

Exploratory research is conducted to discover a topic, that is, to familiarize with a particular phenomenon (Babbie, 2011a). An exploratory research is undertaken when a researcher wants to attempt to examine and understand a relatively new subject of interest or to investigate persistent phenomenon in a field of study (ibid). In other words, exploratory research is appropriate when investigating phenomena about which very little or no information is known (Mlitwa, 2011). It stands at the basic level of research where it is conducted to gain basic information on which the more advanced descriptive and explanatory studies can be based (Babbie, 2011a).

In essence, exploratory research is conducted for three purposes: to have a better understanding, to test the feasibility of an extensive research, and to develop frameworks to be used in conducting future study on a particular phenomenon (ibid). It addresses the ‘’what’’ and “how” questions, which makes it the bedrock of conducting valuable scientific research (Neuman, 2011).

Whilst exploratory research is important for unearthing very basic information needed for further studies, it is by default, not an adequate method for investigating advanced descriptive and explanatory information as sought in this study. Yet, an exploratory approach would be useful in constructing basic questions for clarity, even though the objective of this study extends beyond basic questions of clarity – to more advanced descriptions and explanations of the research phenomenon. More specifically, it aims to understand and acquire explanations to the causes of limitations to the use (or non-use) of e-Health IS by the clinical staff in public hospitals, South Africa, to inform possible solutions.

4.2.2 Descriptive Research

The purpose of the researcher is to describe the situations and events that causes an effect or the outcomes by making observations (Babbie, 2011a). A descriptive research answers the “What” question, and caters for other questions such as where, when and how in the context of a study (ibid). Although this type of study is similar to an exploratory study, however, it is used to describe a topic or phenomenon in more detail. The outcome of the study would consist of a detailed report on the context of the phenomenon being investigated and why the observed patterns exist as well as its implications (Neuman, 2011). However, after giving a detailed description of the state of affairs of the use of e-Health IS by clinical staff in the public hospitals, there was a resolve to give explanations according to the objective of the study. Thus, an explanatory type of research is discussed in section 4.2.3 and its purpose in scientific research.

4.2.3 Explanatory Research

An explanatory study is an investigation that uncovers and reports the different facets of a phenomenon under study (Babbie, 2011a). It investigates subjects that already exist and is set on clearly defining them – the subject(s), for better understanding of causal relationships between variables and tend to address the "Why" question (ibid). It builds on exploratory and descriptive types of research such that it informs the cause and reasons why something occurs (Neuman, 2011). For instance, an explanatory research clarifies 'why' an existing phenomenon occurs, as derived from theory or past investigations, to see how accurate the explanation is or whether it needs modification or is only valid under certain conditions (ibid).

Since the research problem was of a nature that required explanations to the causes of limitations regarding the use (or non-use) of e-Health IS by clinical staff, the researcher adopted an explanatory research in this study especially to clarify the reasons impeding use (or non-use) patterns. Consequently, an explanatory research design would consist of an appropriate research approach which refers to the philosophical convictions and a methodology through which the investigation was shaped and conducted (Mlitwa, 2011).

4.3 Research Approach

A research approach is classified into inductive and deductive approaches with groundings in different philosophical standpoints (Saunders, Lewis & Thornhill, 2009; Neuman, 2011). The inductive approach employs qualitative data collected to build a theory from the data analysis; on the other hand a deductive approach emphasises on theory to form hypotheses and uses empirical research to test the hypotheses and make a conclusion.

Since the objective of this study was to understand and acquire explanations for the causes of limitations to the use (or non-use) of e-Health IS by clinical staff in public hospitals using a theoretical lens – UTAUT, a deductive approach was adopted for this investigation. A research approach is essential because it helps the researcher to understand, articulate and select suitable methods for data collection and analysis (Mlitwa, 2011). The philosophical convictions of scientific research include axiology, ontology and epistemology (Creswell, 2003).

4.4 Research Philosophy

Philosophy can be defined as the inquiry of fundamental concepts and the need to grasp understanding of a particular field through established paradigms (Burke, 2007). A paradigm is defined as knowledge claims (Creswell, 2003) or the identification of the underpinnings used to construct a scientific investigation (Krauss & Putra, 2005). It is also described as a set of fundamental assumptions and principles on how the world is viewed which, eventually,

guides the behaviour of the researcher (Wahyuni, 2012). In reality, it represents the rationale or motivation for undertaking a study (Mackenzie & Knipe, 2006) or is a means of identifying and sharing assumptions about core beliefs and values that shape ideas and actions (Burke, 2007).

Three key aspects emerge in the definitions. At the first instance, a research philosophy (paradigm) is closely aligned with, and presented as a basis for claims to knowledge, with implications that since research is a scientific process towards the discovery of truths about knowledge, that a paradigm is a significant aspect – and a foundation upon which a scientific process should be based (Krauss & Putra, 2005). On this basis, paradigms help in guiding researchers to view and thoroughly analyse the phenomenon under study (Wahyuni, 2012). Secondly, a paradigm is also presented as a source of reference to the operational process of constructing research (Krauss & Putra, 2005). Thirdly, it is presented as a logical guide to the researcher (ibid). It analyses the social world's entities by viewing these from different perspectives such as reality, scientific truth, nature of knowledge and logic of abstract phenomena (Uddin & Hamiduzzaman, 2009).

Its intent is to have a meaningful grip and understanding of a particular field or phenomenon (Burke, 2007). Therefore, the researcher applied suitable philosophical convictions as a guide in conducting the investigation on the phenomenon according to the objectives – to understand and acquire explanations for the causes of limitations to the adoption and particularly, use (or non-use) of e-Health IS by clinical staff in public hospitals. The research philosophical convictions including: axiology, ontology and epistemology paradigms were applied to this study as discussed in sections 4.4.1, 4.4.2 and 4.4.3.

4.4.1 Axiology

Axiology, which stems from two Greek words – "axios'' meaning worth/value, and logos meaning "to reason'' is concerned with the study of how human beings perceive the value of different things (Weinberg, 1970). It studies the nature of value as well as a different type of value in how things and events administer to human's basic and derivative needs and how they satisfy or affect living. Examples of these values include: ethics, morals, religion and aesthetic (Wahyuni, 2012). Axiology is significant because it assisted the researcher to learn about the importance of ethics and values in the design phase of an investigation. In other words, there were certain areas where the researcher asked some value-infused axiological questions about the processes and the perceived usefulness of e-Health IS to clinical staff. Nevertheless, whilst axiology offered a useful consideration to this effect in the design phase of this study, the focus of this work extended beyond a mere ethics aspect – to a broader understanding, description and explanation to the causes of limitations to the use (or non-

use) of e-Health IS by clinical staff in public hospitals, hence a broader perspective being sought in Section 4.4.2, the philosophy of existence (ontology).

4.4.2 Ontology

Ontology is an explicit philosophy that focuses on the conceptualization[12] of knowledge or reality i.e. knowledge exists and is being represented (Gruber, 1993). It refers to the systematic account of existence in the sense that what "exists" is that which can be represented (ibid). Ontology refers to the nature of knowledge – what reality commonly looks like irrespective of our knowledge of it (Uddin & Hamiduzzaman, 2009). It refers to human assumptions of how we view the world (Flowers, 2009; Bhattacherjee, 2012), and it enabled the researcher to unearth how the perceptions of reality influences the manner participants choose to disclose scientific truths (Bracken, 2014).

Ontology can be classified into realism (realist or objectivists) and nominalism (nominalists or subjectivists) (Wahyuni, 2012). Realism and nominalism have different claims about the existence of the objective versus the subjective of reality (Searle, 1996). The realist assumes that the existence of objective reality is independent of social actors – human and their interpretation which is in line with natural sciences and empiricist approaches to knowledge (Uddin & Hamiduzzaman, 2009). For instance, what our human senses show us as existing in reality is the scientific truth and objects in reality, which have an existence independent of the human mind (Saunders *et al.*, 2009).

On the other hand, the nominalists believe that reality is dependent on social actors and assumes that individuals contribute to the existence of social phenomena (Wahyuni, 2012). The arguments of this ontological perspective are that humans create structures of reality by naming, labelling or defining concepts (Gruber, 1993; Krauss & Putra, 2005).

Since the main objective of this study was to understand and acquire explanations to the causes of existing limitations to the use (or non-use) of e-Health IS by clinical staff in public hospitals, thus dealing with humans and their outlooks towards the phenomenon of investigation, the nominalist ontology about existence of a phenomenon that is socially constructed and contextual was applied to this study. Next, the theory of knowledge (epistemology) that informed this research is discussed in section 4.4.3.

4.4.3 Epistemology

Epistemology originates from Greek words epistêmê, meaning ''knowledge/Understanding'' and logos meaning ''study of'' (Krauss & Putra, 2005). It is also referred to as ''theory of

[12] A conceptualization is an abstract, simplified view of the world that we wish to represent for some purpose (Gruber, 1993).

knowledge'' as it seeks to understand what knowledge or reality is, how it can be acquired, and its validity on any given subject (Creswell, 2003; Krauss & Putra, 2005; Wahyuni, 2012). Epistemology is closely related to ontology and methodology because ontology involves the existence of reality while epistemology addresses how we know that reality on the other hand, methodology identifies the strategies used to acquire the knowledge of our reality (Orlikowski & Baroudi, 1991; Krauss & Putra, 2005).

Epistemology supports our ontological assumptions about the most suitable way to study a particular reality; either we use objectivist or subjectivist approaches to study social reality (Bhattacherjee, 2012). The objectivists builds and draws from the realist ontology which suggests that the valid way to view reality is through an objective empirical way while on the other hand, the subjectivist builds and draws from a contextual, subjective and interpretive way of studying social reality. Objectivism argues that social entities exist in reality external of social actors whereas the subjectivist view believes that social phenomena result from the perceptions and consequent actions of humans and social actors (Saunders *et al.*, 2009).

Therefore, ways of acquiring knowledge in an epistemological philosophy are categorized into empiricism and rationalism (Tedre, 2006). Empiricism refers to the strong conviction that the only valid reality is that which is experienced from human senses or knowledge of appearances (realm of nature) while rationalism deals with human moral reasoning (inter-subjectivity) and hence, social constructs (Hirschheim, 1985; Neuman, 2011).

An epistemology stance to an investigation, therefore, depends on (and is informed by) the phenomenon of investigation and the related ontological presuppositions. Depending on whether a phenomenon is of a natural science, objective and empiricist, or of a contextual and subjective nature, it is what defines the choice between the positivist, critical theory or interpretive epistemology as discussed in the sections 4.4.3.1- 4.4.3.3.

4.4.3.1 The positivism paradigm

In line with the underlying realist (objectivist) ontological presuppositions, the positivist paradigm is a branch of philosophy about the empiricist ways of getting to know. It posits that scientific truths or facts could be verified through empirical observations, measurements and rational analysis of the phenomenon being observed in line with the realists ontology (Creswell, 2003; Babbie, 2011a). The positivist paradigm often makes deductions from existing theories before collecting data in order to verify and support or refute hypotheses and to predict the patterns of human activities, ignoring the consequences of their cultural circumstances (Creswell, 2003; Burke, 2007). Thus, it is only suitable for scientific studies involving direct measurements dealing with statistics. Positivists argue that science is only certain when repeatedly subjected to verification through experiments, measurement and observation (Bhattacherjee, 2012). The positivist views the world as an independent

construction of our minds rather than as a subjective reality, as direct realists believe what you see is what you get and the critical realists, believe that, although there is a reality independent of a person's thinking, it can never be determined to a degree of certainty; therefore, it agrees with subjectivism (Saunders *et al.*, 2009; Bhattacherjee, 2012).

The positivist paradigm is an organized approach that draws upon the realist ontological perspectives of reality which has strong ties with natural sciences and empirical observations; however, this study seeks to understand a socially constructed, context-based phenomena as well as inter-subjective interpretations of knowledge. Therefore, the positivist epistemology was not suitable for the purpose of this study; it is for this reason that alternative paradigms were discussed in the subsequent sections.

4.4.3.2 The critical theory paradigm

Critical theory focuses on empowering individuals to transcend the constraints placed on them by social factors such as gender, age, race, social class (Creswell, 2003). The purpose of this paradigm is not to simply study but to change the social environment by clearing existing myths and align them with reality (Burke, 2007; Neuman, 2011). The critical theory paradigm is driven towards critiquing and changing the society (Reeves *et al.*, 2008). This means that the paradigm supports the concept of subjective reality because it acknowledges the existence of reality being influenced by cultural, economic, and social factors (Myers, 2009). The critical theory paradigm seeks to understand the conflicts caused by cultural, social, political and economic factors and criticizes the approach of other paradigms (Neuman, 2011).

However, the critical theory critiques both the positivist and interpretivist reality in the sense that the critical theory paradigm quizzes the status quo of the positivists approach of giving no consideration to the views and perceptions of humans while the interpretivist approach gives the utmost regard to human perceptions as more important than actual reality (Neuman, 2011). Whilst this paradigm critiques and advocates initiating change in socially constructed contexts, it was necessary at a point in this study to apply a critical interpretive perspective to the eventual findings of this investigation. Nonetheless, the study sought to do more – in the sense that the objective was to understand and acquire explanations for the causes of limitations to the use (or non-use) of e-Health IS by clinical staff in public hospitals. Therefore, an alternative epistemological point of view is discussed in section 4.4.3.3.

4.4.3.3 The interpretivist paradigm

Interpretivism is a "systematic analysis of social meaningful action through the direct detailed observation of people in natural settings in order to understand and interpret how people create and maintain their social world" (Walsham, 2006; Neuman, 2011). The interpretivist

paradigm is used to view phenomena within specific social contexts (Burke, 2007). It helps to understand people, how things are happening and what can possibly happen in the future (ibid). In other words, interpretivism acknowledges socially constructed and contextual nature of human experience and allows sharing of realities.

The main principle of this paradigm is such that research must be observed through direct observation as experienced by the people. Thereby, reality is constructed from human knowledge, where the researcher has a direct interaction from relating with the participants through the use of different strategies of inquiry tools (Walsham, 1995; Thorne *et al.*, 2004) The interpretivist approach makes use of observations, interviews, and analysis of existing literature to get a meaningful reality (Myers, 2009). However, interpretivist believe that the most appropriate way to study reality is though subjective interpretation of individuals' perspectives especially through interviews and then merging the similarities among their responses (Bhattacherjee, 2012).

Since this study deals with interaction between social actors and the phenomenon, such that the researcher sought to understand and acquire explanations for the causes of limitation to the use (or non-use) of e-Health IS by clinical staff in the public hospitals, the interpretivist paradigm was applied as the most suitable paradigm in this study. Thus, it helped the researcher get in-depth information and make subjective interpretations about the research phenomenon. Following this, the methodology that informed the research approach is discussed in section 4.5.

4.5 Research Methodology

A research methodology refers to a collection of methods and techniques used to carry out an investigation within a specific paradigm (Babbie & Mouton, 2001; Ellis & Levy, 2008). Research methods are approaches used to conduct data collection and analysis while research technique refers to the strategies of enquiry used to conduct a research such as questionnaires, observations, interviews, focus groups etc. (Creswell, 2007). The choice of methodology was informed by the research problem, objectives, and the main research question (Mlitwa, 2011). However, a research methodology can be quantitative or qualitative or mixed approach, depending on the context and purpose of an investigation at any given time (Neuman, 2011).

4.5.1 Quantitative Methodology

Quantitative research entails methods and techniques used to carry out a scientific study by measuring numerical quantity (Harwell, 2011). Common quantitative methods of enquiry are empirical and include mostly experiments and surveys, and the questions asked in these methods are fixed with closed-ended questions and pertaining to all respondents (Creswell,

2007). This means that participants are often constrained between a given set of responses and are not free to express themselves as they wish; rather, they conform to what is presented to them. The quantitative methodology supports the realist ontological view and positivist epistemological paradigm. Hence, quantitative methods and techniques are mostly used to do a response comparison across a large cross-section of participants in terms of numeric data i.e. information is acquired based on ordinal measures (Yin, 2012).

However, the objective of this study was to understand and acquire explanations for the causes of limitations to the use (or non-use) of e-Health IS by clinical staff in public hospitals with no intention of statistical measurements. Investigating the phenomenon required an in-depth understanding of the phenomenon as perceived in a subjective and natural setting; therefore, an alternative methodology is discussed in section 4.5.2.

4.5.2 Qualitative Research Methodology

The qualitative research methodology refers to a set of methods and techniques of collecting and analysing non-numeric data usually in words (texts) or images (Neuman, 2006; Babbie, 2011b). Qualitative research often takes place in a natural setting such as the workplace of participants in order for the researcher to be involved in the actual experiences of participant as well as being a part of the environment of study. The researcher tries to find the meaning of a phenomenon from the perceptions of individuals (Creswell, 2003).

In qualitative methodology, the researcher wants to understand the contexts in which participants in a study address a problem – participants and the problem cannot be separated (Creswell, 2007). The choice of methodology was informed by the research problem, objectives, and the main research question (Mlitwa, 2011). Qualitative methods use diverse interactive techniques to create an atmosphere that builds a credible understanding of the participants (Yin, 2012). A variety of these methods ranges from different strategies of inquiry such as narratives, phenomenology, ethnography, and case studies through the use of open-ended observations and interviews for data collection (Creswell, 2003). However, the phenomenology strategy of enquiry was applied in order to decide on the kind of data to collect and whom to collect it from due to the subjective and contextual nature of a qualitative methodology elaborated on in section 4.5.2.1.

4.5.2.1 Phenomenology

In this study, the researcher identified and placed utmost importance on individuals' personal experiences and assumptions concerning a phenomenon in their everyday lives and natural settings (Reeves *et al.*, 2008). Phenomenology aims to provide accounts that provide insight into the subjective experiences of individuals in terms of their understanding and meaning of their interpretations (ibid). The procedure in this type of study involves studying a small

number of subjects through an extensive interaction, to understand and develop patterns and meanings of a phenomenon (Creswell, 2003).

Since the study had to do with subjective and contextual understanding as well as acquiring explanations to the causes of the limitations on the use (or non-use) of e-Health IS by clinical staff in public hospitals, this required identifying participants that provided the researcher with in-depth information about the phenomenon of investigation. Subsequently, the tools of enquiry most appropriate to engage participants in collecting the qualitative data are discussed in section 4.6.

4.6 Data Collection

Data collection can be defined as a procedure of gathering data from participants during a scientific investigation period (Bhattacherjee, 2012). Data collection procedures help the researcher to set boundaries for the study (Creswell, 2003). Qualitative data collection procedures include observation, interviews (including unstructured and semi-structured interviews, focus groups through audio as well as visual resources, and through document reviews (Creswell, 2003; Creswell, 2007). These techniques help researchers to get the necessary and valuable information needed to carry out investigations. However, for the purpose of this study, literature study and interviews were employed to collect data.

4.6.1 Literature Study

A literature study can be defined as the act of preliminary searching and reading relevant background of a specific study in other to know its historical development over time as well as the present stance of investigations (Saunders *et al.*, 2009). The relevant sources include journals, conference proceedings, yearly reports, books, and other forms of information (Creswell, 2003; Neuman, 2011). It is also called literature review because it helps the researcher to generate and refine his/her research ideas and also to demonstrate a strong awareness of the current state of knowledge in the subject, its limitations and how the research fits in a wider context (Bhattacherjee, 2012). The literature study was engaged throughout this study; it was used to investigate the background description of e-Health IS, the research problem, and the techniques on how to conduct a proper investigation.

4.6.2 Interviews

An interview can be defined as a purposeful discussion between two or more people through the use of questions especially in a bid to get detailed information about something or someone, for instance, in conducting a qualitative scientific research (Saunders *et al.*, 2009). Interviews can be categorized as structured, semi-structured interviews and/or unstructured or in-depth interviews (ibid). Structured interviews are based on a fixed set of questions

while semi-structured interviews are conducted with open ended questions (Kawulich, 2005; Saunders *et al.*, 2009). Since structured interviews are inclined towards quantitative methods, they were not applicable in this study.

Conversely, a semi-structured interview was considered the most suitable when researching a subjective problem in a qualitative study from an interpretivist epistemology because it requires a contextual analysis and interpretation and enables the researcher to get in-depth information about participants' behaviours, interpretations and experiences (Ahern, 2007). These interviews can be conducted by the researcher, face-to-face with a participant or by phone and/or in a group of participants (Creswell, 2003). The interview involves unstructured and open-ended questions that allow the participants to express their views as well as grant the researcher the availability of answering the research questions in details (ibid).

Therefore, semi-structured interviews were used to interrogate participants in order to get their views and grasp a profound understanding and explanation of the phenomenon under study. All participants were interviewed by the researcher based on their relevance and the type of information the researcher sought for the study, within the duration of 30-45 minutes at the convenience of the participants. Consequently, the primary process required for data collection (such that the appropriate data sources and number of participants were properly selected) otherwise known as sampling is discussed in section 4.7.

4.7 Sampling

Sampling can be defined as the process of selecting a representative size of subjects (or participants or sample) out of an entire research population to examine in detail, and the researcher uses what is learnt to understand a phenomenon in a larger context (Neuman, 2011). The total set of subjects from which a sample is taken and to which the findings can be further generalized is called a research population (Saunders *et al.*, 2009). As it was impracticable for the researcher to collect data from the entire research population because of budget and time constraints, hence a suitable sampling method was required and selected (ibid). Each subject in a sample size is referred to as the unit of analysis (Bhattacherjee, 2012). A sampling procedure is categorized into probability and non-probability sampling (Babbie, 2011a).

4.7.1 Probability Sampling

Probability sampling can be defined as the procedure used by a researcher to select a sample size, where the research population size and location of the cases are known, and what emerges is generalized to the entire population (Neuman, 2011). In probability sampling, the chances of each case being selected or excluded randomly in a research sample from the research population are usually equal for all cases (Bhattacherjee, 2012).

Thus, probability sampling is often associated with the quantitative methodology, including survey and experimental strategies as the findings can be generalized to every case in an entire research population (Saunders *et al.*, 2009; Bhattacherjee, 2012). Probability sampling can further be divided into the following categories namely: simple random sampling, cluster sampling, systematic sampling, multi-stage sampling (Bhattacherjee, 2012).

Whilst the probability sampling is employed in an investigation in which the number and location of the research population is known, this current study operated under a broader spectrum where it was impossible to know the number, locate and have access to the entire research population; thus, an alternative sampling technique is discussed in section 4.7.2.

4.7.2 Non-probability Sampling

Non-probability sampling can be defined as the procedure used by the researcher to select a subject (or participant) sample, where the number and location of the research population are unknown (Babbie & Mouton, 2001). In non-probability sampling, a small sample can be chosen before and during the research process and is not determined statistically as it is subjective judgment depending on the population (Westberry, 2009).

In other words, non-probability sampling is non-random and may be subjected to a sampling bias by the researcher; thus, information from a sample cannot be generalized to the entire research population (Bhattacherjee, 2012). For example, the research population in this study fits the description of selecting a non-probabilistic sample because the number and location of clinical staff, as well as the e-Health IS that support clinical care, are widely dispersed such that they cannot have equal chances of being selected as a research sample by the researcher.

Furthermore, non-probability sampling can be categorised into: convenience (or haphazard), quota, snowball and purposive sampling (Saunders *et al.*, 2009; Bhattacherjee, 2012). However, purposive sampling was applied to carry out the sampling process in relation to the objective of the study – to understand and acquire explanations for the limitations to the use of e-Health IS by clinicians, as discussed in the section 4.7.3.

4.7.3 Purposive Sampling

Purposive sampling is a non-random sampling technique that uses a range of various ways to locate possible participants based on subjective judgments or bias by the researcher to answer the research question(s) as well as to meet the objectives of the study (Saunders *et al.*, 2009). Moreover, it is referred to as judgmental sampling because only a few cases are selected based on the researcher's choice of which subjects will be most representative of the research population (Babbie, 2011a). It is most appropriate when selecting unique cases

such as a skilled or specialized population in order to gain an in-depth understanding of the phenomenon under study from the sample size, which rarely represents the entire research population (Saunders *et al.*, 2009; Neuman, 2011).

In other words, the participants were identified and selected according to how they fit the purpose of the study. With respect to this study, the hospital staff that were directly linked to the use of e-Health IS in the public hospitals were the research population – unit of analysis, out of which a sample was selected as the unit of observation. Therefore, the judgment on which the researcher selected cases for the research sample was dependent on the research objectives and question(s). Consequently, this helped the researcher to achieve the objectives of the study of understanding the phenomenon and in answering the main research question (and Sub-questions).

To identify data sources, the collection tools, unit of analysis and the unit of observations, the purposive sampling process technique was applied and presented in Table 1 and the passages that follow provide details, as outlined in the next section.

Table 1: Purposive Sampling Table

Research Question: What are the causes of limitations to the use of e-Health IS by clinical staff in the public hospitals of the Western Cape, South Africa?					
Issue of Investigation	**Data Source**	**Tool**	**Unit of Analysis**	**Unit of Observation**	**No. of Participants**
Background, methodology	• Literature	• Read, analyse, write	• Books, Journals, Internet sources, Print media	• Methodology books & Journals, journals on e-Health adoption, Policy documents on e-Health systems – from libraries & online sources.	
Status of e-Health IS adoption and use in the public hospitals	• Literature • Public Hospitals	• Read, analyse, write • Interviews	• Books, Journals, Web-sources • Senior Hospital Administrative Official/s • Clinical Staff	• e-Health Journals, Reports on e-Health systems • Hospital administrator: 1x H1, 1x H2 • Doctors: (3 per hospital) x 6, Nurse: (1 per hospital) x 2	Hospitals: H1 and H2 6 Doctors 2 Nurses 2 Senior Hospital Administrative Officials
Purposes for adoption and use of e-Health IS in the public hospitals	• Public Hospitals	• Interviews	• Senior Hospital Administrative Official/s • Clinical Staff	• Hospital administrator: 1x H1, 1x H2 • Doctors: (3 per hospital) x 6, Nurse: (1 per hospital) x 2	
Perceptions on the use of e-Health IS in the public hospitals	• Public Hospitals	• Interviews	• Senior Hospital Administrative Official/s • Clinical Staff	• Hospital administrator: 1x H1, 1x H2 • Doctors: (3 per hospital) x 6, Nurse: (1 per hospital) x 2	
Limitations to the use of e-Health IS in the public hospitals	• Public Hospitals	• Interviews	• Senior Hospital Administrative Official/s • Clinical Staff	• Hospital administrator: 1x H1, 1x H2 • Doctors: (3 per hospital) x 6, Nurse: (1 per hospital) x 2	
Explanations to the status, perceptions, purposes & limitations of e-Health IS use in the public health sector	• Public Hospitals	• Interviews	• Senior Hospital Administrative Official/s • Clinical Staff	• Hospital administrator: 1x H1, 1x H2 • Doctors: (3 per hospital) x 6, Nurse: (1 per hospital) x 2	
				Total number of Participants:	**10**

In applying purposive sampling technique to realize the objective of this investigation, the research question was split into 4 main issues of investigation. As outlined in Table 1, these issues of investigation are the status, perceptions, purposes and limitations of e-Health IS adoption in the public health sector.

4.7.3.1 Status of adoption & use of e-Health IS in the Public Hospitals

The first of these issues of investigation was concerned with the status of e-Health IS in the public health sector. To investigate the status of e-Health IS acceptance required a basic understanding of words or phrases (attributes) that imply whether the systems were known, if it is being used – functioning, in which format, for what purposes and how it is being used. The background data used to address this issue of investigation was obtained from both the secondary and primary sources. The secondary sources included: books, journals and web-sources on e-Health IS through reading, analysing and writing while the primary sources were through interviews within selected public hospitals.

The public healthcare system in the Western Cape Province of South Africa is a tiered system. It consists of Community Health Centres (CHCs), secondary hospitals (which consists of district and provincial hospitals) and tertiary hospitals (Richards & Jacquet, 2012). The CHCs serve as the entry point for patients seeking primary and emergency healthcare. However, they are limited in resources with respect to clinical facilities. Patients in need of a more specialized clinical care such as laboratory testing and diagnoses are referred to the secondary hospitals and/or to the tertiary hospitals when an even higher level of advanced care such as specialized radiology, surgical operations are required (ibid). However, the hierarchy level of these institutions (the secondary and academic hospitals) varies with respect to clinical care, hence, two hospitals, one each at different levels were selected. Furthermore, additional considerations for hospital selection include the extent of e-Health IS implementation over time, their geographical location and the categories of the population they serve.

H1 hospital is a regional hospital and was chosen because a part of its processes have been automated and are complemented by the paper-based system; it plays a major role in maternal/infant healthcare services in the Western Cape, South Africa. Concerning the UNMDGs treaty signed by all United Nations countries in the year 2000 – which South Africa is a signatory, to reduce maternal and infant mortality rates by 2015, it is only fair to assess the progress made thus far, especially through the use of IT innovations. The second hospital, H2 is a tertiary hospital (also known as an academic hospital) which is the largest in the Western Cape Province, and the second largest in the Republic of South Africa. It offers

all specialized healthcare services and its clinical support remain largely paper-based systems transitioning to automated processes via the use of e-Health IS.

The primary sources of data collection were interview(s) with senior hospital administrative official/s and clinical staff. These were made up of one hospital administrator, three senior doctors/head of clinical departments and one nurse, each from the selected hospitals respectively, thus making a total of 10 participants.

- The senior hospital administrative officials within these selected public hospitals were selected (making a total of two) as representative units of observation because of their superintending roles in the organization. Moreover, they serve as a liaison between the management and the end-users of e-Health IS;

- Three Medical Doctors (from different clinical departments/units) were chosen from each of the selected hospitals (making a total of six) because of their relative level of experiences in their field of specialization. Hence, they were deemed likely to give an in-depth account of their experiences before the initiation, transition from paper/manual systems to the use of e-Health IS in their units; and

- A senior Nurse (from the Nursing unit) was selected from the selected hospitals, making a total of two senior nurses. They were selected because of their ranked position and level of experience in nursing management as well as their involvement in supporting doctors to perform delegated clinical care duties.

4.7.3.2 Purposes for adoption & use of e-Health IS in the public hospitals

The second issue of investigation, the purposes of e-Health IS adoption in the public health sector, focused on getting explanations from the participants about the reasons for adoption and using these systems. For example, this helped the researcher to know the reasons that led to adoption of systems, if the systems were performing what they are meant for and how useful, in terms of what has changed since systems implementation. To get explanations on the purposes of e-Health IS adoption; the secondary sources were reading materials as mentioned in section 4.7.3. The primary source of data was from the selected public hospitals through interviews as a tool of enquiry with the selected participants.

4.7.3.3 Perceptions on the use of e-Health IS in the public hospitals

The third issue of investigation, the perceptions on the adoption of e-Health IS in public health sector, focused on getting explanations from the participants about their opinions. This included attributes on participants' views on the use in terms of usefulness, relevance

and their experiences with e-Health IS for clinical support in the public healthcare institutions. The primary source of data was the selected public hospitals through interviews with the selected senior hospital administrative officials and clinical staff.

4.7.3.4 Limitations to the use of e-Health IS in the public hospitals

The fourth issue of investigation focused on the challenges of e-Health IS use in the public health sector. This was intended to help the researcher gain explanations on the causes of the barriers to the use of e-Health IS by clinicians in the public hospitals. For instance, this helped the researcher find out the difficulties experienced in terms of change management, technical difficulties, IT Skills and training. In order to get explanations to use challenges of e-Health IS; the primary sources of data were from the selected public hospitals through interviews with the selected participants.

4.7.4 Validity and Reliability of Sampling

In mapping out a research design, it is important to consider the influencing attributes such as validity and reliability. According to Bhattacherjee (2012:pp 58), validity is "*the extent to which a measure adequately represents the underlying construct that it is supposed to measure*" while reliability is the extent to which the measures of a social constructs are consistent. This investigation adopts a purposive sampling technique where representatives from a research population were identified from which, to investigate a phenomenon; and does not seek to generalize the outcomes of the study. Hence, the conceptualization of key issues of investigation and the UTAUT were used to determine and validate respectively, the variables to look out for in the primary data (transcripts). The concepts of validity and relaibility ultimately depends to a large extent on the researcher's epistemology assumptions (Becker & Niehaves, 2007). Since the study is subjective and adopts the interpritivist epistemological paradigm, relaibility was ensured by operationalizing the key variables of the issues of investigation and simplifying the wordings in such a way that participants are able to relate. However, this method might not yield the maximum reliability due to the subjective nature of the study. Consequently, the processes used for the analysis of the qualitative data are discussed in section 4.8.

4.8 Data Analysis

Data analysis can be defined as the process of converting data (text, images and/or voice) collected through document (literature), observations and interviews into meaningful and useful information for an intended purpose (Neuman, 2011). This process involves breaking down of the collected data into small chunks to ease evaluation as well as interpretation into

meaningful and useful information, which is then ultimately translated into new knowledge (Saunders *et al.*, 2009; Babbie, 2011a). The purpose of data analysis in this study was to evaluate, interpret and convert the qualitative data collected into useful information that best answers the research questions and meets the objectives of the investigation from the participants' view point (Creswell, 2003).

Since this study is solely based on a qualitative methodology, qualitative data was collected to get an in-depth understanding of the phenomenon being studied, therefore, a qualitative analytical technique was used in the course of research. Examples of qualitative research techniques include grounded theory analysis, case studies or ethnographic analysis, phenomenological analysis, narrative analysis, discourse analysis, hermeneutic analysis and content analysis (Creswell, 2003; Hsieh & Shannon, 2005; Bhattacherjee, 2012).
However, content analysis was found to be most suitable for the purpose of this study with respect to the research objectives and answering the research questions and is discussed in detail in section 4.8.1.

4.8.1 Content Analysis

Content analysis can be defined as a technique of analysing subjective interpretation of text data through a systematic classification process of coding and identifying arrays or themes (Hsieh & Shannon, 2005). By systematic classification, it means a prescribed process of going about addressing the research objectives and questions of a study to inform theory. Primarily, coding and identifying themes were the processes used to analyse and interpret text data in this study (Hsieh & Shannon, 2005; Creswell, 2007). Content analysis is suitable for emerging qualitative interpretive research studies that have textual data obtained from observation notes and semi-structured interviews (Kondracki, Wellman & Amundson, 2003).

Content analysis is commonly applied in line with the interpretive tradition of data analysis together with the hermeneutics principle, placing emphasis on unpacking all the potential interpretations of data and its multiple meanings thereof (Mlitwa, 2011). Therefore, content analysis was identified as the most appropriate technique for the analysis of the qualitative data in this study. Hence, the resolve to use content analysis is grounded in the need to understand the phenomenon under study and come up with meaningful information obtained from the text data transcripts (Hsieh & Shannon, 2005).

In this study, the first step towards analysing the qualitative data collected is to transcribe the interview sessions into text data. Then, the text data is dissected into smaller chunks through 2 processes known as conceptualisation and operationalization. The conceptualization involves defining the terms of the pre-set issues of investigation and identifying its variables.

The process of conceptualization is important because it helps to eliminate any form of vagueness and narrows the definitions of social constructs.

The variables are operationalized by determining their possible attributes – which are words (or phrases) that determine/measure the variables (Creswell, 2003). Then, descriptive codes are assigned to the attributes for easy identification by a process called coding - a process within data analysis which occurs prior to data interpretation (Bhattacherjee, 2012). Coding is necessary in order to identify evolving responses also known as variables. In this study, coding relates to sorting, interpreting, and extensively evaluating data according to the issues of investigation (Saunders *et al.*, 2009). During the coding process, the researcher reorganized the transcripts by allocating particular colours and a descriptive code as a key tool in the iterative process of qualitative study.

The coding process can be further divided into open coding, axial coding, and selective coding (Neuman, 2006). However, open and axial coding was found to be most appropriate and simultaneously combined with respect to the objective of the study. The open coding involves identifying key concepts hidden within textual data, which are hypothetically related to the phenomenon while axial coding involves identifying key concepts and assembling them into causal relationships that explain the phenomenon being studied (Bhattacherjee, 2012). The content analysis process enables the researcher to determine the frequency of the attributes, in order to develop categories and discuss the research findings to complete the process of data analysis.

4.9 Conclusion to Chapter Four

This chapter portrayed the guidelines which the researcher used to conduct the study – including the research design and methodology. It clarified the approach that was used to investigate the phenomenon to answer research questions and achieve the objectives of the study and reasons behind the choices.

The researcher reflected on the investigation through philosophies; the phenomenon studied was socially constructed and subjective to human nature and experiences; these motivated for why the study was carried out under the interpretivist paradigm with cogent reasons that support the claims as well as the methodology used. Then, the data collection method and procedure were elaborated on in detail to clarify the issues of investigation, data sources and unit of observations as well as the use of interviews as tools of enquiry. The sentiments of validity and reliability were also clarified.

The next chapter (Chapter 5) discusses the in-depth research findings from the analysis of the qualitative data.

CHAPTER FIVE – RESEARCH FINDINGS

5.1 Introduction

The aim of this study, as reiterated in previous chapters, was to explore the status of the adoption and use of e-Health IS by clinical staff in the public healthcare institutions in South Africa, and explanations thereof. Of particular focus in this process was to understand the causes of the limitations to adoption and more importantly use (and non-use) of e-Health information systems (IS) by clinical staff in public hospitals of the Western Cape. Thus, the aim of this chapter is to present a descriptive and interpretive discussion of the findings in validation of the literature reviewed and the research process in this study.

The research findings (Chapter 5) are divided into 5 sections. After the introduction section in 5.1, section 5.2 presents an outline of the data analysis process. This is followed by a descriptive presentation of meaningful and emergent information, based on the key issues of investigation in section 5.3, a discussion (and critique) of findings is presented in section 5.4 and a conclusion to the chapter in section 5.5.

5.2 The Data Analysis Process

The research findings presented in this chapter emerge from a step-by-step qualitative the content analysis technique to extract meaningful information from the interview transcripts. The content analysis technique helped the researcher to identify the variables and attributes of the pre-set issues of investigation through multiple stages of descriptive coding and the categorization processes. The content analysis was combined with the unified theory of acceptance and use of technology (UTAUT), which aided the researcher to obtain answers to the main research question (and sub-questions).

5.2.1 The context building process

The focus of the study was to determine and understand limitations to the use (or non-use) of e-Health information systems (IS) by clinical staff in the public hospitals. In this process, the main research question was further divided into 4 sub-questions which represented the key issues of investigation (categories) in this study: 1) status; 2) purpose; 3) perceptions and; 4) limitations of e-Health information systems by clinical staff.

In line with the research methodology (in Chapter 4) the empirical investigation commenced with the data collection. This entailed conducting semi-structured interviews with selected participants (see units of analysis in Chapter 4: Table 1). An application to conduct academic research was sent to the Western Cape Department of Health according to ethical

obligations, after which a clearance letter was granted to the researcher to approach the selected public hospitals for data collection.

On first contact with the public hospitals, the researcher explained the research objectives and the intended contribution of the study. The interview dates were set and confirmed via e-mails and telephone. Consequently, an informed consent letter requesting participants' permission was presented to each of the respondent just before the interview sessions commenced. The original sample size and the eventual number of respondents are represented in Table 2 below.

Table 2: Number of Respondents

Units of Observation	Number of Participants	
2 Public Hospitals in the WC	**Selected**	**Responded**
Senior Administrative Officers	2	2
Nurses	2	2
Doctors	6	3
Total Number of Participants	10	7

Table 2 indicates the unit of observation on the left and the number of participants on the right. The researcher initially set out to interview 10 participants. However, 7 respondents (2 Senior Hospital Administrative staff, 2 Nurses and 3 Medical Doctors) participated in the interviews. Applying the non-probability sampling technique (viz., purposive sampling), the respondents were selected from a research population of the respective units of analysis. Participants from the first hospital came from 1 administrative department and 3 Clinical departments, broken down into an Information Manager, a Senior Nursing Manager and a Medical Doctor. They agreed to be interviewed while the 4th participant, a Clinician was not available due to a regular hectic schedule with patients. At the second hospital, only 4 of the 5 participants – the Information Manager, a Senior Nursing Manager and 2 Medical Doctors, participated in the interview.

After each interview session, the researcher transcribed the voice recorded interviews to text to enable the use of content analysis. The content analysis process enabled the researcher to identify chunks of data (attributes) through conceptualisation and operationalization of each pre-set issues of investigation. In the context of this study, words (or phrases) used to determine a variable are referred to as attributes. Descriptive codes were allocated to the chunks of data in the form of different colour codes to simplify the identification of the attributes with respect to the pre-set 4 key issues of investigation.

The emergent themes were categorised and used to obtain answers to the main research question. Afterwards, the researcher drew from UTAUT to simplify the complexities of the phenomenon of study and obtain explanations and understand the acceptance and use of e-Health IS by clinical staff in a coherent manner. Moreover, the UTAUT assisted the researcher to describe and interpret the explanatory aspects of the responses as observed from participants to discuss the research findings.

5.3 Descriptive Presentation of Findings

This section draws on interview transcripts to outline the findings which are presented under the 4 sub-questions (or issues of investigation). The format of the findings is divided into a descriptive outline of the status of e-Health IS Adoption and Use (section 5.3.1), the purpose of e-Health IS use (section 5.3.2), perceptions on e-Health IS use (section 5.3.3) and the limitations of e-Health IS use (section 5.3.4) in public hospitals of the Western Cape.

5.3.1 Status of adoption & use of e-Health IS in the public hospitals

To identify the status of adoption and use, the researcher conceptualized the terms 'adoption' and 'use' through their definitions. As strongly argued by Venkatesh *et al.* (2003) and Cresswell *et al.* (2013), for a successful adoption of e-Health IS in a healthcare institution, there has to be "acceptance" to "use" by the target end-user groups. There must also be awareness of the existence, purpose and value of a technology before it can be accepted by the intended end-user group/s for use. This section presents findings on whether the operational stakeholders in public hospitals are aware of the electronic information systems (and whether the systems exist) in respective institutions; the type/s and description of existing electronic systems; the purposes for which such electronic systems were (or were not) introduced, and finally, the extent to which the electronic systems are being used across the hospital/s. A discussion of the status of awareness and acceptance of the implemented e-Health information systems in this section reflects a description of respective systems in each public healthcare institution under analysis.

The attributes of acceptance are indicated by positive perceptions (or negative perceptions) about e-Health IS. The researcher engaged the transcripts to look for related attributes of positive perceptions such as perceived usefulness of e-Health IS by the respondents. The emergent variables (sub-categories) of the first issue of investigation from the respondents: awareness and acceptance to use e-Health IS are discussed in sections 5.3.1.1 and 5.3.1.2.

5.3.1.1 Awareness and use of e-Health IS in the public hospitals

Findings suggest that the clinical staff have a high level of awareness, and a relative degree of acceptance to use e-Health information systems to support clinical care. When asked to reflect on the type, purpose and value of the implemented e-Health IS in their public health institutions for example, all 7 respondents (100%) demonstrated a high level of awareness and acceptance of e-Health IS and usage. They demonstrated clear descriptive knowledge of existing systems in their respective institutions, the purposes for which they are used, with positive perceptions on the usefulness of all 8 e-Health IS: CLINICOM, NIMS, JAC, NHLS, SINJANI, DISA Lab System, PACS and the RIS, among systems adopted over the past five years (**AC-H1-R20**; **KM-H1-R6**; **FDT- H1-R3**; **JM-H2-R2**; **GP-H2-R12**; **SR-H2-R8**; **SG-H2-R3**).

Clarity on the name and purpose of a system, with a respondent describing the system "*CLINICOM"* as their *"main patient information system",* used mostly by "…*the clerks…"* to *capture the patients' information…"* (**FDT- H1-R5**). To substantiate this point, this respondent went as far as stating that it was first *"…introduced at H1 in 2003…"* (**FDT- H1-R4**); which can be regarded a high level of conceptual awareness. In addition to CLINICOM, "…*the JAC pharmacy* system" and the "*National Health Laboratory Services* (*NHLS*) *system"* were adopted and have been in use *"…for the past 5 years more or less".* The JAC pharmacy system is specifically…*where the dispensing of medication is captured*…" (**FDT- H1-R5**) and used in the hospital pharmacy "*…only the pharmacists… use it"* (**FDT- H1-R24**).

Similarly, the *"NHLS is the lab system*" (**FDT- H1-R4**) used "…*to speed up…the obtaining of the results…via the computer*" (**AC- H1-R10**). The common belief is that the system is very useful in improving information access and processing for the medical doctors who "…*mostly use that system…"* (**FDT- H1-R5**). Arguments are that medical doctors *"…can view it* [system information] *and print it electronically"* effectively, and with ease. It is evident from the feedback from respondents that the implemented e-Health IS have practical uses, such that it enables management (i.e. capture, store, access, retrieve/extract and verify), and process (decision-making) patients' data/information.

In addition to the aforementioned systems*, "SINJANI"* which replaced the *"DHIS system",* is used *"to capture the stats…"* (**FDT- H1-R4**). SINJANI is described as "… *a report drawing system*…" (**KM-H1-R10**) and "…*a system where you record…monitor and evaluate, adverse incident reports that takes place*…" (**SR-H2-R7**). Moreover, the "*nursing information management system"* is used to "…*get all our requirements for nursing agencies that would cover the wards clinically"* (**KM- H1-R7**). The participants also mentioned the "*meal ordering system"* (**SR-H2-R8**) which can also be seen – and used – as *"…a system for clinical care*

because you see after the needs of the patient…". Likewise, *"the DISA Lab System"* was introduced and described as *"the health applications system"* which is used *"to get access to laboratory results…"* (ibid). Finally, the RIS and PACS which was described as the radiology systems *"used to access X-rays"* (**SG-H2-R3**).

From the unified theory of acceptance and use of technology (UTAUT), the perceived usefulness is instrumental in determining usage patterns, with a direct co-relationship between positive perceptions, and a negative co-relationship between negative perceptions – assumed in the theory. Positive perceptions on this construct are evident in the findings of this study. Positive performance expectations on most of the e-Health information systems for example, suggest positive usefulness perceptions and high acceptance, which in turn, is supported by frequent usage patterns and dependence.

In essence, 'Use' of e-Health IS in the context of this study implies; data capturing, access to patient results, report drawing and data verification functions. Usage frequency of e-Health IS (as embedded in descriptive statements of respondents) suggests functionality, high usage frequency, relevance, and therefore, a fair level of acceptance among the respondents. In the words of one respondent, for example, the systems are used on a daily basis. Referring to the CLINICOM and most of the implemented systems for example, one respondent said it is used "*… everyday, because people are admitted every day… so it's on-going...it's a live system…you know 24 hours"* (**JM-H2-R8**).

When asked which electronic systems are being used in the nursing department, another participant responded that the NIMS are "…*actually very broadly*…" **(SR-H2-R6)** used by the nursing staff. Such feedback confirmed the extent to which the implemented e-Health IS have practical uses for clinical staff and consequently, the state (either systems are in operation or not) in the public healthcare institutions. For instance, a respondent claimed that there is *"…access to technology so you don't have to be dependent on someone else…"* (**KM- H1-R6**), and all "…*important things are on the system…"* (**KM- H1-R6**). This response implied that all information pertaining to patients and their medical history is stored and can be accessed on the e-Health IS in the public healthcare institutions.

It is evident that e-Health IS are being implemented and in full operation in the public healthcare institutions. Without using the very same words in this account, an apparent dependency on the implemented e-Health IS and functionality is implied. Ultimately, the perceptions held by the clinical staff on performance expectancy would either positively (or negatively) influence the acceptance and usage of the systems.

5.3.1.2 Acceptance and use of e-Health IS in the public hospitals

In the context of this study, acceptance refers to both a collective and the individual willingness to adopt and use a technology tool, system or innovation – as demonstrated by perceptions and positive actions of the technology suitability (Bagozzi, 2007). Individual (or collective) willingness to accept a technology according to the unified theory of acceptance and use of technology (UTAUT) is a significant attribute of successful use of such innovation (Cohen et al., 2013). As regards the e-Health IS in this study, all 7 respondents indicated mixed levels of acceptance with only 3 (43%) respondents being slightly sceptical about the use of e-Health information systems in public healthcare institutions (**AC- H1-R20**; **FDT- H1-R21**; **KM- H1-R13**).

As regards the CLINICOM system, a respondent indicated that Medical Doctors "…*weren't very eager use the systems…"* (**FDT- H1-R21**). The majority of them believed that "…*it's more on the administrative side not on the clinical side*…" (**AC- H1-R20**), and they are employed at the hospitals, *"…for clinical reasons and not administrative reasons…"* (**FDT-H1-R21**). Distinguishing between the administration and clinical functions to reject the system assumes that the 2 functions are mutually exclusive, which calls to question the logic of such reasoning. On closer examination, however, it emerged that there could be more to the scepticism than just the difference in functions, with operational literacy limitations appearing to be one of the major causes. For example, certain groups of nurses were "…*still struggling with getting used to electronic…"* systems (**KM- H1-R13**), and, therefore, not entirely accepting the transition. Given the scepticism, awareness level on the suitability of e-Health systems for clinical functions among the clinical staff appears doubtful.

Nevertheless, whilst critical explanations to these isolated cases of scepticism are presented under the discussion of findings (in section 5.4), the majority of respondents appeared to accept the use of e-Health systems. In effect, 4 (57%) respondents (the majority), indicated support and preference for the use of e-Health information systems in public healthcare sector (**JM-H2-R27; GP-H2-R10; SR-H2-R10**; **SG-H2-R7**). In this category of responses, doctors were described as "…*very good with using the NHLS"* (**FDT- H1-R21**), which indicates practical preference, with positive implications on the ease of use. Further, none of the clinical staff had "…*any problems with it…"* (**JM-H2-R27**). On this point, Medical Doctors identified the NHLS as an enabler of access efficiencies (**GP-H2-R10**; **SR-H2-R10**), which further indicates support (and therefore, acceptance). Hence, the adoption of e-Health systems is described as "…*the logical choice…"* (**SG-H2-R7**).

The collective acceptance, on the other hand, goes beyond the individual to include institutional and decision-making level of the willingness to adopt and use a technology

innovation. It is clear in the findings that the public healthcare institutions have acquired e-Health information systems – which at the very least, suggests acceptance at the decision making level. Despite this level of acceptance, however, facilitating conditions are crucial for the adoption and usage of technology innovations to succeed (Venkatesh *et al.*, 2011). These facilitating conditions refer to organizational support such as provision of computer training and incentives, including technical resources including software, hardware and IT support to enable a seamless use of e-Health IS by the end-user groups (ibid).

The findings reflected that there are provisions of electronic systems to aid the execution of work activities by clinical staff. The clinical staff, according to the findings, tends to accept and use certain e-Health IS based on the positive performance expectancy. On the contrary, when the end-users tend not to accept the systems in this study, institutional acceptance at a decision-making level is by default, compromised. In this regard, it can be presumed that job-fit ultimately exists in a co-relationship with extrinsic motivation. The extrinsic motivation suggests that when e-Health IS are perceived not to yield any form of exceptional valued outcome, clinical staff would not accept or use the system.

However, a major percentage of the clinical staff seems to understand the purposes for which e-Health IS should be used in healthcare institutions. As a result, most of them are willing to accept and use e-Health IS. Whilst this suggests a collective willingness by the management of the public healthcare institutions to adopt e-Health IS and the respondents' readiness to use as described beforehand, the sceptical responses imply a need for deeper explanations to validate the adequacy of the findings (as critiqued in section 5.4). The purpose(s) for e-Health IS adoption in public hospitals are provided in the next section 5.3.2.

5.3.2 Purposes for the adoption of e-Health IS in the public hospitals

The patterns of e-Health IS adoption are informed by held perceptions on the supposed purposes of use the systems should serve; hence the patterns cannot be understood outside the context of the perceived purposes of usage (Breen, Wan & Oritz, 2010; Sun & Qu, 2014). In the context of this study, a "purpose" is defined as the reason(s) for which an act is created or exists. Consequently, the researcher operationalized the term by identifying attributes that suggest reasons for the adoption of e-Health IS by clinical staff.

This section draws on the unified theory of acceptance and use of technology (UTAUT) and the phases of technology uptake in the Gartner's Hype Cycle (Figure 4) in chapter 3, to identify the 'rationale' as well as the use of e-Health IS – from the data transcripts. The researcher looked out for attributes that establish the rationale in terms of words or phrases that simply implied the reasons that led to the adoption of e-Health IS in public hospitals.

5.3.2.1 Rationale for the adoption of e-Health IS in the public hospitals

Under this section, the researcher wanted to understand from the participants, the reasons for the adoption of health information technologies (HITs). For this reason, insight was drawn from both the Gartner Hype Cycle (Figure 4) and the UTAUT (Figure 5) to identify indicators from data transcripts.

Data in the findings suggest that the public healthcare sector has gradually risen from the technology trigger phase and is being transitioned to the peak of inflated expectations. At the peak of inflated expectations stage, positive perceptions about the expected outcomes (or benefits) attributed to a new technology innovation influence end-user groups acceptance. The management of the hospitals tend to initiate e-Health information systems without taking adequate cognizance of imminent challenges and conducting extensive assessment studies at initial adoption process stages before usage. This is further supported by the performance expectancy assumption in the UTAUT framework (Figure 5).

On this aspect, findings indicate that the adopted e-Health IS were implemented in the hospitals with expectations among the stakeholders and clinical staff that it would improve clinical care processes. In other words, a major rationale was that systems were perceived to be useful, with high performance expectations (**AC- H1-R37**; **JM-H2-R5**; **GP-H2-R16**; **SG-H2-R1**; **SR-H2-R10**). In this respect, sentiments were that e-Health IS promise "…*the ability to enter clinical notes directly on the computer…*" (**SG-H2-R1**) and apparently, "…*more correct for all the purposes*…" (**JM-H2-R5**). Further assumptions are that e-Health IS can also improve accuracy in the way data is handled, with claims that clinical staff are least "…*likely to make mistakes than a paper system*…" (**GP-H2-R36**). In addition, adopting electronic systems is appositively associated with "*… the green initiative; going from paper use to paperless…"* (**SR-H2-R10**), and therefore, preferred to non-electronic initiatives. Part of the rationale for the adoption and hence, the use of electronic systems in public health institutions therefore, was clearly the positive perceptions on usefulness and performance expectations on the part of related stakeholders.

In the findings, electronic systems were also considered by participants to be an indication of modernity and technological advancement, a positive perception with connotations that the trend should be encouraged. To illustrate this point, for example, one respondent remarked that "…*everything outside of the hospital*…" (**AC- H1-R37**) is mostly electronic, and the public healthcare institutions are "…*very much behind…"*. The respondent further compared developed countries public healthcare institutions to the status quo in South Africa. A comparison was that systems in developed countries, where "…*people don't use papers anymore*…" (**SR-H2-R34**) and "…*everything is electronic*…" (**AC- H1-R38**), are more

advanced than in South Africa where only "…*certain hospitals...”* are equipped*,* with instances such as "…*the second military hospital in Pretoria*…" and "…*Albert Luthuli Hospital in Durban*…", cited as examples of advanced institutions. Hence, it is anticipated on the part of the government and decision-makers that e-Health IS "…*must be introduced*…" (**AC- H1-R37**) and there is no reason "…*anything should remain not electronic*…" (**AC- H1-R39**).

Despite the individual perceptions, decision-makers in the government and the national ministry of health also emerged as the dominant drivers (or a major rationale) for the move towards electronic healthcare systems in public hospitals. Arguments are that the government and the central healthcare bureaucracy made concluded before an adequate pilot study that "…*they were going to implement*…" as opposed to "…*whether it was going to be implemented*…" (**GP-H2-R16**). This suggests a policy imposition that could (or could not) be supported by users in the workplace. In this instance, however, user perceptions already indicate support through positive expectations and acceptance of electronic systems by users on the ground. The emergent trend behind these parts of the rationale is critiqued with detailed causal explanations under the discussion of findings in section 5.4.

It is evident from the findings that positive perceptions about optimistic outcomes such as enhancement of tasks, efficiencies and quality assurance influences e-Health IS acceptance and use by clinical staff unlike its antecedent – paper-based/manual systems. Ultimately, the implemented e-Health IS are continually used in efforts to improve processes vis-à-vis patients' flow from initial point of admission up until discharge as well as decision-making in the clinical care process. An interpretive discussion (and critique) of the findings is presented in section 5.4; however, the individual perceptions on the acceptance and use of e-Health IS are presented in the next section 5.3.3.

5.3.3 Perceptions on the use of e-Health IS in the public hospitals

The willingness to accept (or not accept) and use (or not use) a new technology is greatly dependent on individual (or group) perceptions (positive or negative) on the technology innovation (Cline & Luiz, 2013). In the context of this study, 'Perception' is conceptualized as the way in which a phenomenon is observed or understood by an individual as influenced by their environment. The section presents findings on user experiences (positive and negative) with respect to e-Health IS use. Hence, the researcher identified attributes that implied either positive or negative perceptions from the data transcripts with respect to perceived ease of use, suitability and usefulness as a result of their experiences on the use of e-Health IS.

5.3.3.1 Perceived ease of use of e-Health IS in the public hospitals

In this section, the researcher wanted to know the ease and efficiency with which clinical staff use e-Health IS to execute their work activities in the public healthcare institutions. As regards perceived ease of use, 5 out of the 7 respondents reported positive perceptions on the usability of e-Health IS for their work processes (**AC- H1-R30**; **KM- H1-R22**; **SG-H2-R16**). The respondents disclosed that the implemented e-Health IS are simple, easy and efficient to use. When asked about the user-friendliness of the implemented e-Health IS, a respondent said that the systems "…*are fairly easy*" (**KM- H1-R22**) to use. When properly introduced with training, they are convinced that the systems are "…*so simple…"* (**AC- H1-R30**) and requires little or no expertise to operate the electronic systems. For instance, "…*any person that can use a cell phone is able to access the computer systems"* (**SG-H2-R16**).

The arguments are that if clinical staff "…*don't use a program, it doesn't matter how much training…"* (**KM-H1-R16**); only with frequent use would the users learn, understand and develop a habit of system usage. Ultimately, there is continued use of the implemented e-Health IS which ultimately develops into a habit. *Habit* was defined by Venkatesh *et al.* (2012) as the extent to which an individual performs a certain conduct routinely because of understanding. From the findings, it is clear that there is a co-relationship between the frequent usages of implemented e-Health IS and its suitability to execute clinical work processes. The ensuing perceptions of the clinical staff on the suitability (or non-suitability) of implemented e-Health IS for work activities is discussed in the next section.

5.3.3.2 Suitability of e-Health IS use in the public hospitals

From the previous section, it is evident that positive perceptions on the ease of use influences the clinical staff to frequently use the implemented e-Health information systems. Hence, the frequent usage of the e-Health IS also implies a high level of suitability for work processes of the clinical staff in the public healthcare institutions. In this section, the researcher wanted to find out the extent to which implemented e-Health IS are appropriate for the execution of work processes. The respondents described mixed accounts on the compatibility (or non-compatibility) of the implemented e-Health IS with work processes.

On this aspect, despite acknowledging that the implemented e-Health IS were adopted to improve processes, the respondents alleged that certain e-Health IS do not entirely fit their work processes. For example, the CLINICOM is alleged to be "…*a little bit pointless..."* (**AC-H1-R20**), as the Medical Doctors rarely find the direct need to make use of the system. Another respondent claimed that electronic clinical notes "…*are too clumsy*…" (**GP-H2-R24**)

as it "…*would never be particularly easy to work with…"* (**GP-H2-R28**). The argument is that a co-relationship exists between ease of use and suitability of the implemented e-Health IS.

Although, when asked if the electronic systems are performing what they are meant for, the respondent confirmed that both the *"…X-ray system definitely and the Laboratory system definitely*..." (**GP-H2-R14**) are more effective for work processes in contrast to the clinical notes. The respondent argued that "…*it would be nicer*…" (**GP-H2-R26**) if the implemented e-Health IS are available on portable mobile devices. Similarly, when asked what would influence the use of e-Health IS by clinical staff, another respondent said that the e-Health IS should be "…*more mobile-smart phone and tablet friendly…"* (**SG-H2-R33**).

The unified theory of acceptance and use of technology (UTAUT) suggests that when a technology is suitable for work processes, positive perceptions by the end-users tend to increase the acceptance and use of such systems; as observed in the case of respondents. Suitability of the implemented e-Health IS suggests that the clinical staff found the systems to be useful for work processes in the public healthcare institutions.

5.3.3.3 Perceived usefulness of e-Health IS in the public hospitals

In this aspect, the researcher wanted to know the positive (or negative) impacts associated with the use of e-Health IS by the clinical staff in the public healthcare institutions. On the aspect of usefulness, the major consensus by respondents is that the implemented e-Health information systems serve as a "…*more efficient and effective way…"* (**JM-H2-R5**) to execute work processes. When asked about the experiences of clinical staff since the introduction of electronic IS, another respondent said that "…*it is far more useful, it does simplify our task, and it is quicker…"* (**FDT- H1-R30**). Ultimately, the findings indicate that the e-Health IS have made work processes "…*so much easier*…" (**KM- H1-R11**) by eliminating "…*a lot of unnecessary…"* (**JM-H2-R14**) practices, which also implies *"…shorter waiting times…"* (**SG-H2-R11**) for patients. For instance, Medical Doctors "…*don't have to repeat…"* (**AC- H1-R33**) the same things over again as experienced while "…*using manual systems…" (***SR-H2-R13**). Similarly, the implemented e-Health IS free up nurses and allows them to *"…concentrate on supervision and more clinical work…"* (**SR-H2-37**) within the wards.

Not only is there improvement in time-efficiency, a respondent believes that the government "…*will save billions of Rands…"* (**AC- H1-R37**), after adopting e-Health IS. For instance, findings indicate that the CLINICOM system was adopted as a "…*universal patient system…* (**JM-H2-R16**), to have "…*one folder number for every patient*…" (**FDT- H1-R30**) in all the public hospitals *"…wherever you go in the Western Cape…"* (**JM-H2-R16**). It can be inferred that the CLINICOM system was adopted and is implemented to avoid the need to implement several other electronic systems that perform the same function. Further, the CLINICOM

system serves as a universal electronic system for easier access to and faster processing of patient history (records) by healthcare professionals regardless of the public healthcare institution – in the Western Cape Province.

In summary, clinical staff found e-Health IS useful and it provides a platform to improve the efficiencies of time and cost management expended in the public healthcare institutions. Whilst reflecting on the previous attributes of individual perceptions (ease of use, suitability and usefulness), the findings suggest a 4th perception – Social Influence, and is discussed in the section that follows (section 5.3.3.4).

5.3.3.4 Social influence

In this aspect, the findings indicate that social influence plays a major role in the successful adoption of e-Health IS in the public hospitals. Out of the 7, 5 (71%) respondents believe that the influence of colleagues and the management (as well as decision-makers) would influence the acceptance and use of e-Health IS in the public healthcare institutions. For instance, the argument is that "*…peer pressure would alter and push and force certain people…"* (**KM- H1-R15**) to utilise the implemented e-Health IS. Nevertheless, another respondent believed that the "…*management's view..."* (**FDT- H1-R23**) plays an important role with respect to encouraging and ensuring that "…*those staff to take on the systems…".*

Another respondent corresponded that the adoption of electronic systems is believed to be "…*more political than actually practical approach*…" (**AC- H1-R35**). It is clear that the pressure from colleagues, the organizational management and decision-makers on adoption of e-Health IS would positively influence the willingness of clinical staff to accept and use systems. Further, the proficiency of the skilled elites and the willingness of technophobes are factors that influence the acceptance and use e-Health IS by members of the clinical staff who are yet to adapt to the new technology. Explanations (with a critique) of the probable causes to the findings are presented in more detail in section 5.4. The 4th issue of investigation – limitations of e-Health IS usage in the public hospitals is analysed in the next section 5.3.4.

5.3.4 Limitations to the use of e-Health IS in the public hospitals

In this section, the researcher wanted to know the limitations that influence the acceptance and use of e-Health IS by clinical staff in the public healthcare institutions where this study was conducted. In this study, the term 'Limitation' was conceptualized and defined as a restricting condition that hinders an intended act. In the context of this study, 'Limitation' was determined by variables such as inadequacies and technical difficulty. Inadequacies in facilitating conditions serve as a limitation such that if users lack essential resources

(software, hardware, IT support and training) and knowledge (skills) required to use a technology, they may develop negative perceptions which either result in selective usage or discarding of a new technology innovation (Alwahaishi & Snásel, 2013). Hence, this section presents the findings on user experiences concerning use challenges and the impact of use challenges on clinical care processes. The researcher searched through the transcripts for the attributes of inadequacies with respect to words (or phrases) that indicate actions that impede the acceptance and use of e-Health IS by clinical staff. In addition, the researcher identified words (or phrases) that imply glitches associated with the use of e-Health IS. When asked to reflect on the factors that inhibit the use of e-Health information systems, all 7 (100%) respondents reported various inadequacies and technical faults.

5.3.4.1 Inadequacies of e-Health IS use in the public hospitals

Under this section, the researcher wanted to explore and understand the deficiencies in the use of e-Health IS as experienced by clinical staff. The extent to which adequate facilitating conditions are provided, partly influences the perceptions of individuals to use of a new technology (Karuri *et al.*, 2013). In other words, the perception that the facilitating conditions are deficient or less than adequate, would likely influence the use of a new technology and ultimately the efficiencies of quality clinical care services delivery (Li *et al.*, 2013).

The findings show that insufficient ICT systems, financial, socio-political constraints, busy schedule, resistance and non-flexibility are factors that impede the use of e-Health IS by the clinical staff in the public hospitals in this study (**AC- H1-R32**; **GP-H2-R26**; **SR-H2-R15**).

There seems to be less than sufficient ICT systems for clinical care as a clinician respondent disclosed that they "…*don't have ICT…"* systems (**AC- H1-R32**). Respondents further disclosed that lack of adequate hardware is due to financial restrictions in public hospitals on the part on the government. It was described that the e-Health IS are "…*a little bit slower…"* especially because *"…most of the computers are older than 3 years…"* (**SR-H2-R15**) and even the present backup systems for the workstations "…*are very old…"* (**FDT- H1-R29**). The respondents clarified that the backup systems are overly due for replacement but *"…there's not always finances…"* (**SR-H2-R15**). This was regarded as a major challenge "*…within the government"* (**SR-H2-R15**), as "…*doctors are ruled…by various people* (**AC-H1-R38**), who are accustomed to traditional methods and not willing to compromise. It is clear from the findings that the implementation of e-Health IS are less than adequate, to the extent that there is insufficient budget and the clinical staff feel it is expected that a higher authority should naturally facilitate the implementation of the e-Health IS.

It is evident from the findings that the resistance to use e-Health systems is peculiar to the older generation of clinical staff who "…*aren't familiar with technology…"* (**JM-H2-R10**),

because they perceive *"…computers… as a challenge..."* resulting in the selective use of the system. In addition, the hospital management "…*still don't have very good buy-in …"* (**FDT-H1-R21**) from clinical staff. For instance, the CLINICOM system enables clinical staff "…*to put in information*…" (**FDT- H1-R30**) such as the clinical notes, but that function is never optimized. With respect to some implemented e-Health IS, respondents complained that features were "…*problematic…"* (**GP-H2-R31**) and lacks the "…*ability to enter clinical notes…"* (**SG-H2-R1**) and capture "…*patient held records…"* (**SG-H2-R15**).

The findings also indicated constraint of e-Health IS mobility in terms of flexibility to work at any place and any time, inhibits use. A respondent disclosed that "…*there are two challenges…"* (**GP-H2-R26**) associated with the clinical note system. The respondent further stated that "*…it's not mobile…"* and secondly, "…*you can't enter data directly..."* on to the system. In essence, the system basically stored "…*pieces of paper that have been scanned in their thousands or their tens of thousands*…" (**GP-H2-R19**). The respondent claimed shortcomings are experienced ultimately "…*when the processes are slow…"* and "…*when a user isn't adequately trained*…" (**FDT- H1-R30**). It is clear from the findings that some of the implemented e-Health IS were not pragmatically designed to be used effortlessly, while training the clinical staff to use the systems appears to be a necessity.

The findings show that facilitating conditions are less than adequate. For instance, training to acquire the required skills to facilitate the use of e-Health IS are put in place by the hospital management but it is either not adequate or the individual capabilities ultimately determine whether the systems would be used (or not used).

Moreover, certain e-Health IS are non-compatible with the preference of clinical staff as they lack complete electronic features that restrict the work-flow of clinical staff and also slow down their work processes. In essence, e-Health IS that are suitable and offer consistency with the needs lacking in existing work processes influence positive perceptions; otherwise, non-compatibility and difficulty negatively influences the acceptance and use of e-Health IS. Explanations to these findings are presented in section 5.4.

5.3.4.2 Technical difficulties of e-Health IS use in the public hospitals

In this section, the researcher wanted to know the circumstances that hinder the use of e-Health information systems by the clinical staff. Despite the provision of facilitating conditions by the hospital management to enable a smooth adoption process, the findings indicate that the clinical staff experience technical difficulties using implemented e-Health IS for their work activities in the public healthcare institutions. When asked questions related to use and use challenges, 5 (71%) of the 7 respondents reported that technical difficulties mainly include downtime and slowness of the systems (**AC- H1-R16**; **FDT- H1-R28** & **JM-H2-R15**)

The NHLS is reported to have a regular downtime. Respondents disclosed that the NHLS is frequently down "*…on a daily basis…"* (**AC- H1-R16**), and as a result, it is difficult to gain *"…access…through the system"*. It would seem like systems slowness and downtime are co-related; they are prominently mentioned as the biggest technical difficulties that impede the clinical care processes (**SG-H2-17**). A respondent expressed concerns that slowness is "…*the biggest problem…"* (**FDT- H1-R28**) as a result of power outages, and it "…*affects the medical staff in particular…".*

Further, downtime is experienced "…*when systems need to be upgraded…"* (**JM-H2-R15**); it, ultimately, creates a constant back-log in the work-flow such that users "…*can't verify…"* information (**FDT- H1-R18**). In this instance, lack of adequate enabling environment ensues in slowness and downtime of implemented e-Health IS and the work processes. In line with the unified acceptance and use of technology (UTAUT), less than adequate facilitating conditions ultimately have adverse effects on user perceptions on system usage. In section 5.4, a discussion of the findings is presented with causal explanations and its implication on the use of e-Health IS in this investigation.

Thus far, some of the peculiar challenges of implementation and use observed in the context of low-medium (LMI) countries (section 2.5.2.2) are being experienced in the public hospitals of the Western Cape Province where this investigation was conducted. These challenges include a lack of adequate infrastructure, insufficient financial resources, a lack of proficiency in ICT and even political influence.

The research objective was to understand the reasons for low use (or non-use) of e-Health IS by clinical staff, and clarify reasons for the limitations in clinical support of the systems in the public healthcare institutions of the Western Cape Province. To achieve this objective, an interpretive discussion explaining the findings and a critique is presented in section 5.4.

5.4 The Discussion of Findings

This section presents explanations to the inferences drawn from the descriptive analysis of the transcripts data. The discussion provides explanations based on the findings to address the main research question (and sub-questions) in Chapter 1. It further validates the findings through the application of the unified theory of acceptance and use of technology (UTAUT), with reflections on existing literature, and implications on real life practices. This section builds on the data analysis from section 5.3 to present an extensive discussion and an objective critique of the findings from the investigation and the possibility of future investigations.

5.4.1 High level of awareness and acceptance to use e-Health IS

This section sought to explore the findings under the 1st key issue of investigation – the status of adoption and use of e-Health IS by clinical staff in public hospitals. The findings show that there is a high level of awareness and relative acceptance of e-Health IS by the clinical staff of public hospitals. The high level of awareness and acceptance are attributed to the positive performance expectancy associated to the perceived advantages of using health information technologies (HITs). According to the assumptions of UTAUT, the higher the performance expectancy (and positive outcomes) the higher the chances of acceptance and use of the implemented e-Health IS by clinical staff. For example, majority of respondents are knowledgeable about the implemented e-Health IS in the public hospitals where this study was conducted because they are familiar with its purposes and the potential benefits thereof.

The findings indicate that the CLINICOM system has been more useful for administrative than clinical tasks because it is labelled as patient information system (see section 5.3.3.1). Hence, there is a vague misconception by the clinical staff that the CLINICOM system is of less significance to their work processes. However, e-Health IS such as the NHLS, DISA Lab, NIMS, RIS and PACS which are exclusively designed for clinical staff are established to be of immense significance to the clinical care process because "…*the information they get there would directly fit their patient*…" (**FDT- H1-R21**). The emerging argument is that e-Health IS that offer little or no direct link to clinical staff job suitability are perceived as not useful. However, this is a misconception.

The implication of this misconception of clinical staff is that while some e-Health IS are functionality-specific, there seems to be a discrepancy between the information that the CLINICOM system deals with. It is such that the distinctive differences in the operational functions between administrative and clinical duties of staff create a disillusion of what the CLINCOM system is useful for. While clerks are trained and qualified to input data into the electronic systems and ensure update of patient information, the clinical staff are mostly engaged with the actual healthcare treatment to patients and the formation of medical records. The formation of medical records implies administrative task, yet the clinical staff respondents seem not to fully understand the advantages of utilising the CLINICOM system. For instance, according to Senior Administrative staff respondents, the CLINICOM system is supposed to have all patient information including demographics and medical history; these can adequately inform the clinical staff on the possibility of several occurrences of diseases in a particular geographic area and to help avert the likelihood of imminent epidemics. A practical scenario is the use of patient information systems as demographic surveillance to

track data and device control mechanisms for the spread of lingering Ebola and the increasing cases of the ZIKA (which affects pregnant women and their babies) viruses.

The motivation for end-user groups to accept and use a technology is directly linked to the system's performance expectancy – in that it is adequate and fits both the execution and completion of work activities (Lin, Lin & Roan, 2012). In essence, there is a difference between perceptions prior to adoption and the actual experiences during and after usage of the implemented e-Health IS. The implemented e-Health IS primarily used by clinical staff are patient-centric and directly enables them to quickly diagnose ailments to make decisions on treatment. The CLINICOM system is also an essential utility for data management on a daily basis such that it improves their work processes (since they deal with treatment of patients and medical records). For example, a 2015 report on e-Health News Africa revealed that up to 64% of the physicians in the United States of America (USA) spend more than a day per week on administrative duties rather than patient care.

5.4.2 Improvement of work processes

In this section, the researcher discussed the findings under the 2nd issue of investigation – purpose(s) for adoption of e-Health information systems in the public healthcare institutions. The findings suggest that that the adopted e-Health IS were implemented in the hospitals with expectations by the clinical staff that it improves clinical care processes. Hence, the researcher presented the reasons for the adoption of e-Health IS in the public hospitals.

According to Cresswell *et al.* (2013) in Figure 3, the very first step towards a successful implementation is to clarify the problem a technology is designed to solve, as discussed in the cases of countries cited for inference purposes in section 2.4 & 2.5. The Western Cape Department of Health (DoH) identified a need to improve the healthcare delivery services in the public healthcare institutions. According to findings, the adoption of e-Health information systems in the public hospitals was initiated with the expectations that the implemented systems would improve work processes as opposed to its antecedent – manual/paper based systems. The argument is that there is improvement, especially in information management, which are captured electronically, and patient flow from admission up until discharge is properly monitored.

Doctors believe that e-Health IS were adopted to enable easy access to up-to-date clinical information and encourage evidence-based medicine practices. According to the Gartner's Hype Cycle, numerous technology innovations are allegedly implemented due to the market and publicity hype without preference to how suitable or sustainable it is for the activities of its intended users. A respondent was of the opinion that "…*it is difficult to know if*…" (**GP-H2-R13**) there has been an improvement, especially because "…*there's still an awful lot to go*

through that's irrelevant…" (**GP-H2-R13**). He said that the clinical notes electronic system is "…*not that much better than paper*…" (**GP-H2-R14**) based systems. Another respondent confirmed that while the e-Health IS are being effective, some processes take longer time because they are "… *still using manual systems*…" (**SR-H2-R13**). The responses suggest a parallel kind of operation between the manual and electronic systems, which sometimes causes inhibitions and backlogs in the flow of work processes for the clinical staff.

Further, e-Health IS are regarded as"…*better because it's a very good back-up*… (**GP-H2-R38**), especially in cases where paper records are mismanaged. The implemented e-Health IS, for instance the SINJANI system, aids accountability such that "…*whatever is being used excessively then can be investigated because of the feedbacks*…" (**JM- H2-R9**) from the reports drawn. The NIMS is used for managing the staff in the Nursing department especially "…*because everything about the nurses*..." (**SR- H2-R6**) are on that system. Moreover, processing of patient information within the hospital is faster and more effective"…*because they didn't have to wait for the patient's file*…" (**GP- H2-R35**) or results from a third party, there is rapid access and ultimately, reduction in patient waiting times. Further, the integration of some e-Health IS has enhanced services. For instance, nursing staff procurement and salaries are properly managed and accounted for "…*because the NIMS is also connected to the BAS*…" (**KM- H1-R8**). According to Mchunu (2013) there were evidences of remarkable improvements, including reduction in patients' waiting time, improved legibility of prescriptions, faster access and retrieval of patient information and reduction in the loss of results compared to when it was majorly the paper-based systems.

With respect to the X-Ray and Laboratory systems, they seem to have been the most useful of the implemented e-Health IS because they are "…*totally paperless*…" (**SR- H2-R7**) and contains "…*everything about the patient*…" (**SR- H2-R8**), and in terms of treatment, the e-Health IS has aided nurses to execute tasks quicker so that they can provide care and "…*do the physical things that obviously the computer*…" (**SR- H2-R36**). In essence, clinical staff are obliged to use e-Health IS that enable easy access to information and patients in the process of delivering quality clinical care seamlessly.

From literature, implemented e-Health IS are installed to gradually phase out the use of paper/manual based systems, especially for the management of data in the public hospitals. A study by Cline and Luiz (2013) argued that e-Health IS are adopted to automate clinical care practices and eventually phase out the use of paper-based systems. Before the advent of innovative technology, paper-based systems were being used, which made processes slower, repetitive and subject to different hazards. The processes were slow because clinical staff depended on a second or third party to retrieve patient information which entails time to search for folders and in the processes prolongs the waiting time of patients. Moreover, the

paper-based system is susceptible to the hazards of physical loss; it can easily get damaged and can lead to misappropriation during patient flow – either during consultancy with doctors or while moving between wards or possibly between different public healthcare institutions.

Also, the findings indicated that the adoption of e-Health IS was an initiative to create a universal system across the public healthcare institutions, especially to enhance data management within and across healthcare institutions. The initiative of a universal system is an effort to eradicate duplication and verify patients' medical history "…*because it would reflect on the other system*…" (**JM- H2-R8**) at any other hospital, where the patient is referred or newly admitted. In essence, the universal system is meant to serve as a measure to keep track of patient information regardless of healthcare institution across the Western Cape Province. In addition, the electronic capture, storage and transfer of data/information within and across healthcare institutions enable accountability and security of information in clinical care practices.

The existence of a universal e-Health information system is not only cost efficient, but also eliminates the adoption of several heterogeneous systems for similar purposes in healthcare institutions. There have been several scientific investigations that suggest that a lack of integration between e-Health IS impedes the use of e-Health IS by healthcare professionals. A report from e-Health News Africa emerged in 2015 that lack of integration amongst several health information technologies (HITs) remains a key reason why there are limitations to the use of e-Health IS by physicians in the United States (which is a high income country). Whilst there is evidence of improvement in work processes, the clinical staff perceptions have ultimately influenced their willingness to accept (or not accept) and continue to use e-Health IS.

5.4.3 Perceived ease of use and usefulness of e-Health IS

The implemented e-Health information systems are accepted by the clinical staff of public hospital because they believe it is a significant step and means to improve clinical work processes. This section sought to discuss the findings from the 3rd issue of investigation – perceptions on the use of e-Health IS by clinical staff in the public healthcare institutions. The researcher clarified why the implemented e-Health IS are perceived to (or not to) be easy to use and useful by the clinical staff. The findings suggest that implemented e-Health IS are easy to use to the extent that clinical staff do not have to be "…*dependent on someone else*…" (**KM- H1-R6**) to complete the tasks that usually take so much time, because they can "…*do it straight away on the computer*…" (**KM- H1-R6**).

On the Ease of use, the respondents admitted that the implemented e-Health IS are simple enough to use with minimal or no training. In line with the UTAUT assumptions, as clinical

staff accumulate years in experience, challenges that existed at early stages of use and the effort on e-Health IS usage tend to reduce. Explanations from respondents are attributed to regular use, "…*because people are admitted every day*..." (**JM- H2-R8**); the more clinical staff work on the systems, the more they have become "…*familiar with it"* (**JM- H2-R27**). In other words, as the clinical staff rise above the rigors of daily use of e-Health IS, the systems steadily become easy to use.

It is clear that the implemented e-Health IS are perceived to be easy to use, hence the clinical staff use it regularly, thereby getting familiar with the system and forming a habit of regular use patterns. This validates the moderating effect of users' experience on effort expectancy of the UTAUT. The UTAUT suggests that the extent to which a technology is perceived to be less difficult and easy to understand influences the use of the systems positively. Hence, the clinical staff tend to accept the implemented e-Health IS because they are simple to operate and assists the execution of clinical care processes.

In the aspect of usefulness, while systems like the CLINICOM are perceived as only useful "…*because it prints the stickers*…" (**AC- H1-20**) containing patients' details for the case sheet folder, the clinical staff hardly see the relevance of the system. The clinical staff are of the opinion that their job is supposed to be less of administrative and more of clinical duties (refer to sections 5.3.1.2 and 5.4.5). Another point of argument was that "…*everything should be electronic*…" (**AC- H1-20**) completely instead of combining it – e-Health IS with paper-based systems. For example, the ECM system allows Medical Doctors to access patient clinical notes electronically but they can only view information hence; the perception is that "…*it's pointless reading if you can't write*…" (**GP- H2-R13**).

Nevertheless, the general consensus from respondents is that the implemented e-Health IS have been useful "…*because everything is on the system*…" (**JM- H2-R14**). Therefore, habitually they are compelled to use the systems especially because there is an influx of patients in the public healthcare institutions on a daily basis. For instance, a respondent admitted that the e-Health IS improves efficacy because it allows them to "…*save so much of time and so much of paper*…" (**AC- H1-R34**) at the same time, users do not have to "…*repeat the same thing all over again*…", while at the same time, they "…*verify certain data very quickly*…" (**AC- H1-R34**). Further, the implemented e-Health IS are perceived as useful because they speed up processes, compared to the paper based systems.

It is evident from the findings that before the advent of e-Health IS in the public hospitals, processes were slow due to the use of paper-based systems and hence the dependency on a third party to get clinical work processes completed. Whilst there are positive feedbacks on the ease of use, frequent use implied the suitability of e-Health IS for clinical care processes

and vice versa. For instance, the X-ray and Laboratory systems are reported said to be well suited to support clinical care, but the clinical notes are not captured electronically; and when they are, it is not better than the use of paper. This negatively impacts the perceptions and the workflow of clinical staff. These perceptions eventually influence the willingness of clinical staff to accept (or not accept) and use (or non-use) of the implemented e-Health IS in the public healthcare institutions.

5.4.4 Social influence among clinical staff

This section sought to explore and present how social influences affect perceptions and the willingness to accept and use implemented e-Health information systems among the clinical staff of the public healthcare institutions. The findings suggest that social influences, especially among colleagues have influenced the willingness of clinical staff to accept and use IS. For instance, certain electronic systems that were not extensively publicized were being propagated by"…*word of mouth or the people are showing each other…*" (**AC- H1-R31**) regarding how to use such systems.

On the part of the older generation, while there is resistance, some older clinical staff are reported to use the systems because "…*the younger generation has shown them…*" (**SR-H2-R20**) how to operate systems and accomplish their work faster. This implies that age moderates social influence such that the younger healthcare professionals teach the older how to understand and operate e-Health IS. This is due to the versatility of the younger healthcare professionals with changing phases of several technology innovations outside the hospital environment especially with the advent of social media. Age is cited as a moderating factor which influences individuals' willingness (or intention) to accept and use a technology innovation (Venkatesh *et al.*, 2011). This is reflected in the cultural belief, and reception of e-Health IS, oftentimes negative from older generation of technology users.

A respondent admitted that other than training, their "…*colleague or someone in the office or someone else…"* (**KM- H1-R16**) explains how to operate the functions on a system. For instance, a respondent admitted that until someone "…*showed me how…*" (**SR- H2-R23**) to do certain functions quicker on the systems; he took longer time for the completion of tasks. Further, pressure from senior managers influences the willingness of users to use implemented e-Health IS. For instance a respondent said that users are persistently compelled to use the NIMS "…*because they don't have a choice…"* (**KM- H1-R14**), otherwise the wards where they supervise (or manage) would be excluded in terms of management. In essence, social influence plays an important role in a mandatory setting (Veer *et al.*, 2015). In line with the UTAUT, the outcome of subjecting clinical staff to duress from their peers or even higher authority may either have a positive (or negative) influence

on the acceptance of the clinical staff to use the implemented e-Health IS, especially when they are obligated to fulfil work related tasks. It is evident in this study that social factors such as colleagues and even the organizational management are important because their support and encouragement, influences the acceptance of clinical staff to use e-Health IS in a positive manner.

A practical example was the case of a particular nurse who used to rely on her colleagues "...*to put her orders on the NIMS*…" (**KM- H1-R15**), until she eventually succumbed to use the system voluntarily due "…*so much peer pressure*…" (**KM- H1-R15**). It is evident that peers influence other individuals' willingness to use a technology such that they, ultimately, develop perceptions (positive or negative) due to the commendation (or disapproval) of other people about the use of the systems. In this regard, voluntariness will influence the willingness of clinical staff to accept and use e-Health IS. It is clear that voluntariness of use has a moderating effect on social influence assumptions of the UTAUT.

5.4.5 Cultural belief and training of clinical staff

This section further explains the findings that emerged from the 3rd issue of investigation and the practical implication to real life practices. The researcher sought to explain how cultural belief and training influences the acceptance and use of e-Health information systems by the clinical staff in the public healthcare institutions. The findings suggest that, whilst it is evident that e-Health IS are already adopted in the public hospitals of the Western Cape; there are instances whereby the systems are not being used or, are under-utilized. A respondent argued that it is "…*impractical to see a patient at the beginning without any paper work*…" (**GP- H2-R18**) hence, the belief is that "…*there would always be a place for papers*…" (**KM-H1-R11**). The paperwork leading to diagnoses and treatment can be done on e-Health IS, but the perception is that it would be impossible to eliminate paper in the process of administering care – an indication of resistance towards change. Another respondent confirmed that clinical staff "…*would be rather be hands-on with a patient*…" (**FDT- H1-R22**) than use e-Health IS. This further reinforces the stance of clinical staff in the public hospital that they are employed for clinical purposes rather than to engage in administrative tasks as earlier mention in section 5.4.1.

Although, the under-utilization of the implemented e-Health systems are attributed mostly to the older generation of Clinical staff "…*because they don't want to comply..."* (**AC- H1-R35**), as a result, they are resistant to absorb change or anxious to embrace the use of systems because "…*they represent the out-dated ancient belief that those systems are corrupted*…" (**AC- H1-R35**) and would yield undesired outcomes if utilized. In an ideal situation, provisions are meant to be put in place by the hospital organization to create an enabling environment

for clinical staff to easily learn and develop the skills and competency to use e-Health IS in public healthcare institutions.

On the aspect of skills acquisition to use the implemented e-Health IS, one of the senior hospital administrative respondents admitted that they provide "…*quite an in-depth and thorough training*…" (**FDT- H1-R19**) tailored to the specific area or department. However, clinical staff (especially nurses) claims that they "….*don't always know what a specific program can do*…" (**KM- H1-R25**). It is evident that training is provided, yet there is a degree to the lack of understanding on the full practicality or the awareness of benefits particular e-Health IS offer. A lack of understanding can be attributed to shortfalls in training methods (because trainings are alleged to be provided).

There is a varied response about training. A clinical respondent believed they would not *"…have managed without…"* (**GP- H2-R31**) being trained while another respondent thinks it is a typical "…*excuse that training must be provided*…" (**AC- H1-37**). The belief is that the effectiveness of training is dependent on the "…*capabilities…"* of the end-users (**FDT- H1-R19**) to understand. It is apparent that training is provided despite the varied views of some respondents on its importance and the ease of system usage without training. It can be inferred that the training provided on the use of e-Health IS are, oftentimes, less of a major determinant than the actual willingness of an individual to learn and be proficient on usage. Hence, the clinical staff utilize the implemented e-Health IS they perceive to have relatively low difficulty (or easy to use) on a daily basis, especially with or without training.

In this study, the willingness to learn and understand how e-Health IS are used is attributed to resistance on the part of clinical staff and the methods or forms of training within the public healthcare institutions. Their argument is based on the belief that their job is to treat patients' hands-on (practical) rather than use health information technologies (HITs) despite admitting that it improves work processes in conjunction with the provision of training. The findings that emerge from the 4th key issue of investigation are discussed in the next section 5.4.6.

5.4.6 Mobility restriction and problematic features of e-Health IS

This section explores the findings under the 4th key issue of investigation – the limitations to the use of e-Health IS by clinical staff in the public hospitals. The researcher presents the explanations to the emergent findings. According to the findings, some of the implemented e-Health information systems restrict the clinical staff in terms of its design, especially because the systems are not "…*completely electronic…"* (**GP- H2-R18**). For example, the clinical notes involve "…*scanning pieces of paper rather than entering data*…" (**GP- H2-R32**) directly into the system.

It is evident from the findings that, the implemented e-Health IS are mainly installed on workstations, which means that clinical staff are constrained with respect to where and how they use the systems. This restriction limits the use of e-Health IS because clinical staff have to scribble "…*clinical notes on paper*…" (**GP- H2-R13**) when consulting at the wards and off office workstations, only to have it scanned at a later time on the ECM system. This begs to question the data accuracy and integrity of the decision making process made by the Clinical staff with respect to data management. After consultancy with patients, if the doctors or nurses have to wait until they are less busy or end of the day before scanning clinical notes into the ECM system, there is a likelihood of mistake or loss of paper due human error or even fatigue as a result of being occupied throughout the day as a result of the hectic schedules observed in the public healthcare institutions. Ultimately, this confirms that there was less than adequate considerations before making the choice or poor judgement in selecting a suitable system that meets the clinical needs of clinical staff as discussed by Cresswell *et al.*, (2013) in Figure 3.

Furthermore, implemented e-Health IS such as the CLINICOM and the ECM systems are reported not to have a clinical note facility, which makes aspects of data management such as searching for information, editing and updating information clumsy. With respect to the CLINICOM system, it does allow doctors to enter information and "…*view their patient's notes*…" (**FDT- H1-R30**) but voluntarily choose not to make the most use of it. Concerning nurses, because "…*there's shortage of staff*…" (**FDT- H1-R23**), they get too busy because they deal with "…*with huge numbers..."* (**KM- H1-R28**) of patients; the skills to use the implemented e-Health IS are "…*the first thing that's going to fall away consciously*…" (**FDT-H1-R23**). Besides, "…*computer literacy is not that high within the nursing department…"* (**SR- H2-R17**). In this regard, the types and depth of training provided to educate the nursing staff on how to utilize the electronic systems from the pilot study to post-implementation period are evidently less than adequate. Perhaps, the trainings are not directly focused on the aspects that would influence users to take up the use of e-Health IS.

On the other hand, the ECM system stores "…*pieces of paper that have been scanned in their thousands or their tens of thousands*…" (**GP- H2-R19**), hence the system is not fully electronic. The design of scanning documents instead of typing and editing – seems to be an effective measure or tool adopted to simplify the use of the e-Health IS especially for individuals with minimal to no computer literacy. In addition, the scanning of clinical documents saves time given that public healthcare institutions are busy on a regular basis even though it is said to impede aspects of clinical care processes.

Yet, this implies a less than accurate design of e-Health IS to suit the work processes of clinical staff and hence defeats the purpose(s) of adoption even though the institutions

endeavour to "…*confirm the benefits*…" (**FDT- H1-R23**) of using the systems to the clinical staff. Another respondent clarified that there was no resistance because the purpose of the e-Health IS "…*was explained*…" (**JM- H2-R16**). The implemented e-Health IS are such that rather than improve processes, it becomes more tedious. Hence, e-Health IS are selectively used and/or likely to be eventually abandoned because the usage is majorly influenced by the willingness of the individual from their perceptions. In an ideal situation, the management and implementers are supposed to have taken austerity measures to improve or ultimately discard the systems that tend not to adequately satisfy both clinical and organisational needs during implementation process, for instance, the ECM system which is not fully electronic.

Furthermore, the findings suggest that although there are HITs in the public hospitals, they are less in terms of installation and automatically, connectivity. A respondent claims that they do not have e-Health IS "…*because it is not provided*..." (**AC- H1-R40**). The causes of insufficient ICT systems include financial constraints by the government and less than adequate consultations with end-users by the hospital management (or implementers). The insinuations are that a consensus was not reached among different end-users, especially the healthcare professionals. Unfortunately, there were no explanations as to the detailed adoption process and whether healthcare professionals were consulted during and after the implementation of the e-Health IS in the public healthcare institutions. According to a respondent, doctors for example "…*know this is not their specialty*…" (**AC- H1-R39**).

In essence doctors are not entirely involved in the adoption process but expect the organization management to facilitate the adoption of e-Health IS while they – the doctors willingly use the provided systems. The respondent implied that the adoption of e-Health IS seems to be "…*more political than actually practical approach*…" (**AC- H1-35**). Whilst political sentiments were mentioned as part of the causes to why HITs are not being adequately adopted, there were little or no explanations in this regards. A likely basis of political sentiments is usually the complexity of, and interaction between social actors – management stakeholders.

The argument is partly, that the systems hardware and software are often out-dated as a result of lapses on the part of the government; as it is responsible for the cost implications of running public hospitals and overseeing the provision of quality healthcare services delivery. The responsibility supposedly lies within the Western Cape Department of Health or the unit that was set up to oversee the adoption process of electronic systems in the public hospitals. There are backlogs in the process of clinical care which, in turn, takes a negative toll on the use of the implemented e-Health IS by healthcare professionals such that processes in delivering quality healthcare services are slow, and sometimes the patients do get frustrated.

Rather than serve as an enabling tool to improve healthcare services delivery unfortunately, some of the e-Health IS features have inhibited the workflow of healthcare professionals and even patient flow in the public hospitals. Also, regular slowness and downtime of the systems emerged as major causes of the limitations to the use of e-Health IS in the public hospitals.

5.4.7 Regular slowness and downtime of e-Health IS

This section further explains the emergent findings from the 4th issue of investigation and how it influences acceptance by clinical staff and the practical use of e-Health IS to the clinical practices. The researcher sought to explain how slowness and downtime of e-Health IS affects the clinical staff in the public healthcare institutions. The findings suggest that the major technical difficulties are regular slowness and downtime of the implemented e-Health information systems.

The slowness of the e-Health IS are sometimes attributed to "…*load shedding*…" (**JM- H2-R15**) or when "…*the bandwidth is not good enough*…" (**AC- H1-R15**). Another likely reason for slowness of the system is when the software application in "…*systems need to be upgraded*…" (**JM- H2-R15**) and sometimes result in downtime. Moreover, the regular downtime was attributed to erratic electricity supply at a point when the country was having a power supply re-orientation and upgrade. The practical implication is negative on both healthcare professionals and patient alike within the hospital environment. Respondents said that when the NHLS system is slow or down, they "…*can't access the results…"* (**AC- H1-R16**) and it is "…*very frustrating*…" (**AC- H1-R27**) and "…*patients become very frustrated*…" (**FDT- H1-R8**) as there is a delay and increase in the waiting times to consult a Medical Doctor or get the results of medical tests. This is similar to the most common infrastructural barriers of implementing e-Health IS in developing countries as studied by Qureshi, Shah, Ullah, *et al.* (2013). Consequently, connectivity is affected and creates a backlog in the working activities of end-users. Practically, this slows down work processes.

Despite being informed about likely systems downtime, it affects the Medical Doctors, especially to the extent that they use their personal electronic devices such as "…*their own cell phones*…" (**AC- H1-R15**) for the convenience and ease of access to patient results on the NHLS system. Hence, the belief that "…*it would be nicer*…" (**GP- H2-R26**) to have for e-Health IS on portable mobile devices. When problems become imminent (and evident) due to limitations in the usability, functionality and user experiences of a technology innovation, the end-users tend to eventually develop negative perceptions and build resistance towards the systems. Further, they revert to the manual/paper processes as a form of work-around "…*because the work must go on*…" (**FDT- H1-R18**). Unfortunately, the implications of

systems' slowness and downtime are delayed processes such that doctors cannot have readily access to patient results and data cannot be verified; the situation defeats the purpose for the adoption of e-Health IS.

5.5 Conclusion to Chapter Five

This chapter presented the data analysis process and a descriptive presentation of findings through the data transcripts is discussed (and critiqued). After the research process was described, the content analysis was applied through the unified theory of acceptance and use of technology (UTAUT) as a lens to draw specific meanings and explanations from the data transcripts.

At the initial stage of analysis, the researcher broke down the key issues of investigation into 4: the status of the adoption and use of e-Health IS, the purpose of adoption and use of e-Health IS, the perceptions on the use of e-Health IS and the limitations to the use of e-Health IS. This was followed by conceptualization of each key issue of investigation. Applying the content analysis and the operationalization of the 1st key issue of investigation was divided into two sub-categories: 1) Awareness and Use of e-Health IS and 2) Acceptance and use of e-Health IS. The findings indicate that there is a high level of awareness and acceptance from clinical staff to use the implemented e-Health IS in the public healthcare institutions. However, there are conflicting views on the suitability of these e-Health information systems due to the distinctive difference between the administrative and clinical tasks as well as individual performance expectancy. The clinical staff perceive data capturing systems as not applicable to their work processes; as it is irrelevant to make diagnoses and decisions on treatment. Age was confirmed to have a moderating effect on the performance expectancy and the use of e-Health IS mainly by the older generation of clinical staff.

The 2nd key issue of investigation was operationalized and sub-categorised to the 'Rationale for the adoption of e-Health IS'. The findings show e-Health IS were adopted in public healthcare institutions with expectations among the clinical staff and other stakeholders that it would improve clinical care processes. The argument is that the positive perceptions about the expected benefits (or outcomes) attributed to a new technology innovation influence the end-user groups to accept and use the implemented electronic healthcare information systems. The eventual scenario is that when inadequacies are experienced, these tend to alter the initial positive perceptions about the e-Health IS to the extent that the systems are selectively used or ultimately discarded.

Ultimately, the implemented e-Health IS enables clinical staff to capture, store, access, retrieve and verify information about their patients, and they are obliged to use the systems

to execute their activities. Hence positive perceptions about the usefulness of e-Health IS influence the acceptance and use of the systems.

As regards the 3rd issue of investigation – perceptions on the use of e-Health IS were categorised into (1) Perceived ease of use, (2) suitability, (3) perceived usefulness and (4) social influence. The findings indicate that e-Health IS are fairly easy to use. There are mixed reports on suitability: the systems are useful for work processes especially for effective data management and time and cost efficiencies, which confirms several literatures in that regard and social influence influences the willingness of clinical staff to take up and use e-Health IS. Social influence is an essential aspect of acceptance to use a technology. The clinical staff sometimes rely on their peers for support the use e-Health IS and the approval (or disapproval) of such systems affect perceptions. Moreover, it appears that clinical staff are mandated to use e-Health IS by their superiors because it is an integral part of executing their tasks. Hence, when clinical staff are subjected to duress, it can influence willingness to accept and use electronic healthcare information systems. Political sentiments also influence the adoption of e-Health IS in the public healthcare sector.

The 4th key issue of investigation was divided into two sub-categories: 1) Technical inadequacies of e-Health IS and 2) Technical difficult in e-Health IS. The findings indicate that insufficient ICT systems, financial constraints, politics, busy schedule, resistance and non-flexibility are the factors that impede the adoption as well as the use of e-Health IS. Whilst there are reports that there is less than adequate information, communication and technology devices in the hospitals, the causes are attributed to financial constraints on the part of the government – which is supposed to be responsible for funding public healthcare institutions.

Furthermore, the public healthcare institutions deal with huge numbers on a daily basis. Due to a shortage of staff, it is challenging to create time to attend training and understand how to utilize electronic systems (which ironically, is perceived to improve work processes) while consistently attending to several patients. Moreover, the healthcare professionals, especially Medical Doctors believe in the tradition of hands-on for healthcare delivery rather than the use of e-Health IS. Consequently, there is resistance to change and taking up the e-Health IS into the clinical care processes despite its suitability and performance expectancy.

In addition, findings indicate that the implemented systems have shortfalls such as the restriction of mobility for clinical staff that would rather have it on a mobile device and access information on-the-go. In addition, the clinical notes facility is not completely electronic in the sense that it is pieces of paper scanned onto the systems. This inhibits access to patients' information because the system is clumsy and uncomfortable to access. Arguments are that

the e-Health IS were not properly designed to suit the workflow process of clinical staff. Further, the findings reveal that slowness and system downtime are frequently experienced in the public healthcare institutions. Further explanations are insufficient bandwidth on which the electronic systems operate and the aftermath of software upgrades. This hinders the use of the implemented systems and inhibits work process to the point that Medical doctors eventually use their personal mobile electronic devices to access patients' results remotely.

The conclusion of the thesis as well as recommendations and area of future research are presented in chapter 6.

CHAPTER SIX – RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

This section presents the findings from the previous chapter (chapter 5), and the extent to which the research questions was (or was not) answered to validate the research objectives to inform recommendations and a conclusion to the study. This chapter is divided into 4 sections. After the introduction in 6.1, a summary of the thesis is presented in 6.2. This is followed by the recommendations with respect to each issue of investigation in 6.3 and a conclusion with reflections on the research and considerations for future study in 6.4.

6.2 Summary of the Thesis

The basis of an argument by means of scientific research is that e-Health information systems can enhance the efficiencies in healthcare services delivery, if effectively adopted. Despite the prospective benefits that e-Health IS offer to aid the healthcare sector, there are limitations that inhibit its use, especially by healthcare professionals in the public hospitals of the Western Cape, South Africa. Whilst the literature background (in Chapter 2) gives a wide and very useful awareness on the e-Health IS field, it lacks a holistic insight on the status of adoption and the actual use of e-Health IS by healthcare professionals in the context of this study. Hence, the research objective was to understand the reasons for low usage (or non-usage) of e-Health IS by clinical staff in public hospitals of the Western Cape, South Africa and to clarify reasons for the limitations in clinical support of the systems.

To conduct this investigation, the researcher adopted a nominalist ontology and interpretivist epistemological stance, with respect to the interactions between social actors and the phenomenon of study. Moreover, these research philosophical stances aided the researcher to acquire subjective and in-depth information from participants' view about the phenomenon of study. To this effect, a qualitative methodology approach was adopted by the researcher to collect data. The purposive sampling technique (outlined in Table 1) was used to identify data sources and the likely research participants that were interviewed. These participants included senior hospital officials and clinical staff members (Medical Doctors & Nurses) in selected secondary and tertiary level public hospitals.

After the data collection process, the voiced interviews were transcribed to text for analysis. The content analysis technique was selected because it places emphasis on unpacking all the potential interpretations of data and its multiple meanings. To obtain answers to the main research question, the content analysis enabled the researcher to identify chunks of data through conceptualisation and operationalization process. Afterwards, the researcher drew

from unified theory of acceptance and use of technology (UTAUT) as a lens to draw specific meanings, interpret and explain the emergent findings. Consequently, the emergent findings were discussed and critiqued to answer the main research question and address the practical implications thereof. Consequently, after the data collection, a descriptive presentation of the findings was presented in Section 5.3 and discussed in section 5.4.

6.2.1 Findings

To achieve the research objective of this study, the main research question (section 1.4) was broken down into 4 issues of investigation – the status of, purpose of; perceptions on and the limitations to, the use of e-Health IS by clinical staff in the public hospitals of the Western Cape, South Africa in section 1.4.1.

The findings of this study suggest a less than adequate design of the implemented e-Health IS and a lack of extensive inclusion of healthcare professionals in public hospitals in the entire adoption process are the main causes of limitations to the use of the systems in public hospitals of the Western Cape, South Africa. Whilst there is a high level of awareness and acceptance by clinical staff to use implemented e-Health IS, there is a misconception about the use of particular e-Health IS, especially the patient information system. Regardless of the trainings provided, the clinical staff tend not to exclusively understand how the implemented e-Health IS function. Nevertheless, the clinical staff found the implemented e-Health IS to be fairly easy to use and useful as a result of its performance expectancy. It was also found that social influence amongst healthcare professional greatly influenced the willingness to use the implemented e-Health IS. Despite the problematic features of the implemented e-Health IS, as reported by the clinical staff, the ultimate challenges are regular downtime and slowness of systems due to less than adequate facilitating conditions in terms of the hardware support. Thus, the researcher outlined recommendations as possible solutions to the findings that emerged from this investigation.

6.3 Recommendations

The recommendations in this section are made based on the research findings. The purpose of the Table 3 is to provide a detailed illustration, especially the recommendations ensuing from the investigation. On the top part of the table are the research objectives and the main research question; on the left side of the table are the issues of investigation; in the middle are the research findings, and on the right hand side, the recommendations.

Table 3: Findings and Recommendations

Objective of the study: The objective of the study was to understand the reasons for low use (or non-use) of e-Health IS by clinical staff in public hospitals, and clarify reasons for the limitations in clinical support usage of the systems.

Main Question: What are the causes of limitations to the use of e-Health IS by clinical staff in the public hospitals of the Western Cape, South Africa?

Issues of Investigation	Findings	Recommendations
Status of the Adoption & Use of e-Health IS in the public Hospitals	• There is a high level of awareness and acceptance to use e-Health information systems in the public hospitals. • Despite the level of awareness, the clinical staff have a misconstrued perceptions that some implemented e-Health IS are not relevant to their work processes. • The implemented e-Health IS that directly aid clinical staff to make diagnoses (and treatments) decisions on patients (patient-centric) such as the NHLS system, the DISA Lab system and X-ray systems (all fully electronic) are suitable for clinical work processes except the clinical notes (which is not fully electronic). • Trainings are provided yet end-users are oblivious to the full capacity of implemented e-Health IS (refer to section 5.4.1 and 5.4.5).	• It is recommended that the Western Cape Department of Health in conjunction with the hospital management should ensure that the hospital staff, especially healthcare professionals are well-informed on the distinct differences of each implemented e-Health IS in the hospital. • Health information technologies (HIT) should be incorporated into the medical syllabus as pre-requisite courses for practise as observed in the high income countries. • Nursing agencies should facilitate regular in-depth training and provide up-to-date skills acquisition programmes for their staff in the e-Health IS field.
Purposes for the Adoption of e-Health IS in the public Hospitals	• The implemented e-Health IS are adopted with the intention of improving work processes in the public hospitals (refer to 5.4.2).	• It is recommended that electronic systems should be introduced across all level of public healthcare institutions in the Western Cape Province and ultimately, South Africa. • A timeline should be set for consistent evaluation and impact assessment studies on the impact of utilization of e-Health IS, to continuously address shortcomings and improve services in public healthcare institutions.
Perceptions on the Use of e-Health IS in the public Hospitals	• There is resistance by individuals, especially older clinical staff and nurses to use e-Health IS (refer to section 5.4.5). • The implemented e-Health IS in the public healthcare institutions are fairly easy and simple to use (refer to section 5.4.3). • The eventual acceptance to use e-Health IS depends on the willingness of an individual (refer to section 5.4.5) • Social influence plays a vital role in the willingness of individuals (or group) to accept and use a technology (refer to 5.4.4).	• It is recommended that healthcare professionals (across different age borders) should be considered during the design process. • It is recommended that healthcare professional bodies sensitize their members about the current technology trends and their prospective benefits to healthcare. • It is recommended that polices and incentives should be provided by the hospital management to drive the willingness of healthcare professionals to use technology. • Further, South African healthcare professionals should be exposed to current practices by colleagues in high income countries. This can be done via exchange programs as well as collaborative seminars & workshops on the e-Health field to eliminate professional isolation.

Limitations to the use of e-Health IS in public Hospitals	• There is restriction of mobility with respect to implemented e-Health information systems (refer to section 5.4.6). • There are problematic features such that the implemented e-Health IS are not entirely electronic especially the clinical notes (refer to section 5.4.6). • The findings also indicate that there are less than sufficient health information technologies (HITs) for clinical staff in the public hospitals. • Slowness and downtime of the systems are key limitations that inhibit the use of e-Health IS in the public healthcare institutions (refer to section 5.4.7).	• It is recommended that the current and future e-Health IS in the public healthcare institutions should be incorporated on mobile devices (smart phone and tablet friendly) for the suitability of clinical staff and their work processes. • It is recommended that the existing e-Health IS should be upgraded to allow scanned documents to be converted to a “read and write” format while retaining the original document. • Further, instead of scanned pieces of paper onto an electronic media, which is a form of operating a paper-electronic parallel system, future electronic systems should be designed to enable the direct entry of information into the system. • There should be an extensive participation of intended healthcare practitioner users throughout the adoption processes. • A good bandwidth and backup power system infrastructure should be provided and maintained periodically, to eliminate and prevent the slowness of e-Health information systems. • The future e-Health IS should be designed to support accessibility of patient results offline in the cases where systems are being upgraded or expected to be down.

6.3.1 Status of adoption & use of e-Health IS in the public hospitals

The findings indicate a high level of awareness and acceptance of the e-Health information systems in public hospitals, in terms of type/s and description of existing electronic systems - the purposes for which such electronic systems were (or were not) introduced and the extent to which the systems are being used across the hospital/s.

However, it is recommended that the Western Cape Department of Health, in conjunction with the hospital management, should ensure that the hospital staff, especially healthcare professionals, are well-informed on the distinct differences of each implemented e-Health IS in the hospital. Hence, the information and end-users pertaining to systems and the scepticism of the functionality by healthcare professionals are addressed accordingly.

Health information technologies (HIT) should be incorporated into the medical syllabus as pre-requisite courses for practise as observed in the high income countries. In the case of nursing agencies, nursing staff should be made to undergo regular training and sent on skills acquisition programmes in the e-Health IS field.

Further, it is evident that there are oversights in particular functionalities of the existing e-Health information systems. There should be regular training of nursing staff, especially when it is observed that certain functions are not being used, to prevent the redundancy of existing e-Health IS. Otherwise, when usability redundancies are observed, the e-Health IS should be upgraded and customized to suit work processes.

6.3.2 Purposes for the adoption of e-Health IS in the public hospitals

The findings suggest that e-Health information systems are being adopted in the public hospitals as an initiative to phase out paper/manual systems, to improve processes and deliver clinical care. It is recommended that electronic systems should be introduced across all levels of public healthcare institutions in the Western Cape Province and ultimately, South Africa. It is evident that the use of these systems has facilitated and improved the processes involved in clinical care by healthcare professionals.

Consequently, a timeline should be set for continuous evaluation and impact assessment studies on both the utilization and effect of e-Health IS on service delivery and the patient outcomes in public healthcare institutions. Conducting these studies aids the realization of adoption purposes and the benefits of use as envisaged.

6.3.3 Perceptions on the use of e-Health IS in the public hospitals

The usability of the e-Health information systems should be improved to accommodate end-user groups across all boarders and to eliminate the age limiting factor. In essence, it is recommended that older healthcare professionals should be considered during the design process. This way, the older generation of clinical care givers would find it easy to use e-Health IS with little or no complexity. It is recommended that healthcare professional bodies sensitize their members about the current technology trends and the prospective benefits of accepting e-Health in the healthcare field.

It is recommended that polices and incentives by the hospital management that drive the willingness of healthcare professionals to use technology should be sufficiently provided, as findings have indicated that facilitating conditions are not adequate enough. Further, South African healthcare professionals should be exposed to the current trend of practices by their colleagues in high income countries. This can be done via exchange programs as well as collaborative seminars & workshops on emerging e-Health technologies, as a means to eliminate professional isolation.

6.3.4 Limitations to the use of e-Health IS in the public hospitals

The findings indicate that clinical staff prefer to have e-Health IS on a mobile platform; the features on the current e-Health IS are problematic and slow, and downtime is often experienced and inhibits work processes while using the systems.

There are mobile health (m-Health) initiatives being adopted across several platforms in the organizational businesses and healthcare sector. It is recommended that the current and future e-Health IS in the public healthcare institutions should be incorporated on mobile devices (smart phone and tablets) for the suitability of clinical staff and their work processes. It is recommended that the existing e-Health IS should be upgraded to have a function which allows scanned documents to be converted to a “read and write” format while retaining the original document. This would enable rectification of errors, if any, and most importantly, serve as a control measure against in the case of any form of fraudulent events.

Further, instead of scanned pieces of paper onto an electronic media, which is a form of operating a paper-electronic parallel system, future electronic systems should be designed to enable the direct entry of information. This means that the systems should be designed to fully electronic specifications such that its functions enable an editable collection, storage, retrieval and updates of information by healthcare professionals for convenience.

Bearing in mind that public hospitals are packed daily with patients from as early as daybreak until night, Medical Doctors should not be saddled with the additional data

capturing tasks. Hence, there should be an arrangement for the extensive participation of intended healthcare practitioner users through the adoption processes so that the e-Health IS are designed to the suitability of work processes and also in relation to their environment.

Adequate facilitating conditions such as infrastructure, for instance, a good bandwidth and backup power system should be provided and maintained periodically, to eliminate and prevent the slowness of systems. In addition, to reduce the downtime of e-Health IS to the barest minimal to zero occurrences in time, the implemented electronic systems should be designed to support accessibility of patient results offline in the cases where systems are being upgraded or are expected to be down. In this way, the workflow of the clinical staff in the public healthcare institutions is not inhibited under work circumstances.

6.4 Conclusion

As observed from previous scientific literature, there are persistent limitations to the use of e-Health IS by healthcare professionals, unfortunately, in both high and low-medium income countries but with peculiar cases, especially in a seemingly overburdened public healthcare sector. Hence, this served as a motivation for the researcher to investigate and understand the status of e-Health IS adoption; in particular, its use by healthcare professionals in South Africa (Western Cape Province) and acquire causes and explanations to the phenomenon. Therefore, the research objective was to understand the reasons for low use (or non-use) of e-Health IS by clinical staff in public hospitals and aim to clarify reasons for the limitations in clinical support usage.

The study was an interpretive qualitative study with subjective interpretations according to how the researcher perceived the phenomenon from the participants' view. The researcher has engaged scientific literature (secondary source); to acquire background insights about the e-Health IS field and phenomenon of study. The primary source of data collection was the semi-structured interview via a series of open-ended questions to enable participants to express their views. The interview sessions were conducted in selected public healthcare institutions in the Western Cape Province with the hospital management and healthcare professionals' respondents. The involvement of this particular set of participants was to acquire a comprehensive data from the hospital and the end-users.

The findings have shown that e-Health IS are being adopted in public healthcare institutions. Hence, the healthcare professionals have a high level of awareness and accept to use the system because of its perceived performance expectancy and positive outcomes. For instance, findings shows that the implemented e-Health IS were adopted to improve process and enhance clinical care in public healthcare institutions. The evidence includes effective data management, cost and time efficiencies for both patients and healthcare professionals.

It is evident that e-Health information systems are of great importance in the execution of tasks despite the inadequacies, which are mostly linked to the design of the systems.

Further, findings show that the older group of healthcare professionals are yet to accept and use implemented systems. Reasons are due to resistant to change and comfortability, with the long-standing approaches used to attend to patients while some would rather be hands-on with the patient rather than utilise electronic systems. Whilst it is evident that training and IT support are provided by the hospital management to aid the use of e-Health IS, the findings indicate that the acceptance and use of the systems ultimately depends largely on the willingness of the individual. In essence, the use of e-Health IS is affected by several determining factors asides adequate facilitating conditions.

Moreover the findings suggest that social influence plays a vital role influencing an individual (or group) to accept and use e-Health information systems. It is such that healthcare professionals with less competency to use e-Health IS rely on their colleagues to show them how to utilise the systems or perform a particular task quicker. Furthermore, the clinical staff are obligated to use e-Health IS to accomplish particular tasks which are incorporated in their daily activities. Clinical staff indicate the readiness to use e-Health IS; however, political sentiments are another form of social influence that affects the adoption of e-Health IS in the public healthcare sector. The most reported technical inadequacies are problematic features in existing e-Health IS, slowness and system downtime. There are several m-Health platforms and applications that can be adopted and designed by the Western Department of Health for public healthcare institutions. Existing health information technology infrastructure can be upgraded to rectify its inadequacies if they are designed as such to accommodate modifications.

In summary, it is recommended that there should be an extensive engagement of the various stakeholders i.e. the Western Cape Department of Health, the hospital management and healthcare professionals. This would make sure adequate facilitating conditions are provided and e-Health IS are designed strictly to user-experience and specifications in relation to their work environment. Whilst this would foster positive perceptions and trust in the systems, it also paves way to a successful adoption and meaningful use of e-Health IS to improve healthcare service delivery in the Province and ultimately, South Africa. In conclusion, the researcher has investigated, understood and discovered the causes of the limitations to the adoption, particularly the use of e-Health information systems by healthcare professionals in the public hospitals of the Western Cape, South Africa.

6.4.1 Reflections on the study

The research was carried out in only 2 of the public hospital levels in the Western Cape; hence the findings do not necessarily validate the phenomenon and cannot be generalized to other public healthcare institutions or individuals. The researcher experienced restrictions in the course of this study due to lack of proper funding to carry out investigations in more public hospitals within and outside of the Western Cape Province. A mixed approach would have been more detailed. For instance, there would be a larger sample from the research population that includes participants from the government (Western Cape Department of Health), private hospitals and health information technologies (HIT) software development companies. This would reveal a more holistic picture of the events of an adoption process in the public healthcare institutions compared to private establishments.

With respect to the unified theory of acceptance and use of technology (UTAUT) in this study only age, experience and voluntariness were discovered to have moderating effects in the data transcripts analysis and discussion of findings.

Due to the nature of the job and the busy schedule of the participants in the public hospitals, there was a limited time for the interview session, and not all the participants were available. Other methods such as a web link to an online questionnaire would have helped to gather data as participants can answer at their convenience. Overall, the findings mostly reflect positive expectations regarding the adoption of e-Health IS from end-users, but in reality, the outcomes are seldom favourable post-adoption. A broader investigation with the inclusion of all stakeholders at the pre-, during and post adoption processes particularly, its application and the short-lived expectations, would have shaped the insights of this study.

6.4.2 Considerations for future research

Whilst it is evident that e-Health IS are adopted in the public healthcare institutions in South Africa, it is obligatory to continuously conduct extensive series of investigations that would provide insight that would ultimately inform practical solutions to drive the willingness of healthcare professionals (and other stakeholders) to embrace new HITs.

Studies comparing influencing factors in both public and private healthcare sectors to identify factors that enhances (or inhibits) e-Health IS adoption as well as the exclusive involvement of healthcare professionals through the entire adoption process can create insights on the use phenomenon in South Africa. Through this investigation, key performance indicators (KPI) can be developed to determine the likely factors that influence the successful use and optimization of e-Health IS, especially in the public healthcare sector in South Africa.

There are HIT projects abandoned after years of implementation in the South African public healthcare institutions, perhaps unpacking and evaluating such systems to learn from past experiences can contribute tremendously to a long term successful and sustainable HITs.

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APPENDICES

The appendices section displays additional references relevant to the thesis. It consists of 7 appendices in the order of, ethics approval certificate from the faculty of informatics and Design/Letter of request for data collection from the Western Cape Department of Health (DoH) in Appendix A; followed by permission for data collection (interviews) at H1 in Appendix B; permission for data collection at H2 hospital in Appendix C. In appendix D, examples of the interview questions followed by, interview transcripts in appendix E, then a summary of data analysis (Table 4) in Appendix F and frequency of attributes (Table 5) in Appendix G.

Appendix A: Ethics approval certificate

Cape Peninsula University of Technology

Office of the Research Ethics Committee (REC)

Faculty of Informatics and Design

Ethics Approval certificate

Date: 16th September, 2014

Applicant Name: OGUNDAINI, Oluwamayowa Oaikhena

Student Number: 214282422

Qualification : MTech Information Technology

14. Declaration of Investigators

I/we apply for approval to conduct research. If approval is granted, the research will be undertaken in accordance with the information provided in this application, the protocols described in this application, and any other relevant guidelines, regulations and laws.

Investigator / Researcher	Department	email	extension
1. OGUNDAINI, Oluwamayowa O.	Information Technology	mayowa.ogundaini@gmail.com	

15. Declaration of Supervisor/s (if applicant is a student)

I/we have read over this application in its entirety and will endeavor to ensure my/our student undertakes his/her research according to all CPUT ethics protocols.

	Name	Signature	Date
Supervisor:	Prof. N.B.W. Mlitwa		14/09/2014
Co-Supervisor:	Mrs. Gillian Khan	GKhan	14/09/2014

FID Research Ethics Committee comments:

All ethical issues were satisfactorily addressed. Ethics approval is granted. Consent is to be obtained from the Dept of Health.

Mlitwa

RESEARCH ETHICS COMMITTEE
INFORMATICS AND DESIGN
ETHICS APPROVAL GRANTED
Ethics Stamp
24 OCT 2014
Cape Peninsula University of Technology

Appendix B: Approval for research

Western Cape Government
Health

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 6857; fax: +27 21 483 9895
5th Floor, Norton Rose House, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za

REFERENCE: WC_2014RP48_937
ENQUIRIES:

Cape Peninsula University of Technology
PO Box 652
Cape Town
8000

For attention: **Mr Oluwamayowa Ogundaini**

Re: The Adoption and Use of Electronic Healthcare Information Systems to Support Clinical Care in Public Hospitals of the Western Cape, South Africa

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact the following people to assist you with any further enquiries in accessing the following sites:

Contact No. 021 659 5579

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activitiesat requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final report within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. The reference number above should be quoted in all future correspondence.

Yours sincerely

ACTING DIRECTOR: HEALTH IMPACT ASSESSMENT
DATE: 22/12/2014

Appendix C: Permission to conduct research

Western Cape Government
Health

Hospital

REFERENCE: Research Projects
ENQUIRIES:
TELEFONE: 021 938-6267

ETHICS NO: 214282422

The Adoption and Use of Electronic Healthcare Information Systems to Support Clinical Care in Public Hospitals of the Western Cape, South Africa

Dear Ogundaini O Oaikhena

PERMISSION TO CONDUCT YOUR RESEARCH AT HOSPITAL

In accordance with the Provincial Research Policy and Hospital Notice No 40/2009, permission is hereby granted for you to conduct the above-mentioned research here at Hospital.

Date: 3 December 2014

Appendix D: Example of Interview questions

Introduction

My names are ogundaini, oluwamayowa……

I am doing a Masters in Information Technology.

The purpose of my study is to understand the causes of limitations - challenges to the use of electronic health information systems to aid clinical care in the public hospitals of the Western Cape.

These electronic health information systems are simply ICT tools used to assist in the process of administrative and clinical work activities.

Can you please tell me your Job Title, and what you do?

Status of e-Health IS in the Public Health Sector

1. Which electronic systems exist in the hospital? (Administrator)
2. What was being used before the systems were introduced? (Administrator/Clinical)
3. What are the names of the electronic systems frequently used to support work processes (clinical care in terms of decision making or adherence to clinical guidelines)? (Administrator/Clinical)
4. What are the systems used for? (Administrator/Clinical)
5. Before the systems were introduced, what was were being used in the hospital?
6. Why was there a shift to the use of electronic systems? (Administrator/Clinical)
7. To what extent are the electronic systems being used across the hospital? (Administrator)
8. What else is being used in conjunction with these systems? And why? (Administrator/Clinical)

Purposes of e-Health IS adoption in the public health sector

9. Why are you using electronic systems for clinical care? (Clinicians)
10. Are the electronic systems performing what they are meant for? If so/not, what are the feedbacks from users – clinical staff? (Administrator/Clinical)
11. How does it help work processes? (Clinicians)
12. What are other preferred alternatives in the absence of electronic systems?

13. What challenges accompanied the adoption of the systems for clinical staff? (Administrator/Clinical)

Perceptions on the use of e-Health IS in the public health sector

14. How well do these electronic systems fit into daily work processes as clinical staff in terms of decision making/adherence to clinical guidelines? (Clinicians)
15. How have the systems being relevant to work processes? (Clinicians)
16. What are the experiences using electronic as compared to paper based systems? (Clinicians)
17. Would are the impacts of using ICT systems for work processes? (Clinicians)

Limitations of e-Health IS use in the public health sector

18. What measures were put in place to ensure a smooth transition from paper to electronic systems for clinical staff? (Administrator/Clinicians)
19. How user-friendly (easy to use) are these electronic systems to the users (clinical staff)? (Clinicians)
20. Are there any challenges with using the systems? (Clinicians)
21. Could you please elaborate on each of these challenges? (Clinicians)
22. What are the likely causes of the challenges faced in the use of e-Health IS?
23. How have these challenges affected your work processes? (Clinicians)
24. What are the effects of these challenges on your work processes? (Clinicians)
25. What steps/measure do you take to neutralize the system challenges when they occur? (Clinicians)
26. How often are staffs trained to use the system? (Clinicians)
27. How effective/useful are the trainings staffs are being subjected to? (Clinicians)
28. What would you like to influence the use/fit-in of these electronic systems to improve work processes? (Clinicians)

Appendix E: Transcripts of interview sessions

Interview questionnaires and response scripts from H1 and H2:

Interviewer: Ogundaini Oluwamayowa

Interviewee: AC

Institution: **H1**

Venue: Clinician's Office

Date: 10th February 2015

Interview

Interviewer: Good afternoon, my names are Mayowa Ogundaini and I'm a Masters Research student at the CPUT….. Cape Town Campus…could you please…..

AC- H1-R1: I am AC and I'm the principal medical officer for H1.

Question

Ok Errm. Could you tell me what you do?

AC- H1-R2: I am a clinician and I work in community service… erm... I mean in the community and in H1 sometimes in Groote Schuur Hospital. I also run some administrative tasks… err… that... err... the superiors want me to undertake.

Question

Err… If I may ask, for how long have you being working now?

AC- H1-R3: 10 years… here in H1.

Question

Ok… Err…If I may ask you, how… how do you think your daily work can be improved? i.e. what you do as a principal medical officer

AC- H1-R4: Definitely I would love to have less administrative work. I am a clinician. Ok... I am not an administrator. So this is how it could be improved. You know… so i…i think that the administrative functions might not be certain functions that are run by doctors and nurses… errm… actually so… so to speak outsourced… err… by the proper administrative people who're supposed to run them. So we are trained through various tasks like filling the forms that are purely used probably later on to data capturing and various statistical information but that data…should not be…actually… those functions should not be filled out by us. You know... I don't think so… you know… the same… we are not here to run administrative tasks as such so this is the first step of improvement.

Question

You mentioned you've been working at H1 for 10years, can I ask which electronic systems exist in the hospital.

AC- H1-R5: ….Chuckles…. They are so little…you know… I have problems even finding them in my mind. Its e-mail communication…e-mail communication and sometimes NHLS online system to capture the results of the patients

Question

NHLS?

AC- H1-R6: National Health Laboratory System……. Services sorry…. National Health Laboratory Services

Question

Ok… errrm… what was being used before NHLS was introduced?

AC- H1-R7: We were just phoning the labs for the results but NHLS system… before NHLS system was just slightly different… erm… because they kind of improved how the customer and client and interface looks like however, the system is frequently down. So we have to phone anyway.

Question

Ok…erm… this NHLS, how does it work?

AC- H1-R8: You just type the patient number and you get the results

Question

Are the results being put in by Lab attendants or?

AC- H1-R9: Yes… yes

Question

Ok if I may ask, why was the NHLS system introduced?

AC- H1-R10: Why the system introduced… obviously to speed up… to ease the… the obtaining of the results **rather than phoning in**? Instead of phoning to actually to obtain via the computer

Question

And the NHLS, is it connected to…is it connected all over the hospital

AC- H1-R11: Yeah…

Question

Or is it certain people that have

AC- H1-R12: … actually not all of the hospital… It is free accessible on certain computers. However you can access the database through the internet and doctors frequently do it through their cell phones because our computers sometimes are down and we have to use our own cell phones to access the website and then to access the results

Question

Since when has this NHNL…NHLS systems being introduced? For how many years now?

AC- H1-R13: I wouldn't tell you, you know, probably for the se… as far as I remember you know, it was there…ok….we could get the results online, I think for 10 years now it has been there but when it was exactly introduced, I don't know.

Question

Was there a pilot study before this NHLS was rolled out?

AC- H1-R14: I don't know… I have absolutely no idea

Question

If I may ask you, have the NHLS has it been performing the task it is meant for? Or what's d feedback from how you use it?

AC- H1-R15: It is frequently down… the system is frequently down as I said you know. You can't access the results. It freezes…ok…or it's over loaded…. I don't know the bandwidth is not good enough… I have not... I have no idea what is the problem. So that's y the doctors…or the computers, they…err…the point is down… the particular computer...or …err…the computers that can access the database are down so doctors are using their own cell phones to get to the systems.

Question

So err…is it like…Since when did this start... Is it being frequent since the inception of the system or it just started like…..?

AC- H1-R16: that it was down? Yes... it is very frequent….very frequent……. On a daily basis…Now and then…you know… it was simply you can't access the results through the system

Question

And errm…what has…what effects have this had on your work processes?

AC- H1-R17: Of course you know, if the systems is down…of course there is frustration and err… and you need to phone… when you phone, you need to wait in the line to get err… to get response from the lab. Sometimes it would take you up to I'm not joking 15minutes or 20minutes to get the results. So this is time that is wasted.

Question

If I may ask, where's this lab situated?

AC- H1-R18: In Groote Schuur

Question

Oh ok…Errm…Is there another system being used in conjunction with the NHLS?

AC- H1-R19: No

Question

It's just the NHLS?

AC- H1-R20: It is the only database….only database or electronic systems that we have… you know we don't have any other system… I know that we have… err… You will have to speak to the…err... clerks because they are using errm…they are using data capturing for patients… so that's what I know about… we are not using it directly….errm… how's it called the system…errm…. CLINICOM yes… so CLINICOM is used by the clerks you know to capture basic patient's information but it's more on the administrative side not on the clinical side...this is the reason why I didn't mention it. However, it is useful because it prints the stickers. So that we can use the stickers instead of re-writing the patients' name again and again…However you must admit it's a little bit pointless because if you have CLINICOM and you have the name of the patient and the number of the patient and everything, yet you need to produce stickers to put it on the paper. This is where the problems lies because…err...if you have such a system, everything should be electronic…everything should be electronic so then you wouldn't have to re-write the same information again and again about the patient because this is what's happening in the case sheets…yeah you re-write it, you copy the information from another page onto the new page and so on whereas when you use the electronic system, you don't have to do that… the certain particulars are always there, visible for you…. You understand what I'm saying?

Question

Yeah…so errm…so how do you cope…so It doesn't kind of improve….It doesn't kind of do what the electronic system should do, you still have to do it manually?

AC- H1-R21: Of course you know… you just got the sticker…. You just obtain it for the doctor…you just obtain the sticker

Question

Errm… what's this sticker like?

AC- H1-R22: The sticker contains… It's just the patient information so. The name and the number of…errrm…. the unique number that CLINICOM gives, plus the address of the patient, ID number, it's all on the small sticker alright, however…erm…ok so that sticker you will put for example the lab form…if u fill manually the laboratory form, you can put the sticker instead of filling the patient's information in.

Question

Erm… there's a popular belief that before the electronic system, the paper based system was in use… What are your experiences using electronic as compared to paper based systems?

AC- H1-R23: We don't have no electronic system, we still use paper. True we just have patient sticker

Question

Including records?

AC- H1-R24: Everything is paper…paper based. I know that there's some data capturing…you know… on the admin end… I know that they capture data but from the manual registers.

Question

If I may ask back to the NHLS now…. Errm the technical difficulty seems to be that it's always down or it's always freezing?

AC- H1-R25: it's frequently down or freezing….our computers are not accessing the database

Question

But before, how was it working before this started, was it working perfectly or it was after……

AC- H1-R26: It was working a little bit better…ok…it was working a little bit better when the old system was like 8years ago, so you know I definitely had less problems than nowadays

Question

Errr…and how has the hospital tried to rectify this frequent down problem?

AC- H1-R27: I have no idea… however there are frequently reports that it is very frustrating to everybody. It is a daily occurrence so everybody knows about it, together with the people who are in charge and NHLS knows about it. I'm sure it is a technical problem…it is not err….It is some kind of connectivity or networking problem.

Question

On the issue of Eskom's power load shedding, how has it affected the systems in the hospital?

AC- H1-R28: It affected the country, the hospital was not affected that much because the hospital has got its own generators, so it functions normally…ok, there might be some problems with obtaining results but then we phone…ok we phone NHLS during those times but the hospital have generators so they are not affected.

Question

And what's the time difference between when you phone and when you get the results? How does it affect your decision making? Response time

AC- H1-R29: No look definitely, the system works…these online system works but it's much faster to get the results from the screen, you just key in the number of the patient and you have the results...ok so it would take you about a minute but when you phone it can take up to 15 minutes to get the results…sometimes it is faster sometimes it is slower

Question

If I may ask, how does the basic...the basic computer literacy affect the use of the NHLS?

AC- H1-R30: It's so simple. You know, I don't think that… you really need a very basic computer literacy...you know, so you need to click on the… one icon on the desktop to open the interface…ok…log in…because you have got your login and password…and type in the patient number. It's very simple...ok…so even the person without computer literacy can be thought very quickly how to do that

Question

Was there any form of training?

AC- H1-R31: No…It was just information spread, on how you access it…it's the word of mouth or the people are showing each other…you know… how to use it

Question

Ok…If I may ask…Are there any policies guiding the use of ICT in H1?

AC- H1-R32: Not that I'm aware of… I am personally not aware of any…but anyways as we said… I said, we don't have ICT as such…because what ICT do we have? We just have the e-mail communication…ok…so we have our inboxes, we have NHLS system and we have the CLINICOM…but these are all kind of like independent entities…each one function…functions on its own

Question

Ok…there's no integration between any of these systems?

AC- H1-R33: No… No…No… We don't have an integrated one electronic system…that you can put everything on the system. We don't have it

Question

If I may ask…Errm… how do you feel clinicians can embrace the use of ICT?

AC- H1-R34: In many ways… *chuckles* … you know I saw…you know in the late 80's in Europe…actually, doctors were not making notes…that was in the late 80's…ok…so the doctor was doing the ward rounds…with a little recorder and giving the recorder to the secretary who was typing the notes…so doctors were never typing the notes…If there was something relevant to be said about a patient, he was recording it like you are recording me now…that was late 80's….we're talking about 27…28 years ago right…*chuckles* … so that was then so you can imagine how it looks now...ok…they don't even touch the pen alright…and because of wireless communication, doctors simply have tablets and this is how they communicate with the mainframe through the tablets and not through the PC stations alright…it's very advanced alright…and here, it's just paper based… I would improve…you know massively because you save so much of time and so much of paper first of all, plus you are saved from so much of confusion…as I said, you don't have to repeat the same thing all over again plus electronic systems can verify certain data very quickly. So there's actually less possibility of a mistake. Err... electronic system is the king at the moment... absolutely…so they had an electronic system here which I shut down actually which was called CRADLE…and CRADLE was the…was an effort to capture certain clinical data about the patient. Errm…in order to create a database that could be accessed and then certain data can be retrieved for statistical reasons or for research reasons but that system… Firstly, nobody was using it…so there were a lots of data capturers that were feeding the data into the system but nobody was retrieving the data. On the other hand, the data was incorrect which I proved… ok, I was comparing the actual data with the data on the system and the system was presenting the wrong data plus it was very un-user… very user un-friendly so...plus it was derived once again from any mainframe. Ok so we didn't have electronic notes…Errm… CLINICOM was working on its own… CRADLE was working on its own. It didn't work.

Question

Asides the data inaccuracy, you mentioned that users were not accessing it…nobody was accessing it…can you tell me why users were not accessing it?

AC- H1-R35: Because it was presenting the wrong data firstly, secondly, it was not propagated… I mean, it was not promoted properly. Errm… you know and thirdly once again, it was not integrated with a solid system…you see, you can't have only certain things electronic, you must have everything electronic...ok because otherwise, you are carrying on your shoulders those people who are less computer literate right, because they don't want to comply...or it is not really very comfortable for them to introduce such a system, or they represent the outdated ancient belief that those systems are corrupted or they will create chaos or something like that…It's a very old way of thinking right….so they are opposing or maybe they are not lobbying for such systems…it's more political than actually practical approach you know…that's what I think. Such systems are ready to use….i mean they are used in other hospitals and you can electronize… I mean you can make the whole hospital electronic, you can do it and there are specialists who can do it very quickly. Ok… so it is not a very complicated issue at the moment

Question

Errm… Since there are these issues that surround the use of these systems, how do you think clinicians can embrace the use of ICT for their work processes?

AC- H1-R36: Those are young people usually you know, they can embrace it very quickly you know…they can embrace it on the fly…ok….they don't need any training...they are living with computers; they are living with smart phones, tabloids...tablets and whatsoever. So they don't need any training, it is their culture…ok I'm talking about the doctors maybe who are old fashioned… all the doctors...they might have some problems but if you simplify it enough, I don't think that even them would have much problems with using it, as they can embrace it very quickly… if it gives you the comfort, firstly of not repeating relentlessly the same information of the patient but you can just call it in, of course it would save massive amount of time…massive amounts of time yeah

Question

Errm…lastly, I would like to ask you, what do you think would be the short and long term effect of the use of these electronic systems on patients…in attending to patients?

AC- H1-R37: You know…It is very difficult to answer this question because the…. I mean everything outside of the hospital…most of the things are electronic ok so actually we are kind of like very much behind…so Errm…I don't think there would be… I mean it's almost expected that something like that should happen right…so what would be the short term consequences…..the short term consequences might be only the resistance or dragging from the people who are opposing those systems because they are used to the old fashion systems but this is more based on belief, it is based on their frame of mind than the actual reality…ok so there could be a drag because they are adjusting to the new reality…ok… there could be a resistance from people who want to train

students or train doctors to take the full history of the patient but it can be done in a separate fashion…if it is an exercise for the student, he can do it still on the paper or he can do it on his tabloid…on his tablet why not instead of writing it, he or she can type it alright so…short term consequences would just be resistance and the typical rationalisation or excuse that training must be provided and so on…when it comes to the younger doctors, the younger people will have no resistance… on the long term consequences, you will save simply billions….Just billions of Rands you know…because you don't use paper anymore, you don't have to copy relentlessly, you don't have to print… ok you don't have to copy the same information about a patient… you have access to the information rapidly but of course for that, you must have a good…good bandwidth, good framework, good networking…and you need to …..Have a very reliable power source and then you can introduce it. So on the long term… it is very difficult to count the positives because Errm…thousands of them, just thousands of them…plus you know for example, you don't have to decipher the notes, doctors have…..doctors are rushing….so their handwriting is terrible, with electronic systems you will never have these problem again…this is why I said mistakes would not happen, actually with electronic systems the mistakes would not happen…ok and it must be introduced because otherwise we are just….the government is just wasting millions, so the investment will be returned very quickly

Question

Errm…Coming back to why there are no ICT, electronic health information systems asides the CLINICOM for clerks and the NHLS for clinicians, why is no rollout of electronic health information systems at H1?

AC- H1-R38: you see, the NHLS system is dealing with very solid data, a kind of unequivocal data, those are laboratory results…it's like the pharmacy…the pharmacy has its own kind of little network of the stock and whatsoever but those are just numbers… see when it comes to CLINICOM, this is just the patient information…basic patient information, what date she must come back, or what is her number, where does she live, what is her ID number…very basic static information right…when it comes to the doctors, now you have the clinical information alright and doctors are ruled by various boarders…by various people, sometimes those people are not the youngest ones right and I think they are very scared of introducing such a system, this is why it is not rolled out…. However you know to…what contradicts this stance is what is happening overseas that everything is electronic… everything is electronic plus in South Africa you have got certain hospitals everything is electronic…I think the second military hospital in Pretoria is very much electronic, alright I'm not sure about that but I think that they are pretty much electronic, Albert Luthuli Hospital in Durban is fully electronic and has got the German network… Err... I think it is the network provided by Germans. Errm overseas, hospitals are electronic and they are interconnected with each other alright…so this is to say that it contradicts the stance of certain bodies or certain organizations or group of doctors or lobbying groups that are simply dragging this thing and not letting it happen… I think so or do you think it's the Government Issue

Question

That is what I would like to know, because Errm… I have heard instances where I've that doctors don't have…they don't have err… an opinion on what kind of systems are being rolled out into the hospitals, it's kind of being forced on them to use without considering their needs…..?

AC- H1-R39: You see with electronic systems, as I said they are already systems that are in place in other hospitals, there are specialists who can introduce these systems alright and err… the fact is that everything should be electronic… I don't see a reason that anything should remain not electronic. Ok for God's sake we are storing now things on the clouds… we don't operate in the paper reality anymore...ok so everything should be electronic…. Everything…every record should be electronic…ok, even if we do CTG for patients (Carditotogram)…. Overseas, you have it displayed on the screen and it is recorded and it is in the database of the patient and the pictures are recorded into the database of the patient, X-ray pictures, CT pictures…anything can be recorded. So I can't imagine that there should be anything left which is not electronic…you can even confirm your identity with the fingerprint *chuckles* …so I....If you are saying doctors are not consulted and… I don't know, maybe they are expecting that everything should become electronic. They are a little bit confused; they know this is not their specialty to kind of tell you

Interviewer: That's one of the reasons I'm doing this research to know what exactly is the issue or the problem is with clinicians not using or not adopting electronic systems

AC- H1-R40: because they don't have it….It is not provided...it is not provided….they are just repeating what the superiors want them to do. So if there is a young doctor, intern or community service doctor even the registrar, he would be repeating exactly what the superior is telling him to do because that doctor is still so-to-speak at school…he's doing time as they say alright…so they are just repeating alright… so the superior is asking them to write down notes, so he's writing down the notes because otherwise he will not conclude his internship or community service or registrarship or whatever it is alright…so they've got very little say in the matter. It is not provided for them…so how they should…what opinion should they have

Interviewer: Ok, that's interesting...Err… without taking further of your time… thank you… this discussion has been enlightening and I thank you very much…. And I hope errm… if I need you to consult you more I hope to find you on seat, you would be available… Thank you very much

AC- H1-R41: No problem…Anytime….ok……thank you!

Interviewer: Ogundaini Oluwamayowa

Interviewee: KM

Institution: **H1**

Venue: Management Suite

Date: 13th Friday 2015

Interview

Interviewer: Good morning, my name is Mayowa Ogundaini. I'm a student at…. I'm a masters student at CPUT and I'm carrying out my research in health information systems, I want to find out the causes to the limitations in the adoption of…. in the adoption and use of electronic health information systems at H1. Could I know your name please, and your position in the hospital?

KM- H1-R1: My name is KM and I am the head of Nursing at the hospital.

Question

Ok…Thank you. Since when have you been the head of nursing in this hospital?

KM- H1-R2: Errm… I have been appointed as the head of nursing on the 1st of August 20…2009. And before that, I was acting head of nurse from the 1st of May, 2008 until the day I was appointed.

Question

Like…. How many years of experience do you have in the Nursing field?

KM- H1-R3: Errm…you don't want to know…..37years

Question

That's a lot…so if I may ask you, from your years of experience, how do you think your work processes can be improved?

KM- H1-R4: In terms of technology…? Or in general?

Question

What you do as a nurse, as a senior…as a head nurse….yeah?

KM- H1-R5: and how the condition as improved? I don't quite understand the question…..

Question

How your work can be improved from what it used to be…..and how it is now? Maybe through the use of technology…..including that also….

KM- H1-R6: Now… a great part of the 37years, I was a clinical nurse in the neonatal unit... (**Interviewer:** in the what unit?) …. In the neonatal unit, that is where they look after small…sick small babies, premature babies or/and babies who are born and who are not well…so and… when I entered the managerial field, a lot of stuff still had to be…was paper based. So you would write a letter by hand, and bring it to one of the typist down in the office to type the letter for you and sign it whereas now, you've got access to technology so you can…Errm…do your own letters, don't have to be dependent on someone else to do your letters, you can do it straight away on the computer. Information is also shared much more easier, before we used to depend on all the internal memos going around, not always reaching everybody…now just with e-mail, information can be shared straight away and immediately…Errm to everybody else, you don't have to be dependent on the phone, phoning someone in the ward …to ask for something or to get some information from… you can send an e-mail quickly and also with….*clears throat*… before CLINICOM, we had the Gynae program and we had a Neonatal Program and if you needed any statistics, you need to get those reports…but still they're specific things, just maybe numbers, whereas now you can go on CLINICOM and get all you admission numbers, you can get your birth numbers, you can get whatever numbers you need and now in my position, we get reports from head office so if I want to know something about one of my nursing staff, I can go onto that report and get all the information…which salary level she's on, date of birth, years of service…yeah…so it just made a huge difference. I don't have to bother the HR department every time I need something… information about a nurse. There are still some specific things that are paper based but the important things are on the system and I can access that

Question

Ok... Errm… you mentioned… before the electronic systems were introduced…what was being used?

KM- H1-R7: You must also remember that my managerial position also came about when the electronic systems were sort of… already in place and Errm…I mean it's still improving and it's still rolling out new programs and especially in terms of finances and financial reports and CLINICOM reports and the SINJANI reports where you can look at all sorts of things in terms of patient care for example…Errm… so I think that would accessible…. Errm…what was the first part of your question? What did we use before? Now the other thing…. I'm mostly talking about nursing as such…the other thing that came about technology and the improvement of technology is the nursing information management system, that they call NIMS… nursing information management system…so we that system, before we would get all our requirements for nursing agencies…Errm that would cover the wards clinically…so I would need say 5 professional nurses and I would phone the nursing agencies and I would phone 5 to 6 nursing agencies, and I would tell them is my requirements for tonight or tomorrow…and then they would all phone me back in the afternoon to say I can fold that one for you… I can fold that one for you… I can fold that one in post-natal for you, whereas now we put the requirements on the NIMS system, all the agencies out

there…nursing agencies see it….they can respond, they can give them a time in which they must respond… I put an order in now, I can say I'm closing the order by 4 O'clock so anybody who didn't respond by 4 O'clock then missed the boat…and then they provide me with names, so then I can check the person's experience because there's a profile next to that person's name…so I can see that Mayowa has worked at Groote Schuur, labor ward and worked at Somerset in post-natal… so I can then choose whichever person I want that fits the profile that the person needs to cover….so that's being the huge improvement that the NIMS have brought about.. so there's no more phoning giving them all the requirements and we put them all out at once, we give them a time that they need to respond to and they do the nominations, we choose who we want and we then order it like that and then we confirm the ones that we would like to come work for us.

Question

You mentioned CLINICOM, SINJANI and NIMS… I want to ask, why was there a shift to these electronic information systems?

KM- H1-R8: I think to make it more easier, to improve the services but also so that there's more control especially with the NIMS…because the NIMS is also connected to the BAS which is the basic accounting system. So from the NIMS, the BAS can then see how much money is being spent…..*phone rings*…….

Question

Ok, since when have these systems been put in place?

KM- H1-R9: the NIMS is not more….at least 2yrs since 2013 that the NIMS is in place… CLINICOM has been around for a while, not exactly sure how long and SINJANI is also being around for about 2 to 3years now.

Question

If I may ask, how widely spread are the use of these systems across the hospital? How spread is the use….Is it just for your department, the nursing department or it is used in all departments in the hospital?

KM- H1-R10: No, it is used… I think…..the CLINICOM is used all over right; Errm… the SINJANI is just a report drawing system… so the information manager will draw all… because the CLINICOM also feeds into the SINJANI…. So the information manager will then draw all the reports from the SINJANI….Errm…and yeah so…but the CLINICOM is used allover and the NIMS are used exclusively by the operational managers when they all do their nursing...their agency staff…procurement of the agency staff

Question

What are you experiences…..What have your experiences been since you've being using these electronic systems compared to when you were using the paper based systems?

KM- H1-R11: It's just so much easier…it's just so much…and I know my desk is full of paper but…*chuckles*….but I think there would always be a place for papers but it made a huge difference.

Question

Like…so…does it mean there are some certain work processes that can only be done by paper based systems? You said there would always be a place for paper based systems so does it mean that these processes cannot be done electronically?

KM- H1-R12: I think when it comes to statistics and information management; those things I think would…or are most probably electronically done….Errm but eventually I think…paper based….most of the paper would die out but I think there would still be space for certain…for hard copies so to speak…Look for example, with my nursing managers meeting for example, I've done away with handling out hardcopies of minutes, so the minutes all get sent electronically to my managers and when we come and do the…when we come to the meeting we put the previous meeting minutes on the screen, so corrections would then get done from there, so we go through the minutes on the screen, so…but I still sit with a copy which is just easier for me then to make these amendments on the minutes for reference later on …..

Question

If I may ask, what are the feedbacks from your nurses on the use of these electronic systems?

KM- H1-R13: Listen, I think there are some people who're old school…who're still struggling with getting used to electronic…some of my managers for example…there are still some of them who don't use the e-mail… I don't know whether they're scared…or whether they think it's going to bite them…*chuckles*…..or what, but I would send them mails and would never send me a mail back. Errm…not even acknowledging the mail, and…but they do read it….if I ask them about it, they would confirm that we did get your e-mail but there's no response…it's something that I'm working on.

Question

Can I ask…I would ask two questions……. Can I ask why they are not using the electronic systems and how you are actually working on making them use it?

KM- H1-R14: We've done quite a lot of in-house training about it… and I don't know where that stubborn resistance or… I don't know what it is…… but it is something that we are constantly trying to get them to do, at least all of them work on the NIMS system because they don't have a choice, if they want their wards would not be covered…they must go and put their orders on the NIMS

Question

Errm… so how do they find the use of the NIMS?

KM- H1-R15: Some of them struggle…there was one specific person who still asks someone else…one of her colleagues to put her orders on the NIMS but I think there was so much peer pressure that she then had to succumb and start doing her own…yeah…so I think peer pressure would alter and push and force certain people to get into the electronical…electronic usage…yeah

Question

Errm... you mentioned quite a lot of positive experiences with the use of electronic systems, are there any challenges?

KM- H1-R16: You see… I had gone through a lot of computer training, but I found that if you don't use a program, it doesn't matter how much training you could have gone through because most of the stuff I know how to do on the computer… I had training but it's also my colleague or someone in the office or someone else…come and show me quickly how do I do this….then I can do it….and then if I do it regularly it becomes second nature so…

Question

So…Is it only the use challenge you have in the system? How about technical difficulties….system downtime?

KM- H1-R17: At the beginning…. you know...it is strange that you ask that question because just the other day, I thought when we started working on electronic stuff…every time the computer will do this and I would have to phone Althone up there to say…Althin … this is happening with my PC now, what must I do?.... I haven't had that kind of experiences recently and I just thought... nothing happening anymore… is it the system that is better…or …or is it that it's moi that's better… *laughs*……..

Question

Errm…So if I get you right…you've had electronic….you've had issues, you have to call someone, what does the person do? The person you call what…..

KM- H1-R18: he would either guide me telephonically… most of the time it was something simple…Errm…like just press that button…just do that…..and then it's all sorted… and I don't know why I didn't think of that…Errm and sometimes when it is something bigger yeah…we phone the help desk and then they would also assist from their remote office…yeah

Question

You mentioned training, how often are staffs trained in this hospital for the use of electronic systems?

KM- H1-R19: We don't have in-house training… but through our skills development, we …people can apply to go and do training outside and will be funded to go and do training outside

Question

How often are…do people go outside for training?

KM- H1-R20: I think over the last couple of years, quite regularly…yeah…like myself and the two administrative assistants in this passage…. There was a year we used to go like every Friday…or every second Friday, we would go for training

Question

And how has this training helped with the use of these electronic systems?

KM- H1-R21: It improved my skills but as I said, the program that you don't regularly use, you lose that skill…

Question

I'm thinking, what would you say is the cause of not regularly using these programs?

KM- H1-R22: Well, if there's no need for me to use a specific program then I'm not going to use it.

Question

How user friendly are these systems, in terms of ease of use? How easy are they to use?

KM- H1-R23: I think they are fairly easy…I think they are fairly easy, it's just that you need…If you don't use it regularly then….

Question

How does basic computer literacy… how does it affect the use of these electronic systems? Like you gave an example of your colleagues not checking their e-mails or not actually replying…so how does their basic knowledge of computers affect the use systems?

KM- H1-R24: I'm not quite sure whether there's a lack of basic knowledge…. I think the basic knowledge is there… (**Interviewer: but?**)... I think there is still that… maybe stubborn resistance…passive resistance and I don't know why

Question

Could it be because they are used to doing their work manually?

KM- H1-R25: Errm… maybe… errm… you see, there's a younger group…and I'm thinking now in terms of age, they are still some of us who're in our 50's but we old and there are some of them who're in their 40's and they shy away….so….and I don't know what it is but it's there…it's definitely there

Question

How do you feel clinicians can…nurses can embrace the use of these electronic systems for their work activities?

KM- H1-R26: I think like the NIMS system for example…the NIMS is not just for the procurement of agency staff, there's other uses for it…we just need to explore those other uses and put the training in place so that the program can be optimally used… I think sometimes, we don't always know what a specific program can do for us… I think that lack of knowledge is sometimes there

Question

Ok, if that's the case, which leads me to my next question of, what would influence the use of these electronic systems by nurses?

KM- H1-R27: No… you must understand that when I talked… I talked about the managers reporting to me…so they thought of the operational managers in the various wards but I can assure you that the group of nurses below them…are therefore more electronically inclined than they are…so it's just that group of…..that layer of people that need to realize the benefits and the use of electronic systems… like I've got 2 managers that does everything electronically…and then there are others who would…they would make their own reports, develop their own results on the system and they would give all the reports electronically but the others would still use the draft and write it in and submit that

Question

I'm thinking… so what's the short and long term of the use of these systems on patients? So far since you've been using it, what effect has it had on patients? In terms of…for example, patients are being attended to on time…you able to keep records of all your patients intact?

KM- H1-R28: …. All our patients are already entered into CLINICOM, when they come into OPD, they report to the clerk…they log them into CLINICOM as in attendance so and…so all our admissions are also done on CLINICOM, all of our discharges are done, all our transfers…transfers from one ward to another ward on CLINICOM…so at any given time, if you come in and ask, it should be like that…in which ward is KM then the person in admissions or wherever should be able to check on CLINICOM and tell you.. Oh KM is in B ward…..but patient's clinical records are still not captured on….electronically… now I must tell you...in 1998, I was privileged to do an internship in Neonatal health care in the states...and in the hospital where I was doing this internship in IOWA… d… in IOWA, Errm, the doctors would go on ward rounds with the sisters or the nurses and all the notes would be made and after the ward rounds, they would go and sit and enter all the clinical notes for the morning or for the day on the computer and after each incident and they need to see a patient, they'd go back into there…so eventually all the patients record are electronically saved…and I think we are faraway off…that was like 16 years ago…to almost 17 years ago, that was already happening there

Interviewer: which is one of the reasons I'm carrying out this research, I want to know why….

Question

If I may ask…you said patient clinical records are still not electronic…why is that?

KM- H1-R29: It's still all hand-written. I think we work with huge numbers, you see private…when I go to my orthopod….. (Interviewer**:** to your?)…to my orthopedic surgeon, he would have my X-rays on the system, he would have all my notes on the system so it would all be there on his…on the screen and I can read it and he can read it, and he can access it and that's all there…but I think in the public system, we dealing with huge numbers, so for doctors do go and seat and enter everybody's clinical note unless they work around with i-Pads and so every time they see a patient, instead of taking them 10minutes to write that, they can enter that…their findings and their planning for the day onto the i-Pads which is then connected up to the mainstream system at a later stage and all get entered like that.

Interviewer: *chuckles* I also spoke to someone that brought up the issue of mobile devices…which I think you also just mentioned now. Thank you very much (**KM- H1:** I hope that was useful). I think I got even more than I bargained for in terms of how nurses use electronic health information system. It's also kind of surprising that you didn't mention that you were having so much technical difficulties and you even mentioned there was an improvement from when you first started using the system up until now that you don't have any technical difficulties

KM- H1-R30: There are the glitches but I think it's just…It's not…It doesn't absorb you, it doesn't take over the day, Errm…and I think that depends on the individual, if you have lots of glitches during the day…technical glitches then you can either then say I'm sick and tired of this system and it doesn't work for me and …….tadadadadada…or you can have it sorted out and go on.

Interviewer: Thank you very much Ma, you've been more than helpful, thank you for your time and I hope when I'm done with my findings, I can get you a copy (**KM- H1:** I hope so too)… Just to find out how we use…how we can improve work processes in public hospitals with electronic systems… Thank you very much.

KM- H1-R31: Thank you, it was a pleasure assisting you (**Interviewer:** Thank you very much Ma… the pleasure is all mine…Thank you very much)… you're welcome! …. **KM- H1:** taking account…I think…Errm… because then they link the money to the procurement system…and they can see how much money we spend on…on nursing agencies…yeah…the BAS is linked to NIMS

Question

Are those the only two systems linked together?

KM- H1-R32: I don't know… I don't know

Interviewer: Ogundaini Oluwamayowa

Interviewee: FDT

Institution: **H1**

Venue: Administrative Unit

Date: 13th February, 2015

Interview

Interviewer: Good morning, my names are Mayowa Ogundaini and I'm a Masters Research student at Cape Peninsula University of Technology. The purpose of my research is to find out the causes to the limitations in the adoption and use of electronic health information systems for the public hospitals in the Western Cape… could you tell me your name and your position in the hospital?

FDT- H1-R1: I'm FDT. I'm the Information officer at H1…so I assist with training on the systems that we use in the hospital….and monitoring those systems as well… *chuckles*….most importantly…

Question

Can you tell me since when you've being working…..like how many years of experience do you have?

FDT- H1-R2: I've been in the government service…For a pretty long time….for about 26 years but I've worked through various areas… Errm I've been in the information office department… Information management department rather for the past 2 years… (**Interviewer: 2years?**)…..2years

Question

Can you please tell me what electronic systems exist in the hospital?

FDT- H1-R3: So we use….at the moment we use; CLINICOM… we use JAC, NHLS and SINJAN….want me to close the door? ....so that are the systems we basically use at the moment

Question

When were these systems introduced?

FDT- H1-R4: Errm…at various times….CLINICOM has been….CLINICOM is our main patient information system and it was introduced at H1 in 2003….it's being rolled out to other hospitals before then…but at H1 since 2003….the JAC is more recent…we've being using…H1 was one of the pilot sites for JAC, so we've being using it for the past 5 years more or less ok….Errm and NHLS is the Lab system….Errm…that system is also more recent but I can't say for sure but we've being using it also for about 5years more or less, I can't say for sure neh…SINJANI….SINJANI is also…the information that we capture the stats on…so we used to use DHIS previously and then SINJANI was introduced in….SINJANI was here when I came…*laughs*……Errm... it's also between 8years…10 years more or less…more or less

Question

So who are the users of these systems?

FDT- H1-R5: ok…CLINICOM as I said…is a patient information system, so the clerks use that system mostly… they capture the patients information…each patient that comes, that attends H1, the attendance is recorded on the system and any admission of the patient is also recorded on that system… it's a system where we extract our data from as well….the JAC is the pharmacy system. It's a system where the dispensing of medication is captured on…Errm…it feeds into CLINICOM, so any patient that receives medication, JAC would dispense it but it would link and see if that patient actually attended H1…so we preventing fraud in the same time…. you know…so medication isn't dispensed to a person….to a fictitious person…let's put it that way. NHLS is the National Health Laboratory Services...Errm… we use slightly different system previously to extract our lab results…but we can access that information electronically now….the doctors mostly use that system…Errm so when bloods are taken... it gets sent away and we may need to see the results and access it from our system…previously, it was a paper based system and we were to phone the labs to get the results, now they can view it and print it electronically. SINJANI is the system where we capture all our information and I said previously it was DHIS but in the Western Cape, we use SINJANI the rest of the country still uses DHIS and SINJANI feeds into DHIS

Question

Why was there a shift between DHIS and SINJANI?

FDT- H1-R6: Errm…it was felt that SINJANI is a more user-friendly system, the DHIS sometimes when we used to export data…or when data was imported, it used to muddle information a little bit, so they just felt that SINJANI is a … was a better way to capture information.

Question

Sorry…What do you mean by muddle information?

FDT- H1-R7: Muddle…. It used to…some of the information used to disappear and sometimes information would be extracted incorrectly on the other side…

Question

So…are these systems performing what they are meant for…so far?

FDT- H1-R8: Mostly, mostly they do…we do however have slowness of the network which affects the work quite often… they've tried to increase our data line speed to help us capture info….for example, CLINICOM at one time was very slow and just remember that the clerks here are to capture information in the clinics and our clinics are very big...we sitting with a lot of people and each patients' information has to be captured… so we have to say…what's your name….what's your surname…what do you earn, where do you stay…. All the little details are all captured on the system and when the system is very slow, our patients become very frustrated neh…and it delays the work…but…it delays the patients going through to the doctors as well…you know…At first we had lots of those little hiccups but they've increased our data line speed, so CLINICOM is operating much better…it isn't…we aren't able to extract all the information that we would like to at the moment, we're still using some manual registers even though some of the data captured, we can't extract them the way we would like to do it but otherwise, it does allow us to draw quite a few/bit of reports and we are able to verify that information against manual registers and…

Question

What's the cause of not being able to extract much information as you need?

FDT- H1-R9: Errm…they're still developing some reports… for example; we are H1 hospital, so our core business is delivering babies…Errm…while we are able to capture some of the information on CLINICOM… we previously had a different system called CRADLE and that was a system that just focused on obstetrics information…so to tell you all about the baby, the mode of delivery, who delivered the baby, the weight of the baby…you know…to give you all the details around that…and then certain information was also used to export to the city of Cape-town, for birth registration purposes, CLINICOM doesn't do that, CLINICOM doesn't allow that, CLINICOM doesn't feed into the system that city of cape town uses so we still have to do that but manually…we still need to go and count our registers and submit that information manually but it is developing… I think they have to purchase another module for maternity which is quite expensive I believe….

Question

Which of these systems are integrated?

FDT- H1-R10: CLINICOM is like sort of our main system, and then the JAC would integrate with CLINICOM….We also have the primary health system that the MOUs use and it is also integrated with CLINICOM, it also feeds some of the information…gets feed into the CLINICOM system. So when a patient…because we are referral hospital, the patient would go to the MOU and book complications arise and then they are referred in to H1. But the system that the clinics use, is called the primary health care information system, it generates a folder number, and that folder number would be accessed from CLINICOM or feed into CLINICOM and some of the data…information that's captured into that primary healthcare system would also feed through to CLINICOM….so we get the folder number, the patient's name, the patient's date of birth…they're currently also expanding to get some additional information …so that the patient arrives here, we can search for the patient on our system and we get their information…we might not get all the information but we'd get some of the information.

Question

Is the CLINICOM integrated with the primary health care information system?

FDT- H1-R11: the primary health system is integrated with the CLINICOM, it feeds into CLINICOM

Question

Why was there a shift from paper based system to the use of these systems in the hospital? (**FDT- H1:** when?)…. Why? ..... (**FDT- H1:** where?)… Why was there a shift…?

FDT- H1-R12: It is mostly in our outpatients department. Before CLINICOM…we had a Gynae program, so our admission(s) was done on the Gynae program but only to a certain extent… CLINICOM you can get some additional information and so it's being changed in the wards as well as the admissions suite...so this Gynae was just focused on…in the admissions area

Question

To what extent are these systems used in the hospital?

FDT- H1-R13: Errm…we use it quite widely… like I said, all our patient that attend…the outpatients, the information is captured on the system…patients that are admitted, the information is captured on the system…as the patient transfers throughout the hospital, through the various wards, the system allows that and then once the patient goes home …is discharged, the ward clerks then discharge the patient off the system as well

Question

What is being used in conjunction with these systems? Like you mentioned the Gynae program wasn't giving anything so the CLINICOM was introduced, what's being used in conjunction with systems and why?

FDT- H1-R14: ……For us at the moment we are only using CLINICOM to extract our information…we get some…the information that's captured in CLINICOM is extracted through reports…we normally access it through cognos report viewer neh…and…but it's the same information that's captured…it's just linked into that system…so we'd extract our reports for different systems almost…but it's fed from the CLINICOM… we do our daily reports that we extract directly from CLINICOM... that we can check and monitor and see if our information is accurate….

Question

What measures were put in place to make sure there was a smooth transition from paper based systems to the use of these electronic systems?

FDT- H1-R15: When they rolled out CLINICOM with us, there was first of all a team of people that did research, they needed to see now many PCs we need, what information we need, how are we going to need to capture the information, who's going to be captured in the information, and then, once all of that was established, we were then given the computers, the hardware, and then training was provided to those people to train the rest of the staff…so training was provided before…what we call the Go-live of the system…. Training was provided but we also had support for quite a long time and we still have what we call system controllers, so if we have any problem we just contact them and they would then support us with whatever is… problems we are having with the systems

Question

What…where are these systems controllers?

FDT- H1-R16: The system controllers are stationed Errm…our systems controllers are stationed at the Red Cross just up the road basically but we're in telephonic contact as well as e-mail contact constantly with each other…

Question

And how long does it take for them to rectify…problems?

FDT- H1-R17: It depends….some of the problems they're able to assist us with immediately…there are other times when they might refer us to a person with more knowledge…and there's times when the call needs to be logged…it needs to be logged to the actual systems' developers and then that can take some time… sometimes 2 weeks…we've already had problems, we've had difficulties in rectifying some

Question

What effect does that waiting time have on work processes in the hospital?

FDT- H1-R18: Fortunately, it doesn't happen very often…*laughs*… it might be for example, one patient that you know there's a certain problem with…and then yes… we are unable to do anything on that particular patient and then we have to wait so... we just have to make manual records of the information and once it is rectified, they let us know and we later on capture that information but unfortunately it's not a lot of patient... It has to be one odd patient and there that has the problem… sometimes when it is a bigger problem…Errm… I need to weigh this carefully… *laughs*….. Errm… When...I'm trying to think of an instance, For example, there's a particular report that we want to have a look at and we can't look at the report at the moment, it impacts on us in that we can't verify our data that's how it's going to impact us but the systems developers are working on it doesn't just affect our hospital, it would affect all the hospitals then because it's a system problem but they would normally communicate with us and once they're fixed up, then they would let us know…and then inform us about it…they're upgrading the system all the time and developing new things all the time so as we identify a particular problem yeah, they would fix it up…then one of the other little things for example was, the cell number…when the new codes came…I think it was the 083….there's a new cell number now, I can't remember…the prefix.…the system didn't recognize that prefix ok, so it picks it up and says this is not a cell number but then... we would then…I would work around it and say…put the cell number in the comment box…so the comment box was there and you can then view it there you know.. It just meant that the person capturing information and the person looking at the information has to be trained to just view the comment box as well… so there would be training around a little bit…with work around….because the work must go on…and you have to find work around with some stuffs

Question

You mentioned about training earlier, how often are staffs trained?

FDT- H1-R19: When somebody comes in brand new, we normally do quite an in depth and thorough training…. Training is also aligned to the area that they're going to be working in…once they've been trained and they've been stationed in a particular department, they're monitored and they would be called back for a top-up training…if there's a need….We also…because I do the training…ok, so I would go to the department and tell them in the training room, and then once they are at the station, I would go to the station and go an monitor them and give them the support there……and then I also view the reports and when I see them making too many mistakes on that particular function, I then call them in for training as well and then when you get more from a different department so...I train all the time but it's not necessarily the same staff all the time… some people just catch quicker and some people a little bit slower, so you need to call them back and give them more training… so the amount of training that a person receives depends on the capacity or capabilities of that person to absorb the training… did that answer your question?...*laughs*…It is difficult to say once or twice a week…you know, it depends entirely on the person but you are demanded to be on the system all the time…to get your reports.

Question

What feedback do you get from the users…on the use of the systems?

FDT- H1-R20: they would tell me when they are unable to do…perform certain functions or the system is slow then they would inform me and I would see what I can do from my side and if I can't then I would contact my system controller because there's an organogram map to follow a little bit…ok that's it

Question

Errm…What challenges accompanied the use of these systems for clinical staff?

FDT- H1-R21: Clinical staff…they weren't very eager to …….at least at H1 they weren't very eager use the systems…lots of the clinical people are of the opinion that they are here for clinical reasons and not administrative reasons and they thought the computer was an admin function, so we didn't have good buy-in from clinical staff, we still don't have very good buy-in from clinical staff… It's still a bit of challenge to get clinical staff to use CLINICOM system in particular. Doctors are very good with using the NHLS… that they don't have a problem because they know the information they get there would directly fit their patient but they don't always see the relevance of the CLINICOM system

Question

Can I ask why that is the case?

FDT- H1-R22: I really don't know, it's just their mindset that's got to change... Errm because with some hospitals, some of the clinical staff are quite good with capturing the systems…like I said at H1 it's just the clerks… like it's just an admin function that's got to be done there but then we specialize in a certain area, there's a shortage of staff… we are pretty busy, so yeah they would be rather be hands-on with a patient than sit in front of a computer and capture information…

Question

Can I ask, what has been done to kind of….as an incentive for them to use these electronic systems?

FDT- H1-R23: Errm….. I have only being the information officer for a pretty short…short time so I do try and communicate with the supervisors all the time…and, some of them started moving towards…and mostly the nursing staff but as soon as there's a shortage, that's the first thing that would fall away, so there's shortage of staff… get very…very busy and then that's the first thing that's going to fall away from…consciously…so we do try to encourage them, give them information about the system and all its short comings and I do offer the training and do send out e-mails, and say you know …please, you're welcome to come for training, presentations... we would….you know, confirm the benefits of the system…they say you can lead a horse to water but you can't make them drink…..*laughs*….and that's the case…… There are few of the nursing staff that are very eager and have called me that….I would like to have trainings and then we would go ahead and we would train but I think it's also management's view on these systems…that plays a big role in how much they are encouraging those staff to take on the systems…

Question

Between the CLINICOM, the JAC, the NHLS and the SINJANI, which of these systems do clinicians' use the most?

FDT- H1-R24: NHLS…the National Health Laboratory Services…that Errm…. Doctors'…that's their system, they use them… the nursing staff also use the NHLS…the JAC is just a pharmacy system, and so only the pharmacist would…it's only in the pharmacy….it's only the pharmacists who use it…. The SINJANI is more…where information is captured on them and extracted in tables and… I tend to use that mostly, so when I get the information, I would just forward to them, slideshows and graphs and stuff

Question

Are there any policies regarding the uptake of these systems?

FDT- H1-R25: Yes…yes, we do have…CLINICOM standards… guides on how the system is used and what the system is used for and we also so have other final instructions on other policies and protocols that advices us on how to use the systems and what systems to use for whatever needs

Question

How do these policies affect the users and the systems?

FDT- H1-R26: Errm…when you say how does it affect them…would you like me to talk in the positive or negative manner…? Look, the policies and the protocols are what we have to adhere to, you can't deviate from it…it's got to be adhered to, if you don't it can have repercussions for the institution… so, something might not be pretty….what's written in that policy but its' got to be adhered to. Well, for most of the time, people would comply with the instructions but this instruction doesn't always come from the CEO, it comes from the head office and from our regional offices so we're told this is what you must do and how you must do…and if you don't….*laughs*

Question

I want to draw your attention back to…access to these systems, because it kind of deals with patient information which is a sensitive data so who has access to these systems and how do you control the access to these systems?

FDT- H1-R27: The access is….first of all, you have to be trained and there is a confidentiality document signed, when you open CLINICOM, it also tells you patient information is….all the systems would tell you that patient information is confidential…Errm…yeah so that…they have to sign that form…you are trained and given the access…if you leave the department, then your access is immediately disabled…so if you leave here, you won't still be able to access our system

Question

You mentioned about slowness of the system, is that the only technical difficulty…?

FDT- H1-R28: At the moment, that's the biggest problem that we have and especially with the power outages and stuff, we had a communication now again that said… the NHLS Labs would be down this weekend, so Errm…because they are working on the upgrading the system and so …yes, that would affect the medical staff in particular because they then need to have…some of the results would be urgent but then they have to call…so it came out yesterday and I have distributed to the heads of departments who have to pass the message down

Question

So in this kind of situation especially the power outage, how does the hospital cope with these electronic systems?

FDT- H1-R29: We've got backup generators which would keep the overall electricity on…We are meant to each have a UPS back up battery for each PC…the ones kept in this office are very old and they need to be replaced… there wasn't money…In this financial year, to purchase the replacements, so we are looking at the near financial year to replace at least some of them where the main function is…with our machines and OBDs and things…Otherwise we have our backup generators.. there are times when we have been informed about this power cuts that the main server would then be off limits or shut down for a certain time but then they would normally communicate this and we had to go back to paper based systems…manual systems and then once the systems are back on we then have to capture…make sure that we capture all that information…so we normally are informed ahead of time …if there is a planned cut-out and then put systems in place…but in any case we always have to be ready for power outage …so there's certain rules and this is part of the clinical standards as well that when there is a downtime, there's a procedure to follow…there's a document on what and how to do….

Question

So far so good, with the introduction of these systems, what have been the experiences in terms of use in H1 since the introduction of electronic information systems? What has been the atmosphere since the introduction and the use?

FDT- H1-R30: Like I said, CLINICOM is mostly being used by the admin staff, when it was rolled out; there was quite a few people that had a fear of the computer, to the point where 1 …or 2 of them resigned, they were pretty close to retirement age and they just felt they weren't going to be able to cope with the…learning something new… there were those that had the fear of the PCs but they've overcome the fear…and they are pretty confident on the system now. They can actually teach the others now as well…on the training bit as well...we have what we call the core trainers…so I train the main trainers and give support but in the hospital itself, the one colleague would give some support and say to their new colleague if this is a new person coming to their area, they also have the responsibility of training them… that is it….anything else? What did I miss out on?… it is far more useful, it does simplify our task, it is quicker, we are able to access our information… the only thing is the shortcoming is of course when the processes are slow and when a user isn't adequately trained…and this morning I had training with somebody as well… because the person was moved to a brand new area without having the necessary access and my rule is that… I don't give access if I haven't trained you, but if I'm not aware that you are being moved then I can't train you. So I need to be informed…there needs to be a process in place, the difficulty is that the supervisor retired at the end of last year and someone new is taking over, and the new person is still trying to find her feet, she's only just helping out so they're still finding their feet…so they're making changes and they're not always informing me of the changes that's happening so that is a little bit of the shortcoming…is the supervisor isn't aware of the processes. Errm… and then things can fall apart a little bit because I had to squeeze her in today for training, so I have to go next week when she comes back because she works shifts, she would be off Monday, Tuesday and then she would be back on Wednesday so I must make sure.. I have to go and see her…are you ok...which puts extra pressure on me because I have my schedules and stuff to do….

Question

I think I have one more thing to ask, that in terms of what the management of the hospital has done to encourage clinical staff to take up the use of other systems that they think is for administrative purpose only?

FDT- H1-R31: My feeling is they can encourage them more…that is my feeling. To start off, they were informed that they have to learn the systems but other than that it's just…my opinion is that they can…they've got to raise their voices a little bit to say listen, this is what is got to be done and this is how it's got to be done…cos if you don't, if you don't do whatever is needed then, this is going to be the short-fall…unfortunately it is not being done right now… I don't want to bad mouth them, *laughs*… I don't want to put it in a negative way…because I think they work pretty hard, I do communicate with the head of obstetrics and the head of neonatology constantly on about systems and they are very accommodating, it just like I said….the one biggest problem that we have, is what we call ICD 10 codes…I'm not sure if you've heard about it? (Interviewer: ICT what?)….. ICD 10 code… so that is a code that the doctor has to identify...if you come and see the doctor, they have to say this is the code…at the moment, we now had to develop forms and stuffs for them to write on the paper so that the clerk can capture it where essentially they wouldn't need to capture that sort of information because CLINICOM does allow for clinical staff to put in, information…the CLINICOM system, is meant…where there is one folder number for every patient that is seen at the hospitals, so if I come to H1 I have a folder number and that same folder number, I can use it at Groote Schuur and use at Somerset, I can use all over, ok, so…when a doctor views that patient's notes, they should be able to see this patient has been at that hospital... and that hospital…and that hospital and this is whatever information is on the system relating to that patient but it's not being used at the moment…*laughs*…it's not which is just sad at the moment yeah…. All I can do is encourage, motivate and

speak about it…… maybe somewhere they would take a lick on the water…but I mean I work with a fantastic team of people, just because they won't work on the system doesn't necessarily mean they are bad…It's just that they do see the patient as the most important person in the working environment….and if they can avoid this and rather spend their time there, then that is what they'd do and I respect that…so I help out however I can….ok

Interviewer: Thank you very much…..

FDT- H1-R32: No problems….All the very best man…good luck with your thesis that you are going to be doing and who else and where else do you have to go?

Interviewer: Errrm…. X2

FDT- H1-R33: So…X2 is where we normally go do our meetings…our information officers meetings so they also inform of us the changes on the systems and that we have to bring back and yeah…so the main system controllers are at CLINICOMS…so they would obviously tell you a little bit more about CLINICOM, and the NHLS and the JACs….they don't work on the SINJANI maybe as much…. I don't know where in X2, it depends on…..who is it in X2you are seeing?

Interviewer: Ogundaini Oluwamayowa

Interviewee: JM

Institution: TH

Venue: Information Management Unit

Date: 4th March, 2015

Interview

Interviewer

Good Morning, my names are Ogundaini Oluwamayowa, I'm a student at Cape Peninsula University of Technology. I'm carrying out my masters in the adoption and use of electronic information systems to support clinical care in public hospitals in the Western Cape. So the purpose of the study is to understand the causes of limitations and challenges to the adoption and use of electronic information systems. So I would like to know your name and your Job title?

JM-TH-R1: Can you just pause it…. I just want to… ok, my name is JM. I am the assistant director for information management at H2 hospital.

Question

I would like to know what electronic systems exist in the hospital.

JM-TH-R2: Well, there is SINJANI which is basically used for clinical data, there is PACS which is used for radiography, there's also CLINICOM for clinical data, patient administration data revenue for patient account and there's the JAC which is used for pharmacy data…yeah…that is more for clinical and then for finance, there is BAS and SYSPRO which is more for procurement and billing purposes and payments

Question

BAS and what did you call it?

JM-TH-R3: BAS and SYSPRO… SYSPRO is for procurement, BAS is where we actually do the payments

Question

Before these systems were introduced, what was been used in the hospital?

JM-TH-R4: Basically before that…. Data was manually collected. So yeah, everything was captured or recorded in manual form

Question

What led to the adoption of the system in the hospital?

JM-TH-R5: Well basically, the manual system takes long so it's more for….more efficient and effective way of capturing data and at the end of the day, if you have one…electronic system is faster, it's more efficient, it's more correct for all the purposes and…correctness…and data quality, all those stuff.

Question

To what extent are the systems being used in the hospital?

JM-TH-R6: I would say it's for the full extent, every service point is involved, from admissions where the patient comes in to every service point where the patient goes…for instance, say the ward, when the patient goes out...for argument sake…we have to…talking about a specific CLINICOM where the patient is discharged and also the patient's…the patient's account are generated with revenue office…department, so all the systems are there. So where it starts from…admission or OPD, it goes right through from the...to the different service points until the patient exits the hospital or the OPD section.

Question

Which of these systems is mostly used by clinical staff in the hospital?

JM-TH-R7: Mostly, Errm…is CLINICOM, CLINICOM are mostly used for clinical data…in from the admissions, in the wards, and JACs where the patient gets his medicine...is also another electronic system…so the main system is CLINICOM…are being used in different service points for clinical data specifically

Question

How often…from your records, how often do clinical staffs use these systems?

JM-TH-R8: Well on everyday….every day, because people are admitted every day, people comes through admission; everyday people get discharged on the system. Everyday people get admitted in the wards, so it's an on-going...it's a live system…you know 24 hours….. if you want, say your patient is transferred out and the patients are being discharged from this hospital, and needs to go to another hospital then they cannot admit the patient in the hospital, they first have to discharge the patient here because it would reflect on the other system at the other hospital, the same system would reflect patient account……so a patient first needs to be discharged here before the patient can get admitted into another hospital

Question

What has been the feedback from clinical staff on the use of the system?

JM-TH-R9: Well, there's a monthly meeting, few meetings telling clinical data of what is happening within the wards or the facility, the service points, so they can see how the figures…Errm… what is going up…what is going

down, for monitoring and … purposes. So they give feedback as to say…Err…what merits need to be taking place…so yes, on a monthly basis at the meetings, there is some feedback of measures that needs to be put in place to ensure that data quality are being done, see if they are having the correct, for instance, where raw ICD 10 codes are being kept…so they go back and see where we can improve the quality of the data. But also what…. it's not as clinical data but also the FBU system whereby expenditures, procurements say for every wards, operations in theatre, or wherever people are using equipment or procuring some goods and services but in a specific way then we need to report it so that call centre, that manager of ….or that clinical head wants to see what is going on in is department and what is being used…we are going to give feedbacks, say for instance, in theatre… screws, bow basins or whatever is being used excessively then can be investigated because of the feedbacks…because of the meetings and we show them what is being done in that department…so then they can go back and check what is being procured, what is being spent, what is the department in the facility…so there would be feedback or say investigate…and that helps them to…with the budgeting or with the monitoring in the direction of their own department in the facility.

Question

Can you give me instances of clinical staff feedback on the use of the systems…their experiences with using the systems?

JM-TH-R10: Errm…Like challenges or…. Ok, in the beginning when people were trained, the much older, they aren't familiar with technology or there is resistance, they are a bit scared of being trained on technology, the computers, for them it's a challenges…some of them don't want to be...but the new generation is more opened to technology and more willing to learn and want to do…so I think if, especially the nursing staff, if they could be trained at we have our city, or college or they can be introduced there with computers it would be much better knowing that they are into the systems and won't be scared of electronic systems

Question

From these challenges, what has been done by the hospital to checkmate the challenges?

JM-TH-R11: What we do is give training, assistance, or mentorship in-side training….that is what we can do on the system…explain to them, what is required, and what needs to be done, so there's a mentorship and inside training that goes on regularly

Question

How has these regular training been effective on the part of clinical staff? Has it being effective?

JM-TH-R12: Errm…. Yes most definitely, it has been effective, efficient…*coughs* because they can easily locate a patient's history and where his current folder is… so you have a history on the side…on the system and I can see where the patient was previously and so yes it makes it easy for all the purposes…it also makes it easy for reference and easy access and very efficient and very effective patient details…and also, the system is user friendly, it's not that difficult to understand that is another advantage

Question

What measures were put in place to make sure there was a smooth transition from paper based system…from the manual process to electronic processes?

JM-TH-R13: First of all, staffs were trained; until they understand…they were trained in a specific profile… what they were going to do…after that, with the systems going live, the project team, they were on site for a specific time to assist when the system was going live and then after hours, there were also support until the system was now fully effective there was always support from the project team as well as the trainers…the core trainers…the people who train in the facility. So they were stand-by, they were on site in the beginning of the system transition, they would always support day and night in the hospital facility, there were always some people with assistance

Question

How would you say the work processes are now when there have been measures put in place for smooth transition to electronic as opposed to when it was manual? What would you say about the work processes?

JM-TH-R14: In terms of the work processes, it's much faster electronically…it's much faster, easier access, it's much faster and it cuts out a lot of unnecessary processes that were in the way but when you go in the electronic system, it makes it faster and you don't have to go and look for someone because everything is on the system.

Question

You mentioned monthly feedback from the clinical staff, did this include physical challenges?

JM-TH-R15: Technical challenges…..at the moment they isn't really technical issues, Errm, it's just when systems need to be upgraded or something, then they know there would be off-time or in case of where it really happens with load shedding or what happens sometimes we have whereby a system have a downtime….so you put all those records in a file, so when the systems go off at some point, then you would capture all those data when the system was off at a specific service point, if for instance that service point wasn't ON because of the load shedding, but in most cases there are generators…so the systems would always be ON.

Question

As regards to clinical staff, what challenges accompanied the adoption of the systems for clinical staff in the hospital... Was there a buy-in from the clinical staff at the introduction of the systems?

JM-TH-R16: No….actually there were no resistance, because they were explained the purpose of the systems…to have a kind of universal patient system whereby you have one patient number wherever you go in the Western Cape you will have one patient number for each patients…and it doesn't matter which hospital you go, the same history will be picked up…so that universal system…it doesn't matter where you go in the Western Cape, the patient would have the same number… Yes.

Question

So how did this help clinical staff with the use of the systems?

JM-TH-R17: Because the history of the patient is on the system, and the patients' particulars are on the system…so his ID number, his cellphone number, his address, all those stuffs would be on the system……..and also for doctors to see what is the patient history when the patients come in, what was done previously on the system…on the patient

Question

Are there any policies guiding the use of systems?

JM-TH-R18: Well, there's what we call a BPR…there's a business process where it guides you to say what is the process…….to make flowing of the data, also …strict confidentiality to say passwords are confidential, patient information is confidential, to tell users before they can have any access on the system, they would have to sign documents to say that they would keep the information confidential but there is some document that guides you to say on what must and what mustn't be done

Question

How do these policies affect the use of the systems?

JM-TH-R19: It basically ensures…the patient confidentiality and make sure that they don't give out there passwords or allow someone else to work on their…because there's disciplinary action would be followed if they do not adhere to those policies and procedures as required from them

Question

So how do you manage data quality….how do you ensure data quality and security issues on the system?

JM-TH-R20: Ok…what happens is you would have... you would get training and after training, you would get some manual documents to help you check, for instance, to see if patients, say for example patients were at the OPD, people attended for a specific day, they had an appointment, to see if the person, did he attend or did he not attend and you have to make sure when you go through that list at the end of the day, which patient attend, which didn't…so if the patient did not then you would complete this and say a patient didn't attend or if the patient is an in-patient, the patient has been discharged…you check with the system, you check with the register in the ward to say whether this patient has been discharged but in the system the patient hasn't been discharged….but in real the patient has been discharged out of the ward…so you rectify and do rain-checks to see what is going on…but if what is going on in the register looks alright…does it speak to what us going on with the system? So yeah…..

Question

How do you deal with security issues on the system?

JM-TH-R21: Security issues on the system….Errm, basically there's this one way of checking to see when… if people are still employed and how many days before the person's password expires…so if for instance the person didn't work on the system for 3 months then you would have like a print out to say is the person still employed or is this person still working, and then at the end of the day, these names are taken off….if in 3 months or 90 days the person's password expires, then they would have to change his password…that is one security……

Question

You mentioned that before the use of the systems, things were be done manually, you mentioned about delta 9….is delta 9 still in use now?

JM-TH-R22: It's not in use. In most facilities it's not in use but I think there are still facilities probably between 10, 13 facilities must still go live onto CLINICOM but I think...but not here, but other facilities may still be using it. The project team maybe still busy….

Question

Why did you stop using Delta 9?

JM-TH-R23: The problem with Delta 9 was…Delta 9… if you would go into Delta 9…. I don't think Delta 9 was user friendly. Delta 9 wasn't ….it was more kind of facility based…so I couldn't…if you had a patient here, then it wouldn't be a universal…although it's the same system but…the patient's data or his history stayed within the facility. So even in another hospital, if you have the same Delta 9, it wouldn't be interlinked you see, so you wouldn't have the data...and the thing is… yeah it was...Delta 9 was mostly used for admission and account purposes so you wouldn't know what really goes on in the ward... you would only know what is going on by reading a report gotten from the admissions to say what is going on in the hospital but you don't…there was some flaws…you don't know really sometimes, if a patient has been discharged or he is still in the ward or…you don't know where this patient is, so there was some flaws in the system and that's we decided to have new system….there the patient goes in from the beginning in admissions until the patient is being discharged. So you

can... the flow of the patient was easily seen and monitored and accessed. So you can have a good idea of how and where the patient went…and basically how the patient is being discharged, the whole map of the patient, the flow of the patient, can basically easily be updated with CLINICOM the new system. But with the old system, it was more facility based, more kind of an admission system

Question

So, are the systems used in H2 integrated?

JM-TH-R24: Integrated….Yes. It is integrated into one system which they called FBU. So lots of the systems, they are integrated into one system, FBU. So you can…from the FBU system, you can draw some reports to see what is going on within the facility, clinical data, financial data…you have procurement data…and yes, what is going with each call center, It's more basically telling down to the service points whereas in the past you would only get one figure of…say for instance, the hospital, they have goods and services, where they say which amount were used but now, with FBU its specifically which call center, which department, which call center were used to buy or procure a specific project …say for instance within theatre, it would tell you which call center uses a specific item, so it would tell you your expenditures right down to the lowest level of who completed some documents for procuring a specific item.

Question

What does the FBU mean?

JM-TH-R25: It means functional business unit. It means basically all the systems, feeds into one system and that…it shows you the clinical data, it shows you the financial data, pharmacy data…all of those are incorporated into one system, which goes down to…down to where were procured or where expenses occurred within a specific department

Question

What do you feel about the use of these electronic systems in the hospital?

JM-TH-R26: I think it is very good, efficient and effective, easily accessible and you can extract data from it, you know…and you can have presentations, you can make sense of data, make sense of what is going on within the facility you can present it, you can…it easily …you don't have to wait a long time, it's easily accessible, it's yeah…effective and efficient…Yeah

Question

How will you rate the use of these systems by clinical staff…how will you say the clinical staff are using the systems?

JM-TH-R27: Maybe I don't understand the question so well…..talking about the CLINICOM or the FBU system? I think you are referring to the CLINICOM system, I would say they found it…..they don't have any problems with it…Errm, they passed the challenge phase… so it's more familiar with them, they use it every day, they are quite familiar with it, so they do what is expected of them so they have no problems. Because the more you work on the system the more you get familiar with it….yeah

Interviewer: Thank you very much for your time, thank you for giving me time and agreeing for me to make a record on this. I hope I can contact you again if I need your assistance.

JM-TH-R28: Is that the final one…..Yeah...its fine, no problem…ok bye.

Interviewer: Ogundaini Oluwamayowa

Interviewee: GP

Institution: TH

Approach: Phone Conversation

Date: 5th March, 2015

Interview

Interviewer: Hello… Sorry that was the network…….

GP-TH-R1: Hi

Interviewer: OK... Fine thank you…. Can we start now?

GP-TH-R2: Yes it's fine

Interviewer: Just for the record, I would like to … Errm… I would want you to introduce yourself so that I would have like an official statement as the start of this conversation

GP-TH-R3: Well, I'm GP…. I'm a Radiation Oncologist at H2 and the University of Stellenbosch in government practice

Interviewer: Ok…Errm I would like….. Hello……

GP-TH-R4: Are you on a cellphone?

Interviewer: Yeah…. I am on my Cellphone

GP-TH-R5: I've got a landline obviously; don't you have a landline you could phone me on?

Interviewer: Errm….No

GP-TH-R6: Ok, but I can hear you a bit better... Ok, carry on

Question: I would like you to tell me what you do and for how long you've been doing it?

GP-TH-R7: Errm…about my job?

Interviewer: Yeah… your job… yeah

GP-TH-R8: I have been working in Oncology since 1993…. Errm…and I'm a specialist since 1998

Question: Can you tell me how the hospital has helped you to improve your daily work duties?

GP-TH-R9: Are you talking just about the IT now?

Interviewer: …..Errm…in all areas including IT yeah.

GP-TH-R10: Errm….well I mean speaking of IT….I will give it to IT for the access to the patient records, for the access to lab results, accesses….. Errm…but it is also used for booking…booking a patient and arranging transport for them and I guess in things like ordering of stock and record keeping and stock taking and so on and access management but I'm not involved with that.

Question: So which systems exist in the hospital for clinical staff?

GP-TH-R11: Well Errm… our laboratory results and our X-ray viewing is web based so it's just used on internet explorer.

Question: what is the name of these systems called?

GP-TH-R12: It is called DISA Lab and PACS… yes. And similarly the record keeping was called the ECM, is also just web based. Errm the booking system might well be web based as well but I'm not involved with the actual program.

Question: Ok… before these systems were introduced, what was being used in the hospital?

GP-TH-R13: Errm… ok well, the booking system was electronic for years…. So but I guess you know…it must have been just a paper based, with books….. Errm….the patients' notes were kept manually, so there were hospital files in an archive which are then transported when a patient arrives at a certain place to be viewed by the doctor treating the patient…then he adds the note to those files and then they were taken back again. Err… so…yeah so that took time but it worked alright….and of course it took a lot of space… Errm then after certain time, a new system came into action microwave... not microwave…. Microfont… and then it's stored and had to be viewed in a special viewer but Errm… you know that… that stopped years ago. All of those documents were scanned and kept in an electronic-record keeping which is available on…when you log in to the computer. So the physical pieces of paper in the folders which had to be managed and transported around rather than accessing them on a computer screen. The X-rays also were physical X-rays… I mean…you liked at the X-ray on a white screen under a lamp and that also took a lot of space because of the processing to see them…and there was not much you could do with the image, you could just look at the image in front of you, you couldn't process it in anyway… so I'd say the X-ray viewing is definitely better. There's more you can do with…it's much quicker, the films don't get lost or get damaged and so on. Errm…as far as the record keeping goes; it is difficult to know if we really have improved the system or we just replace one system comes with another because there's still an awful lot to go through that's irrelevant before you find what you're looking for… And the main problem with the record keeping is that there's no note facility to make any notes yourself… you still have to write your own notes and that's a big defect…because you know, It's pointless reading if you can't write. So I still have to write

notes…clinical notes on paper which then gets scanned as part of the electronic records…that's unfortunate, I should be able to write directly onto the system.

Question

Would you say the systems are performing what they are meant for?

GP-TH-R14: The X-ray system definitely and the Laboratory system definitely…the clinical notes, not so well….not so well… It probably with excess space, it's probably easier to manage, but in terms of getting what you want, the clinical notes, it's not that much better than paper.

Question

How has this helped….how has this affected your work processes?

GP-TH-R15: Errm… It probably is more compact and quicker… to process…yeah. More compact and quicker to process but Errm…does not give me that much information and does not make the information easier to process than physical pieces of paper. And it also restricts where I work to where I can get access to a computer screen whereas if I could carry a file around, where I could see… I could work anywhere.

Question

You complained about or you mentioned not…some little challenges with the use of the system, Was there a pilot study before the system were rolled out?

GP-TH-R16: Errm… Yes there was. It was done in out department about 5 or 6 years ago. They started just working with our patients, until the whole patient in the hospital…and yeah then it started going… but I think they had already decided that they were going to implement, it was just a case of doing a pilot study knowing it was going to be implemented rather than whether it was going to be implemented.

Question

Did you take part in the pilot study?

GP-TH-R17: Errm…hardly…because I was working at the department at that time, I wasn't really part of the process. But I did serve on a committee for a … a little bit later that worked with the team in the general implementation of the whole system for about 6 to 9 months….that's in reference to the clinical notes, not the X-rays, not the lab results …those are working pretty well.

Question

If I may ask, what else is being used in conjunction with these systems and why?

GP-TH-R18: Ok we have a … our department still has its own folders which are processed and scanned later. Ok…and I think that probably is with other departments as well, society, social work, cardiology, they all have their own individual folders before they become part of the hospital folders….general hospital folders. Errm…it's impractical to see a patient at the beginning without any paper work at all. So while the patient is being treated, we need subsection of paper folders that we can refer to…we can't just call it up, the hospital folders are too big, we need the smaller subsets……..

Question

So how was the transition from paper to electronic systems for clinical staff in the hospital?

GP-TH-R19: It was quite problematic. Errm…because it would be easier if the whole thing was completely electronic, then it would make accessing documents easier. But because it is basically pieces of paper that have been scanned in their thousands or their tens of thousands onto electronic media, it's a bit clumsy and searching for a specific thing is not that good. If it were to be X-rays where the whole thing is electronic where there's no paper work at all, that works smoothly…but I don't know if that could have been avoided…they certainly couldn't have packed out all the…*yawns*….*coughs*…hundreds of thousands of pieces of paper that are scanned. It just had to be scanned as pieces of paper and that then means accessing them as well makes it difficult as I said to you earlier, you can't write anything directly onto the system, you have to write on a piece of paper and then the piece of paper is scanned and that to me is a big defect, you should be able to write directly onto the system

Question

As compared to the paper based systems, what have your experiences been, using the electronic systems available in the department?

GP-TH-R20: Well, it's good… I have got…in my office…I can even access it on my laptop, so the access is very good

Question

What features are mostly used on the systems... what system do you use mostly in the hospital for your work?

GP-TH-R21: Well I told you, the PACS for X-rays, and the ECM for electronic something… for access to patient records

Question

What features are mostly used on the systems?

GP-TH-R22: it's just purely viewing. To find any bit of information and look at it or look at a report or look at some notes somebody else made. You can't do anything else other than to view stuff on it

Question

So would you say the systems are user friendly?

GP-TH-R23: The X-rays are, and the laboratory is, but the clinical note is not that user friendly. I think it's just because it's too big.

Question

Because u said….it's just because?

GP-TH-R24:

It's too big. And because it wasn't electronic to start with, that's crucial. The X-ray system and the Laboratory system is electronic right from the beginning but the clinical notes were paper at the beginning and gets scanned, so they don't have the good features of an electronic system. They are too clumsy.

Question

Ok…there's a popular belief that the younger generation are more tech savvy than the older generation, how does this apply in your hospital?

GP-TH-R25: Well…I am tending towards the older generation but yes, I think that's true. The younger generation might be more adaptable which makes them more tech savvy. How does it apply in my office, not really…i mean…we… you know, it just means perhaps, the older generation would just ask the younger generation from time to time if there's a problem they can solve

Question

Are there any challenges with using the systems?

GP-TH-R26: Well there are two challenges; one is that it's not mobile, so it would be nicer if I was working around with a small tablet, because I could just use… just take it out of my pocket and use it like a notebook but instead I have to be at the desktop computer to use it. So one, it is not mobile and the other one, you can't enter data directly... you have to first write on a piece of paper, which then goes to be scanned to enter onto the system, whereas you should be able to enter data directly

Question

Are there any other technical difficulties with the use of the system?

GP-TH-R27: Nah, Errm just the normal stuff that happens with any network, sometimes it crashes, sometimes the connection need… sometimes they need rebooting, that's just not the hospital system, that's any system.

Question

How have these challenges affected your work processes?

GP-TH-R28: Not much…not much. As I said, the only challenge I have is that it's not mobile; I would like something in my pocket so that I can take it out like a notebook and use. So there are two challenges, it's not mobile and you can't enter data into it directly. I mean, I have told you that now a couple of times…that's probably the two challenges I've had.

Question

Have there any measure been taken to face out these challenges...probably during a monthly meeting there have been a complaint that systems should be more electronic…and what has been done?

GP-TH-R29: During the pilot scheme, we gave a feedback regularly and then a short training course and as far as the clinical notes, although it's not as good as the other two, it has improved and easier to work with now but it would never be particularly easy to work with.

Question

Are there any forms of staff trainings offered on the use of the systems?

GP-TH-R30: ……..when we first implemented….they do attend to problems quite quickly if you call or e-mail them…… they do attend to that very quickly.

Question

Did you say there was no form of staff training?

GP-TH-R31: Yes there was at the beginning, interactive courses and demonstrations and so on but not anymore.

Question

Would you say the trainings were effective on the use of the systems?

GP-TH-R32: Yes I think it was effective, I don't think we would have managed without it. I don't think the training was a problem; there were some element of the system that was problematic. And the main problem with that is because it's just scanning pieces of paper rather than entering data into it.

Question

If I may ask, are there any policies that influence the use of these systems by clinical staff in the hospital?

GP-TH-R33: Policies? No…I don't think so…they just use as they need it. Only if they've got an objection to something that shouldn't be done

Question

What would you like to influence the use of electronic systems to improve work processes in the hospital?

GP-TH-R34: Well, just go back to what I said. Improve mobility so I could have something in my pocket. So if the hospital gave each of us a small tablet, with the systems running on it, that would be nice and also the ability to add information myself, to type in clinical notes onto the system rather than have to go afresh to get a file and write notes and that in for scanning ……

Question

If I may ask, how has the introduction of these electronic systems affect clinician-patient relationships?

GP-TH-R35: I don't think it did. Errm… Perhaps in seeing patient faster because they didn't have to wait for the patient's file to arrive you know…you still write notes as you see the patient, but perhaps, it makes the processing of things a little bit faster, otherwise it hasn't really affected it.

Question

Lastly if I may ask you mentioned that papers are still being scanned, how has this affect or how has this affected the data quality of patient information?

GP-TH-R36: Errm… I think that would be determined by the processing alright. If folders were processed well, it shouldn't have any effect, the two should be just as good. But folders are more easily lost than electronic information. And more so, paper get damaged, forged and put in the wrong folders. So I would say the electronic information is easier to….is least likely to make mistakes than a paper system. But if paper system is run well, the two should be equal.

Question

So Errm, have you had instance where you found out that a folder of a patient was damaged?

GP-TH-R37: Yes… No…. our folders do get damaged and they get lost

Question

In that situation what does….what do you do?

GP-TH-R38: Then the electronic system is better because it's a very good back-up. So I can go and print out the document that has been scanned in…so the electronic system is very good when the folders get lost.

Interviewer: Thank you very much for your time doc., you've being very helpful

GP-TH-R39: If you need clarification on anything, just call me eh.

Interviewer: Ok. I'd do that

GP-TH-R40: ….or e-mail me I'd answer and put it in writing and send it back to you.

Interviewer: Ok. I'd do that….. Thank you very much……. bye

GP-TH-R41: Ok… see you bye!

Interviewer: Ogundaini Oluwamayowa

Interviewee: SR

Institution: TH

Venue: Nursing Department

Date: 19th March, 2015

Interview

Interviewer

Good Afternoon, my name is Mayowa Ogundaini, I'm a Masters research student at the Cape Peninsula University of Technology. The title of my research is the adoption and use of electronic information systems by clinicians in the public hospitals. The purpose is to understand the causes to the limitations in the adoption and use by clinicians in the public hospitals. Could you tell me your name and your post in the hospital?

SR-TH-R1: My name is SR. I'm a deputy nursing manager in…at H2 hospital.

Question

For how long have you been the deputy manager?

SR-TH-R2: For the past 4 years now.

Question

And in terms of experience, how many years of experience do you have in the nursing field?

SR-TH-R3: In the nursing field, I've got 29 years of experience in the nursing field.

Question

If I may ask, how has the hospital helped to improve your daily work activities in the hospital?

SR-TH-R4: How does the hospital help? ... I don't understand the question… within the hospital? Errm, well… Errm, the hospital assists me with tools to do my work better…part of being a nurse manager is obviously is to do

ward rounds or whatever. So there's a lot of walking involved but to eliminate that walking, we have introduced some electronic systems like computers and so forth, so it's simple when you need to send out a message to any of the people working in different areas and it saves you from walking around.

Question

If I may ask, which electronic systems exist in the hospital?

SR-TH-R5: We've got the desktop computers that we've had….we've been supplied about 2 years ago…Senior Nursing Managers have been supplied with notebooks and the purpose of that is mostly for minute taking in certain meetings and we also download some of the e-Mails on the notebook… so you can work at home to assist you with that.

Question

While going around, there were some of….the name of the electronic systems that came up were like CLINICOM, Nursing Information Management System…..which electronic systems do you use in the nursing department?

SR-TH-R6: I use…the CLINICOM program…is actually a program on the computer. The CLINICOM program we normally use to procure and to approve certain disposables or equipment that have been ordered by nurses…nursing staff at the unit level, Errm CLINICOM system also helps you to locate, when you're busy with serious incidents in the work place and you need to locate certain patient information, you also get that from the CLINICOM system ok. The Nursing Information Management System is a systems that is actually very broadly being used by the nursing staff because….everything about the nurse you will get on that system, you'd get names, you'd get surnames, you'd get age, you'd get qualifications, you'd get placements, where the nurses are placed, you'd get if they are paid up with the council body on the CLINICOM systems….i mean on the Nursing information System, you'd get if you require Nursing agencies, over time records of nurses you'd get, that is all the stuff that you can do, there's much more…you'd get activities, they call it err… daily living activities (DLA) and that is all the activities that can be recorded at ward level from nursing side that you can see on the system because it can tell you who is on duty, how many people on duty, who is on leave, who is not on leave, we can also use that system to verify how people took how many leave in a certain cycle

Question

Which other electronic systems asides those two is used in the nursing department?

SR-TH-R7: There's a lot of other systems that we use in the nursing…. We use e-mail is the most common that we use, there is the provincial government western cape intranet that we use that is for internal communication from the head office side and so on, then we have got a radiology system, and on that radiology system, because we went totally paperless with our X-Rays so we can access that, we have what they call the laboratory system, so you can access laboratory results from that system, Microsoft outlook is now the e-mail system that we've got on the system, the health application system is like….this is the…it's actually the CLINICOM system, where you can procure, get patient access and get information on that, we've got the SINJANI system. The SINJANI system is a system where you record and monitor and evaluate, adverse incident reports that takes place at this institution….what is there still else? We've got the meal ordering system in other words, on wards level, as soon as the patient gets admitted, the systems order automatically a meal for the patient, so what the system at ward level needs to do is just to ensure that the correct type of diet is… I mean to the patient. That is about it…I told you about the DISA Lab, which is the laboratory system that is about….then there's the other normal computer systems that we have…we've got excel, we've got word, we've got err… what do you call this err….that thing where you make the presentations…PowerPoint, that comes normally with the system. Those other systems I called are the extras over above the word and the whatever…. Excel.

Question

Which of these systems that you've mentioned do you use for clinical care?

SR-TH-R8: For clinical care, we use the nursing information management system; we use CLINICOM, for those kind of things. The meal ordering system, you can also put it in as a system for clinical care because you see after the needs of the patient, the radiology system you use because you access X-rays from that, the health applications or the DISA Lab system you use to get access to laboratory results and then the CLINICOM system is got everything about the patient on it.

Question

If I may ask, before these systems were introduced to the hospital, what was being used?

SR-TH-R9: Everything was manual and paper.

Question

And why was there a shift from paper/manual to electronic systems?

SR-TH-R10: Well, we were actually… it is the green initiative, going from paper use to paperless. It's much quicker access to certain information, it's a much better system to capture certain information, patient information, staff information; you don't need lots and lots of files like we used to do in previous years. Its quick access to

auditing, so if auditors come, you can with the press of a button show them whatever that you have used within the hospital

Question

Can you tell me since when each of these electronic systems have been in use?

SR-TH-R11: The computer usage for nurses started about 10-12 years ago, and we have introduced different systems at different stages from then. It wasn't called the CLINICOM system at the time, but it was a patient information system that we could get access to which we initially started with. And about 2-3 years later, we came up with a meal ordering system, it wasn't called the meal ordering system as it is now, but it was a system where you automatically could order meals, then later on nurses designed their own nursing information system which is now in progress for the past 7-9 years and it's still being fine-tuned, extra stuff are still being put in, we've got the program connected to err…you know that we've got director of nursing, so to the head office, that nursing information system is coupled to the head office. So whatever head office wants to see the activities…..what is going on at a certain hospital with the click of a button they can do that. They are also busy with roll out of the system to other hospitals because it's not completely rolled-out at smaller hospitals and institutions. And smaller hospitals and institutions may use different programs but it all boils down to the same system or the same storage of certain information

Question

If I may ask, was there a roll-out; was there a pilot study before the systems were rolled out?

SR-TH-R12: Yes, the nursing information management system was piloted at here…at H2, we were the first hospital to pilot the study because we had the program…we had a lot of input from our side and it worked for us and it rolled out from here to bigger hospitals and from there to smaller hospitals. So from head office side, they're still busy training people at smaller hospitals to use these systems

Question

Have the systems been performing what they are meant to do?

SR-TH-R13: Yes, the systems are performing what they are meant to do. But like I'm telling you, if there's any shortcoming or if there's anything we want to add, we normally inform our head office or at meetings we would say for instance, this is taking very long or that is taking very long because we are still using manual systems, and it's like a system – the nursing information management systems, it's like a system they are continually working on and continuously repairing and changing to suit the nurse manager or nurses at ground level

Question

What else do you use in conjunction with these systems?

SR-TH-R14: There's nothing specific that we use in conjunction with the systems. What we normally do, and that is perhaps where we say we don't go completely paperless is that when you load something on for your own safety and to have a backup, we print the information and keep it, just to have a backup especially with this load shedding that we've got now.

Question

And how has the load shedding affected the use of the systems?

SR-TH-R15: of course when its load shedding, it's completely down and whatever, but we didn't have any loss of information. And sometimes you would see after load shedding that the computer is a little bit slower you know to open or whatever but then again, most of the computers are older than 3 years and our lifespan within the hospital is…we refresh our computers every third year. So there's not always finances – it's a big problem within the government, so there'snt always money to refresh exactly on the third year so you can't get it a times and get a very old computer but it gets refreshed in time

Question

Ok…how does this refreshing work?

SR-TH-R16: There is a budget that is allocated for refreshing of computers or soft wares or those kind of things and we redistribute the computers in the ranges of the oldest get refreshed first before the later models you see…that is why I say sometimes you might get a rather old computer but we use it till and we wait till we get…there's motivations that you write to say that your computer is now a certain amount years old, you are in need of a new computer, a printer or a keyboard or whatever

Question

How has the transition from paper/manual to electronic being in the nursing department?

SR-TH-R17: Nursing is a very practical profession. So to go from writing to putting things on a computer and computer literacy is not that high within the nursing department. So for the older nurses, it's a problem. For the younger generation, they are being trained at university, at nursing schools; they are up-to-date with IT and IT equipment. These young students coming from school have got IT training at school whereas you older nurse is used to the pen and paper. So it's something new to them but we have got training programs in place to train nursing staff, all staff working at the hospital in…with regards to computers, with regards to certain programs on the computers and that is now your word, your excel those kind of programs that is on there and then specific things like the nursing information system, we've got programs in place that we train each and every new appointee, with regards to that and the older people as well, so that everybody is on par and become acquainted

with those systems. Then we've also got this peer-teaching. That you…I have got knowledge of computers, and you teach me or I teach you on certain thing or how to get access to certain things within the computer

Question

So how have these electronic system been impacting on daily work activities in terms of clinical decision making and adherence to clinical guidelines?

SR-TH-R18: Normally, if I take just one system, the X-ray radiology system, normally you take the patient to the X-ray department that was now in the older days before computers… the patient gets to X-ray, the patient comes back from X-ray, the X-ray gets developed and that takes its own time…they wait for a quarter to come to a certain ward to come and deliver the X-rays, now you must contact the specific doctor to look at the X-rays and the doctor is by this time now in theatre, what happens now is wherever the doctor is, as soon as the X-ray has been taken, with the click of a button he opens the radiology program, and he immediately sees the results of the X-rays, so with a telephone call he just gives the sisters in the ward a call to say do this and do the other thing. So you can see the quick turn-around with help of that…just that system.

Question

How about the impact of other systems like the CLINICOM, the SINJANI?

SR-TH-R19: The SINJANI is more a capturing system. We still do the manual you know reporting…investigation if there was an incident…a negative incident but just to capture that we used to have thousands of files full of medical incidents because in a hospital, you get follow-ups after 10 years, after 20 years, legal follow-ups with regards to an incident that happened in the hospital; so what we've done now with a click of a button, you can open ten years ago negative incident and it would be right there at your dispense. The Laboratory system also is the same …normally used to wait for laboratory results, it gets now processed and you see it…the doctor can work wherever he is and see immediately the blood results coming from the laboratory rather than to wait for results coming on a paper to certain ward or unit for that. Nursing information system like I told you, it has increased the speeding up of payments because you have immediate access to the nurse attendance for a month, so you just forward it and it is proof that the nurse has worked for a month and there's no problem otherwise you would have done it manually. The other thing with the nursing information management system, I can draw report to see what is my…..is there a decrease or increase in the usage of agency staff, and I can question why, is there shortage of staff, was there a lot of staff absent, was there a lot of staff on leave, so I can monitor that in a specific department.

Question

You mentioned issues between the older generation and the younger generation with the use of these systems, so how widely spread is the use of these systems in the hospital?

SR-TH-R20: It is widely spread, it is in each department, and you know there's certain…you talking about….we talking about IT now, there's ultra-modern system that we call the cellphone that we also you use if you setting up meeting and there's urgently something that you need, I sms or…how do they call this lot….to get quick access to a lot of people, I've got group sms and can quickly get a response on that…so that also helps. And the older generation are now upping their game, they've also got the latest editions of these phones now because they don't want to press anymore, they also want to just swipe across the screen and its some kind of an achievement now for the older people to be able to work on the computer and what I can tell you, the people that are more on the verge of retiring, the younger generation have shown them certain systems on the computer on how to budget, how to do your expenses, how to work your income and so on and they are very appreciative of that.

Question

That would lead me to my next question, like what features are mostly used on these…on SINJANI and the Nursing information management system and the radiology system? Like you mentioned in terms of how to do budget…..on how to use the systems

SR-TH-R21: Features like what? I cannot tell you specifically about features using. Because if you open for instance nursing information system, it gives you a whole range of what do you want to use. People… For instance when you open the system, do you want to do the daily attendance, or do you want to check how many agencies have you ordered, do you want to order nursing agencies, those things….ordering of nursing agencies and ordering of additional staff for that matter gets done on a daily basis, on a 4-hourly…5-hourly daily basis because nurses get sick, they phone in so you need to use that system to order people. The daily attendances are being done on a daily basis because you need to register that everybody is on duty or not on duty. The night manager captures all the staff on night duty, that is on duty and that is not on duty, it is also for financial purposes that they do that. The meal ordering system gets refreshed on a daily basis as patients get discharged, and new patients get admitted, that system gets in. Your DISA lab, your radiology, it depends on what investigations have been done and they use the system…but it gets used on a daily basis. So there isn't a specific system you use more than another system

Question

If I may ask, what are your own experiences with using the systems?

SR-TH-R22: I can tell you, because like I told you...when we opened, my job is more… is 50-50. 50% administrative and 50% clinical in the sense that I need to go and do ward rounds, go and see how quality things are going on ward level, so with these systems it shortens my life in the office and it gives me more freedom to go

and see what is happening in ward…on ward level. I also need to attend to a lot of meetings and with these systems, it gives me quicker access to do work and be able to attend the meeting at the same time.

Question

Are there any challenges being faced with the use of the systems?

SR-TH-R23: Like I told you, the challenges, there isn't challenges getting access to any of the programs, but the challenges might be the IT handicap at certain times, not…especially when there's new programs or when somebody comes and tell…show you quicker thing….quicker way to approach certain things like for instance, in my case I work with the hospital's staff establishment so each and every month, I get a pivot table from head office and it's a spreadsheet of all the staff working at the hospital and this institution; it's over 4000 people working here. So it needs a lot of filtering and whatever to get to the nursing staff and house-keeping staff specifically. Initially, it was a challenge for me to filter and shorten the report so that I can get exactly get to …just do the nurses, not do the other people working in the hospital but somebody have showed me how to filter and how to get it easily and it's going quite quick now but at other times it took me very long to work through the whole report ….now it takes me much quicker to work through it.

Question

Why did you have that challenge, why did it take you a while?

SR-TH-R24: I didn't used to do…I didn't used to work with the establishment previously. So when the establishment was given to me, I needed to work on that so I actually trained myself on that.

Question

So are there any technical difficulties with the use of the system?

SR-TH-R25: from my side….specifically, not at the moment. Not that I'm aware of.

Question

…And how about the nurses? Any technical difficulty feedback you got from the nurses?

SR-TH-R26: There is a lot of technical difficulties. You know that we've got a lot of people. People are appointed and people resign and people go. Especially with the newly appointees, not the brand new graduates coming from the university, they know how to work computers. But to get them to know the systems that we use in the hospital, it can be challenging but with the new appointees, it doesn't take that long, within a week they are settle, they know how to work the systems but people coming from other hospitals where they don't use computer at all or where they don't use the systems at all, it can be quite challenging but like I told you, we do give them training just short after appointments.

Question

How often does this training take place?

SR-TH-R27: Every month. Every month with all new appointees we do training and whenever the need arises for a person to be refreshed, we send them to certain training programs.

Question

What has been the feedback after training from nurses?

SR-TH-R28: you know, the only feedback that we only get is just to see that the person is working efficiently and effectively. But we don't get formal feedback from training institution or the person training, we just know that this person is got the certificate of competence within this and the person is now comfortable with any system, comfortable with the computer or so. But we don't get any formal feedback to say what is the result now because of the fact that this person was there at the training

Question

And have you seen improvements after the training?

SR-TH-R29: Definitely….Definitely

Question

If I may ask, if you get new nurses coming from other institutions and they are unaware of how to use systems in this hospital, how does that affect work processes?

SR-TH-R30: It doesn't affect nurses per say…. And we've got people working in….we do not have people coming from other institutions who do not have access to those kind of things alone in a unit. So there's always help but get their training within the first week of the month of being appointed here.

Question

How does basic computer literacy affect the use of the systems within the department?

SR-TH-R31: Basic computer literacy is actually quite important nowadays in the hospital because there's a lot of things… basic things that needs to be reported on a computer system. So basic computer literacy is quite important and we ensure that people get clued up or…goes for training as soon as they are available and they can go for training.

Question

Are there any policies that influence the use of these electronic systems in the hospital?

SR-TH-R32: No…there are no policies in the nursing department that they have influence on that. The policies that we have…we do have is with the IT department cell. But that only pertains to…you know these computer comes up… out with certain games and those kind of things that people…and that is the first thing, how the person actually gets computer literate by playing a game but we don't want nurses to play games. We've got a policy restricting them to play games on ward levels or wherever levels that they are but otherwise, there's just a privacy policy with regards to the computers and everybody gets an access code, if you are registered to go on to the computer and with that access code also comes privacy policy with regards to information.

Question

How does that security and privacy policy affect the use of the system?

SR-TH-R33: Errm.… It's actually difficult to tell you because I do not actually monitor that. It gets monitored at the central computer station, so the people that will be able to answer you would be those people to tell you how does it affect but… there is no system here in my office that I can monitor that

Question

If I may ask, how do you feel clinicians can embrace the use of electronic systems more for their daily activities?

SR-TH-R34: They can really embrace the electronic systems more because there are a lot of things that otherwise took quite some time. You know we are moving towards the modern era and we are a competition in the global sector…global world, we are a competition and if we look at what is happening abroad where people don't use papers anymore, all documentations are recorded on a computer, on a laptop or whatever is next to a patient obviously it is a bit risky in South Africa because you cannot leave a computer or a laptop or a notebook next to a patient in H2 hospital, if you get there it's gone after visiting hours. So that's just the risk but there is.…it is long, the time is long for making clinical notes and so on…it is best to work with a notebook, get to your patient, check everything you have written. We have introduced a new electronic filing system also, it's actually a system that speeds up the collecting of patient records so every patient that comes here gets a clean empty file, the doctor opens with a password and he prints in the patient's identification and he gets access to the patient's…all the patients previous clinical notes. So he makes sure that he scans it.…you are asking me now how can they embrace it? If they do have computers there, they can immediately print out what is the findings now and forward it to the records department without any paper hanging around. You talking about embracing.…we also have this when doctors…clinicians doing operations in the operation theatre that they constantly record what they specifically are doing and if they record and that are being done electronically within the theatre, it saves a lot of time. We are in the process of having, they call it a digital pen where you record all those clinical notes on a computer, we are in the process of going over to electronic triage system, currently we have a manual system where patients are booked for emergency operations so we are on the verge of going to the electronic triage systems with regards to these patients, it's almost like at the airport where they got these billboards where the patients name is and it falls down and it falls down until the patient falls off and the doctors come to re-register emergencies still urgent.…ok

Question

You're mentioning notebook, what do you mean by notebook?

SR-TH-R35: It's that small.…it's not a laptop.… It's smaller than a laptop

Question

Finally I want to ask…what.…how or before I ask, the final question, how can these electronic systems further improve nurses' work? Because we've spoke about clinicians/doctors, I want to know how the nurses can embrace the use of these electronic systems more…..

SR-TH-R36: Nurses would be freed up to give patient care, to be at the patient side and these long writing and whatever taking them so long would be shortened. Patients would have more access to the nurse if electronic systems are in place. If a nurse goes around from bed to bed and records everything she wants to write with a pen and a paper, and she just does it electronically, it would free her very quickly so she can be at the patient side to do the physical things that obviously the computer can't do at the moment.

Question

Ok…so that leads me to my last question, how has the introduction of these systems currently in the nursing department… how has it affected nurse-patient relationship?

SR-TH-37: There is more access to patients at the moment. But the nurses, there is certain things they must do on the computer but in the past it took a person…the sister-in-charge…it took the sister-in-charge half a day to do certain things within her office whereas now, in the morning after she does her round see who's on duty, who is not on duty, go into the office, it doesn't take her half an hour to finish with those things. Now she can concentrate on supervision and more clinical work within the ward area.

Interviewer

Thank you very much. You've been of great assistance, thank you for your time and allowing me to make a record of this, I am very grateful.

SR-TH-38: Thank you it's a pleasure

Interviewer: Ogundaini Oluwamayowa

Interviewee: SG

Institution: TH

Approach: Phone Conversation

Date: 2nd April, 2015

Interview

Interviewer

Good Afternoon, for reference to this discussion, my names are Mayowa Ogundaini. I'm a Masters Research student in the Information Technology Department at the Cape Peninsula University of Technology. The title of my research is the adoption and use of electronic health information systems to support clinical care in the public hospitals of the Western Cape. The purpose is to understand the causes to the limitations in the adoption and use by clinicians in the public hospitals. Could you tell me your name and your position at H2 hospital?

Question

I would like to know… how do you think you daily work/duties can be improved?

SG-TH-R1: More computers in every room, less computer (network) downtime, mobility (access on tablets) and the ability to enter clinical notes directly on the computer.

Question

How has the hospital helped to improve your daily work/duties?

SG-TH-R2: Making all of the patient information available electronically

Question

Which electronic systems exist in the hospital?

SG-TH-R3: In my daily practice, I have access to the following electronic systems: Clinicom (all patient information including billing info, address, appointments, record of hospital stay and discharge, future appointments, movements between hospitals etc.) ECM (all patient notes, scanned after completion and available on the www), DISA (all laboratory results, also available on the intranet and internet), PACS, RIS (access to all X Rays and other imaging tests intranet and internet), Science direct (access to all electronic medical journals) as well as Up-to-date (access to clinical information). There are more systems (Sinjani, Delta 9) in information technology, and I can access this information on request- e.g. budget breakdown on items procured, monthly statistics, bed occupancy rates etc).

Question

What was being used before the systems were introduced?

SG-TH-R4: Microfilms and telephones

Question

What are the names of the electronic systems frequently used to support work processes (clinical care in terms of decision making or adherence to clinical guidelines)?

SG-TH-R5: Up-to-Date, Science Direct

Question

What are the systems used for?

SG-TH-R6: Evidence based medicine

Question

Why was there a shift from microfilms and telephones to the use of these electronic systems?

SG-TH-R7: It was the logical choice- improved access to information

Question

When was this shift initiated?

SG-TH-R8: about 2009

Question

Was there a pilot study before the rollout of the systems?

SG-TH-R9: Yes

Question

Have the electronic systems been performing what they are meant for? With some feedbacks from users

SG-TH-R10: Yes; only when there is network downtime it becomes difficult to manage

Question

How have the systems assisted with your daily activities and processes? First of all, in terms of decision making? , then secondly, in terms of adherence to clinical guidelines?

SG-TH-R11: Improved patient flow, better access to information, shorter waiting times, no loss of information between institutions

Question

What else is being used in conjunction with these systems? And why?

SG-TH-R12: Paper based, patient-held records (as not all small clinics have access to the internet)

Question

How does this affect transition from paper to electronic systems for clinical staff?

SG-TH-R13: Very Good

Question

What are your experiences using electronic as compared to paper based systems?

SG-TH-R14: Positive Impact

Question

What are your experiences using electronic as compared to paper based systems?

SG-TH-R15: Much better, except for patient held records that are not captured whilst the patient is moving between clinics

Question

There's a popular belief that the younger generation are more tech savvy than the older generation, does this apply in your hospital? How widely used are these systems across the hospital?

SG-TH-R16: No. Any person that can use a cell phone is able to access the computer systems. Has not been an issue for years.

Question

Are there any challenges with using the systems?

SG-TH-R17: User interface is very easy; only challenge is slow computers.

Question

What are the likely causes of the challenges faced in the use of e-Health IS?

SG-TH-R18: No Challenges

Question

Since when have you been experiencing these challenges?

SG-TH-R19: N/A

Question

What has been done to rectify these issues?

SG-TH-R20: More training

Question

How have these challenges affected your work processes?

SG-TH-R21: Not at all

Question

What steps/measure do you take to neutralize the system challenges when they occur?

SG-TH-R22: Call IT

Question

How often are staff trained to use the system?

SG-TH-R23: Every time there is a change to the software, intensive training takes place.

Question

How effective/useful is the training the staff are offered?

SG-TH-R24: Very useful

Question

How does basic computer literacy affect the use of the systems?

SG-TH-R25: User interface very easy- just enter password and follow the prompts on the screen.

Question

Are there any policies that influence the use of these systems in the hospital?

SG-TH-R26: Probably, but I am not aware of any.

Question

Since when?

SG-TH-27: NA

Question

How does it help you as a user?

SG-TH-R28: N/A

Question

How do you feel clinicians can embrace the use of ICT to improve their work?

SG-TH-R29: It has been in use for several years and is part of day to day practice.

Question

What would you like to influence the use of these electronic systems to improve your work processes?

SG-TH-R30: Make it more mobile- smart phone and tablet friendly.

Question

How has the introduction of these systems affect clinician-patient relationships??

SG-TH-R31: Improved patient care, better patient flow, and quicker retrieval of documents.

Appendix F: Summary of Data analysis (Content analysis)

The table below presents the summary of key responses on the 4 key issues of investigation obtained from applying the content analysis technique in Chapter 5 – section 5.3 (Descriptive presentation of findings).

Table 4: Summary of data analysis

Issues of Investigation (Categories)	Sub-Categories	Summary of Key Responses (Operationalization of Sub-Categories)
Status of adoption and use e-Health IS in the public hospitals	**Awareness** and **Use** of e-Health IS in the public hospitals	**Q:** Ok if I may ask why was the NHLS system introduced? **R**: "… to ease the… the obtaining of the results…via the computer" (**AC- H1-R10**) **Q:** When were these systems introduced? **R:** "…our main patient information system…" "…it was introduced at H1 in 2003…" (**FDT-H1-R4**) **Q:** So who are the users of these systems? **R:** ok…CLINICOM as I said…is a patient information system…" "…the clerks use that system mostly…" "…they capture the patients' information…" (**FDT- H1-R5**) **Q:** Between the CLINICOM, the JAC, the NHLS and the SINJANI, which of these systems do clinicians' use the most? **R:** "…the JAC is just a pharmacy system, and so only the pharmacist would…it's only in the pharmacy….it's only the pharmacists who use it…"(**FDT- H1-R24**) **Q:** Ok... Errm… you mentioned… before the electronic systems were introduced…what was being used? **R:** "…before we would get all our requirements for nursing agencies…that would cover the wards clinically…" (**KM- H1-R7**) **Q:** If I may ask, how widely spread are the use of these systems across the hospital? How spread is the use….Is it just for your department, the nursing department or it is used in all departments in the hospital? **R:** "…the SINJANI is just a report drawing system… so the information manager will draw all… because the CLINICOM also feeds into the SINJANI…. So the information manager will then draw all the reports from the SINJANI…" (**KM- H1-R10**) **Q:** How often…from your records, how often do clinical staffs use these systems? **R:** "…every day, because people are admitted every day, people come through admission;

		everyday people get discharged on the system. Everyday people get admitted in the wards, so it's an on-going...it's a live system…you know 24 hours….." (**JM- H2-R8**) **Q:** Which other electronic systems asides those two is used in the nursing department? **R:** "…The SINJANI system is a system where you record and monitor and evaluate, adverse incident reports that takes place at this institution…" (**SR- H2-R7**) **Q:** Which of these systems that you've mentioned do you use for clinical care? **R:** For clinical care, we use the nursing information management system; we use CLINICOM…". The meal ordering system, you can also put it in as a system for clinical care because you see after the needs of the patient…" (**SR- H2-R8**) **Q:** Which electronic systems exist in the hospital? **R:** "…PACS, RIS (access to all X Rays and other imaging tests intranet and internet)…" (**SG-TH-R3**)
	Acceptance and **Use** of e-Health IS in the public hospitals	**Q:** It's just the NHLS? **R:** "… it's more on the administrative side not on the clinical side...this is the reason why I didn't mention it…" (**AC- H1-R20**) **Q:** If I may ask…Errm… how do you feel clinicians can embrace the use of ICT? **R:** "…you don't have to repeat the same thing all over again…" (**AC- H1-R34**) **Q:** So who are the users of these systems? **R:** "…any admission of the patient is also recorded on that system…(**FDT- H1-R5**) **Q:** Errm…What challenges accompanied the use of these systems for clinical staff? **R:** "… they weren't very eager use the systems…lots of the clinical people are of the opinion that they are here for clinical reasons and not administrative reasons…." "…Doctors are very good with using the NHLS…" "…they don't always see the relevance of the CLINICOM system" (**FDT- H1-R21**) **Q:** I think I have one more thing to ask, that in terms of what the management of the hospital has done to encourage clinical staff to take up the use of other systems that they think is for administrative purpose only **R:** "…the CLINICOM system is meant…where there is one folder number for every patient that is seen at the hospitals…" **(FDT- H1-R31)** **Q:** You mentioned CLINICOM, SINJANI and NIMS… I want to ask, why was there a shift to these electronic information systems? **R:** "…to make it more easier, to improve the services…" (**KM- H1-R8**)

		Q: If I may ask, what are the feedbacks from your nurses on the use of these electronic systems? **R:** "… some people who're old school…who're still struggling with getting used to electronic…" (**KM- H1-R13**) **Q: Question** To what extent are the systems being used in the hospital? **R:** "…. CLINICOM, where the patient is discharged…" (**JM- H2-R6**) **Q:** How would you say the work processes are now when there have been measures put in place for smooth transition to electronic as opposed to when it was manual? What would you say about the work processes? **R:** "…faster, easier access, it's much faster and it cuts out a lot of unnecessary processes…" (**JM-TH-R14**) **Q:** As regards to clinical staff, what challenges accompanied the adoption of the systems for clinical staff in the hospital... Was there a buy-in from the clinical staff at the introduction of the systems? **R:** "…so that universal system…it doesn't matter where you go in the Western Cape…"(**JM-H2-R16**) **Q:** How will you rate the use of these systems by clinical staff…how will you say the clinical staff are using the systems? **R:** "… they use it every day, they are quite familiar with it, so they do what is expected of them so they have no problems. Because the more you work on the system the more you get familiar with it…." (**JM- H2-R27**) **Q:** Can you tell me how the hospital has helped you to improve your daily work duties? **R**: "…I will give it to IT for the access to the patient records, for the access to lab results, accesses…."**(GP- H2-R10)** **Q:** And why was there a shift from paper/manual to electronic systems? **R**: "…It's much quicker access to certain information, it's a much better system to capture certain information, patient information, staff information; you don't need lots and lots of files like we used to do in previous years…" **(SR- H2-R10)** **Q:** Have the systems been performing what they are meant to do? **R:** "….we are still using manual systems…" (**SR- H2-R13**) **Q:** How have the systems assisted with your daily activities and processes? First of all, in terms of decision making? Then secondly, in terms of adherence to clinical guidelines? **R:** "…she can concentrate on supervision and more clinical work within the ward area" (**SR-H2-R37**) **Q:** Why was there a shift from microfilms and telephones to the use of these electronic

		systems? **R:** It was the logical choice- improved access to information **(SG- H2-R7)** **Q:** How have the systems assisted with your daily activities and processes? First of all, in terms of decision making? , then secondly, in terms of adherence to clinical guidelines? **R:** Improved patient flow, better access to information, shorter waiting times, no loss of information between institutions (**SG- H2-11**)
Purposes for the adoption e-Health IS in the public hospitals	**Rationale** for adoption of e-Health IS in the public hospitals	**Q:** Errm…lastly, I would like to ask you, what do you think would be the short and long term effect of the use of these electronic systems on patients…in attending to patients? **R:** "…everything outside of the hospital…most of the things are electronic…" "…it must be introduced…" (**AC- H1-R37**) **Q:** Errm…Coming back to why there are no ICT, electronic health information systems asides the CLINICOM for clerks and the NHLS for clinicians, why is no rollout of electronic health information systems at H1 Hospital? **R:** "… in South Africa you have got certain hospitals everything is electronic…I think the second military hospital in Pretoria is very much electronic, alright I'm not sure about that but I think that they are pretty much electronic, Albert Luthuli Hospital in Durban is fully electronic…" (**AC- H1-R38**) **Q:** That is what I would like to know, because Errm… I have heard instances where I've that doctors don't have…they don't have err… an opinion on what kind of systems are being rolled out into the hospitals, it's kind of being forced on them to use without considering their needs…..? **R:** "… I don't see a reason that anything should remain not electronic…" (**AC- H1-R39**) **Q:** What led to the adoption of the system in the hospital? **R:** "… the manual system takes long so it's more for….more efficient and effective way of capturing data and at the end of the day, if you have one…electronic system is faster, it's more efficient, it's more correct for all the purposes and…correctness…and data quality..." **(JM- H2-R5)** **Q:** You complained about or you mentioned not…some little challenges with the use of the system, Was there a pilot study before the system were rolled out? **R:** Errm… "…it was just a case of doing a pilot study knowing it was going to be implemented rather than whether it was going to be implemented…" **(GP- H2-R16)** **Q:** Lastly if I may ask you mentioned that papers are still being scanned, how has this affect or how has this affected the data quality of patient information? **R:** "… the electronic information is easier to….is least likely to make mistakes than a paper system…" **(GP- H2-R36)**

		Q: And why was there a shift from paper/manual to electronic systems? **R:** "… it is the green initiative, going from paper use to paperless…" (**SR- H2-R10**) **Q:** If I may ask, how do you feel clinicians can embrace the use of electronic systems more for their daily activities? **R:** "… what is happening abroad where people don't use papers anymore…" **(SR- H2-R34)** **Q:** I would like to know… how do you think you daily work/duties can be improved? **R:** "…the ability to enter clinical notes directly on the computer" **(SG- H2-R1)**
Perceptions on the use of e-Health IS in the public hospitals	**Perceived ease** of e-Health IS use in the public hospitals	**Q:** If I may ask, how does the basic...the basic computer literacy affect the use of the NHLS? **R:** "…It's so simple…" (**AC- H1-R30**) **Q:** Errm... you mentioned quite a lot of positive experiences with the use of electronic systems, are there any challenges? **R:** "… if you don't use a program, it doesn't matter how much training…" (**KM- H1-R16**) **Q:** How user friendly are these systems, in terms of ease of use? How easy are they to use? **R:** I think they are fairly easy…I think they are fairly easy, it's just that you need…If you don't use it regularly then…. (**KM- H1-R22**) **Q:** So would you say the systems are user friendly? **R:** "…hey are too clumsy" (**GP- H2-R24**) **Q:** There's a popular belief that the younger generation are more tech savvy than the older generation, does this apply in your hospital? How widely used are these systems across the hospital? **R:** "…any person that can use a cell phone is able to access the computer systems…" (**SG-H2-R16**)
	Suitability of e-Health IS in the public hospitals	**Q:** It's just the NHLS? **R:** "…However you must admit it's a little bit pointless…" **(AC- H1-R20)** **Q:** Would you say the systems are performing what they are meant for? **R: "**The X-ray system definitely and the Laboratory system definitely…" (**GP- H2-R14**) **Q:** That would lead me to my next question, like what features are mostly used on these…on SINJANI and the Nursing information management system and the radiology system? Like you mentioned in terms of how to do budget…..on how to use the systems **R:** "…there isn't a specific system you use more than another system" (**SR- H2-R21**)

	Perceived usefulness of e-Health IS in the public hospitals	**Q:** What are you experiences…what have your experiences been since you've being using these electronic systems compared to when you were using the paper based systems? **R:** It's just so much easier…it's just so much…and I know my desk is full of paper but…*chuckles*….but I think there would always be a place for papers but it made a huge difference **(KM- H1-R11)** **Q:** So far so good, with the introduction of these systems, what have been the experiences in terms of use in H1 hospital since the introduction of electronic information systems? What has been the atmosphere since the introduction and the use? **R:** "…it is far more useful, it does simplify our task, it is quicker, we are able to access our information…" **(FDT- H1-30)** **Q:** What led to the adoption of the system in the hospital? **R:** Well basically, the manual system takes long so it's more for….more efficient and effective way of capturing data **(JM- H2-R5)** **Q:** How would you say the work processes are now when there have been measures put in place for smooth transition to electronic as opposed to when it was manual? What would you say about the work processes? **R:** "...it's much faster electronically…it's much faster, easier access, it's much faster and it cuts out a lot of unnecessary processes that were in the way…" **(JM- H2-R14)** **Q:** Ok…so that leads me to my last question, how has the introduction of these systems currently in the nursing department… how has it affected nurse-patient relationship? **R:** "There is more access to patients at the moment. But the nurses, there is certain things they must do on the computer but in the past it took a person…the sister-in-charge…it took the sister-in-charge half a day to do certain things within her office whereas now, in the morning after she does her round see who's on duty, who is not on duty, go into the office, it doesn't take her half an hour to finish with those things. Now she can concentrate on supervision and more clinical work within the ward area" **(SR- H2-37)**
	Social influence among clinical staff in the public hospitals	**Q:** Asides the data inaccuracy, you mentioned that users were not accessing it…nobody was accessing it…can you tell me why users were not accessing it? **R:** "…it's more political than actually practical approach…" (**AC- H1-R35**) **Q:** Errm… so how do they find the use of the NIMS? **R:** "…peer pressure would alter and push and force certain people…" (**KM- H1-R15**) **Q:** Can I ask, what has been done to kind of….as an incentive for them to use these electronic systems? **R:** "…but I think it's also management's view on these systems…that plays a big role in how much they are encouraging those staff to take on the systems…" (**FDT- H1-R23**)
Limitations to the use of e-Health	**Inadequacies** of e-Health IS in	**Q:** Ok…If I may ask…Are there any policies guiding the use of ICT in H1?

IS use in the public hospitals	the public hospitals	**R:** "…we don't have ICT as such..." (**AC- H1-R32**) **Q:** If I may ask…you said patient clinical records are still not electronic…why is that? **R:** "…we work with huge numbers…" (**KM- H1-R28**) **Q:** So in this kind of situation especially the power outage, how does the hospital cope with these electronic systems? **R:** "…the ones kept in this office are very old and they need to be replaced…" (**FDT- H1-R29**) **Q:** Can you give me instances of clinical staff feedback on the use of the systems…their experiences with using the systems? **R:** "…they aren't familiar with technology…" (**JM- H2-R10**) **Q:** Are there any challenges with using the systems? **R:** "…there are two challenges…"(**GP-H2-R26**) **Q:** Did you say there was no form of staff training? **R:** Yes there was at the beginning, interactive courses and demonstrations and so on but not anymore (**GP- H2-R31**) **Q:** And how has the load shedding affected the use of the systems? **R:** "…most of the computers are older than 3 years…" (**SR- H2-R15**) **Q:** How has the transition from paper/manual to electronic being in the nursing department? **R:** "…and computer literacy is not that high within the nursing department…" (**SR- H2-R17**) **Q:** What are your experiences using electronic as compared to paper based systems? **R:** Much better, except for patient held records that are not captured whilst the patient is moving between clinics (**SG- H2-R15**)
	Technical difficulties of e-Health IS in the public hospitals	**Q:** So err…is it like…Since when did this start... Is it being frequent since the inception of the system or it just started like…..? **R:** that it was down? Yes... it is very frequent….very frequent……. On a daily basis…Now and then…you know… it was simply you can't access the results through the system (**AC-H1-R16**) **Q:** What effect does that waiting time have on work processes in the hospital? **R:** "…it impacts on us in that we can't verify our data…" (**FDT- H1-R18**) **Q:** You mentioned about slowness of the system, is that the only technical difficulty…? **R:** "…that's the biggest problem…" (**FDT- H1-R28**) **Q:** You mentioned monthly feedback from the clinical staff, did this include physical challenges? **R:** "…it's just when systems need to be upgraded or something, then they know there would be off-time or in case of where it really happens with load shedding or what happens sometimes we have whereby a system have a downtime…." ON (**JM- H2-R15**)

		Q: Are there any challenges with using the systems? **R:** User interface is very easy; only challenge is slow computers (**SG- H2-17**)

Appendix G: Frequency of attributes (Content analysis)

The table below presents a summary of the frequency of attributes from the operationalization of the 4 key issues of investigation, using the content analysis technique in Chapter 5.

Table 5: Frequency of attributes

Key Issues of Investigation (Categories)	Sub-categories and the frequency of their attributes **Respondents:** AC- **H1**-R, KM- **H1**-R, FDT- **H1**-R, JM- **H2**-R, GP- **H2**-R, SR- **H2**-R, SG- **H2**-R
Status of e-Health IS adoption and use in the public hospitals	**AWARENESS** and **USE** of e-Health IS **(X 22)** (1.) **Name** of e-Health IS**:** *CLINICOM* (AC- **H1**-R)**(X7)**, (KM- **H1**-R)**(X12)**, (FDT- **H1**-R)**(X36)**, (JM- **H2**-R)**(X9)**, (SR-**H2**-R)**(X9)**, (SG- **H2**-R)**(X1)**; *NIMS* (KM- **H1**-R)**(X15)**, (SR- **H2**-R)**(X11)** *SINJANI* (KM- **H1**-R)**(X5)**, (FDT- **H1**-R)**(X11)**, (JM-**H2**-R)**(X1)**, (SR- **H2**-R)**(X3)**, (SG- **H2**-R)**(X1)**; *NHLS* (AC- **H1**-R) **(X8)**, (FDT- **H1**-R)**(X8)**, *JAC pharmacy system* (FDT- **H1**-R)**(X8)**, (JM- **H2**-R)**(X2)** *ECM* (GP- **H2**-R)**(X2)**, (SG- **H2**-R)**(X1)**; *RIS & PACS* (GP-**H2**-R)**(X2)**,(SG- **H2**-R)**(X1)**; *DISA Lab system* (GP- **H2**-R)**(X1)**, (SR- **H2**-R)**(X3)**, (SG- **H2**-R)**(X1)** (2.) **Operation** of e-Health IS: *capture* (AC- **H1**-R)**(X5)**, (KM- **H1**-R)**(X6)**, (FDT- **H1**-R)**(X25)**, (JM- **H2**-R)**(X2)**, (SR-**H2**-R)**(X3)** *store* (KM- **H1**-R)**(X3)**, (FDT- **H1**-R)**(X3)**, (JM- **H2**-R)**(X2)**, (GP- **H2**-R)**(X7)**, (SR- **H2**-R)**(X7)**; *access* (AC- **H1**-R) **(X11)**, (KM- **H1**-R)**(X4)**, (FDT- **H1**-R)**(X14)**, (JM- **H2**-R)**(X6)**, (GP- **H2**-R)**(X11)**, (SR- **H2**-R)**(X17)**, (SG-**H2**-R)**(X10)**; *verify* (AC- **H1**-R) **(X2)**, (KM- **H1**-R)**(X5)**, (FDT- **H1**-R)**(X5)**, (JM- **H2**-R)**(X3)**, (SR- **H2**-R)**(X1)** **ACCEPTANCE** and **USE** of e-Health IS **(X1)** (1.) **Significance of e-Health IS** (AC- **H1**-R)**(X3)**, (KM- **H1**-R)**(X5)**, (FDT- **H1**-R)**(X4)**, (JM- **H2**-R)**(X10)**, (GP- **H2**-R)**(X6)**, (SR- **H2**-R)**(X8)**, (SG- **H2**-R)**(X2)** (2.) **Frequency of e-Heal H2 IS Use:** *Daily (Regular) Use* (AC- **H1**-R)**(X6)**, (KM- **H1**-R)**(x6)**, (FDT- **H1**-R) **(X12)**, (JM- **H2**-R)**(X8)**, (GP- **H2**-R)**(X6)**, (SR- **H2**-R)**(13)**, (SG- **H2 H2**-R)**(X2)** (3.) **Reception:** (AC- **H1**-R)**(X4)**, (FDT- **H1**-R)**(X2),** (JM-H2-R)**(X4)**, (GP- H2-R)**(X6)**, (SR- H2-R)**(X4)**, (SG-H2-R)**(X2)**; *Resistance* (KM- **H1**-R)**(X6)**, (FDT- **H1**-R)**(X4)**, (JM- H2-R)**(X4)**, (SR- H2-R)**(X2)**; *capabilities* (KM- **H1**-R)**(X6)**, (FDT- **H1**-R)**(X4)**, (JM- H2-R)**(X6)**, (GP- H2-R)**(X1)**, (SR- H2-R)**(X2)**, (SG- H2-R)**(X3)**
Purposes of e-Health IS adoption in the public hospitals	**RATIONALE** for the adoption of e-Health IS (1.) **Improve Services:** *speed up processes* (AC- **H1**-R) **(X2)**, (FDT- **H1**-R)**(X1)**, (JM- H2-R)**(X2)**, (GP- H2-R)**(X1)**, (SR- H2-R)**(X2)**; *ease up processes* (AC- **H1**-R) **(X1)**, (KM- **H1**-R)**(X4)**, (JM- H2-R)**(X1)**, (GP- H2-R)**(X4)**, (SR- H2-R)**(X2)**, (SG- H2-R)**(X3)**; *eliminates duplication* (AC- **H1**-R) **(X5)**, (KM- **H1**-R)**(X2)**, (FDT- **H1**-R)**(X3)**, (JM- H2-R)**(X2)**, (SR- H2-R)**(X4)**; *cuts unnecessary processes* (KM- **H1**-R) **(X4)**, (FDT- **H1**-R)**(X2)**, (JM- H2-R)**(X1)**, (GP-

	H2-R)**(X4)**, (SR- H2-R)**(X5)**; *time-efficiency* (AC- **H1**-R) **(X6)**, (KM- **H1**-R)**(X4)**, (JM- H2-R)**(X4)**, (GP- H2-R)**(X2)**, (SR- H2-R)**(X4)**, (SG- H2-R) **(X1)**; *cost-efficiency* (AC- **H1**-R) **(X2)**, (KM- **H1**-R)**(X4)**, (JM- H2-R)**(X4)**, (SR- H2-R)**(X2)**,
Perceptions on e-Health IS use in the public hospitals	(1.) **Perceived ease** of e-Health IS use**:** *Simple* (AC- **H1**-R) **(X3)**, (KM- **H1**-R) **(X4)**, (JM- H2-R)**(X4)**, (GP- H2-R)**(X2)**, (SR- H2-R)**(X2)**, (SG- H2-R) **(X1)** (2.) **Suitability** of e-Heal H2 IS**:** (AC- **H1**-R)**(X4)**, (KM- **H1**-R)**(X6)**, (GP-H2-R)**(X4)**, (SR- H2-R)**(X6)**, (SG- H2-R)**(X3)**; (3.) **Perceived usefulness** of e-Health IS: (AC- **H1**-R) **(X7)**, (KM-**H1**-R)**(X5)**, (FDT- **H1**-R)**(x6)**, (JM- H2-R)**(X8)**, (GP- H2-R)**(x6)**, (SR- H2 H2-R)**(x4)**, (SG- H2-R)**(X3)**; (4.) **Social influence:** *peer pressure* (AC- **H1**-R) **(X5)**, (KM- **H1**-R)**(X8)**, (FDT- **H1**-R)**(X2)**, (JM- H2-R)**(X1)**, (SR- H2-R)**(X3)** *Politics (Governance)* (AC- **H1**-R)**(X3)**
Limitations of e-Health IS use in the public hospitals	**INADEQUACIES** of e-Health IS use**:** *training* (AC- **H1**-R)**(X3)**, (KM- **H1**-R)**(X6)**, (FDT- **H1**-R)**(X8)**, (JM- H2-R)**(X6)**, (GP- H2-R)**(X2)**, (SR- H2-R)**(X2)**, (SG- H2-R) **(X2)**; *Problematic features* (AC- **H1**-R)**(X4)**, (GP- H2-R) **(X12)**, *restriction of mobility* (AC- **H1**-R)**(X2)**, (KM- **H1**-R)**(X1)**, (GP- H2-R)**(X7)**, (SR- H2-R)**(X2)**, (SG- H2-R)**(X2)**; *Lack of clinical note* (AC- **H1**-R)**(X2)**, (KM- **H1**-R)**(X1)**, (GP- H2-R)**(X5)**,(SR- H2-R)**(X2)**, (SG- H2-R) **(X2)**, (FDT- **H1**-R)**(X2)**, *lack of sufficient infrastructure* (AC- **H1**-R)**(X3)** **TECHNICAL DIFFICULTIES** of e-Health IS Use**:** *Slowness (*AC- **H1**-R)**(X1)**, (FDT- **H1**-R)**(X6)**, (JM- H2-R)**(X3)**, (SR- H2-R)**(X1)**, (SG- H2-R)**(X1)**; *Downtime* (AC- **H1**-R)**(X8)**, (FDT- **H1 H1**-R)**(X3)**, (JM- H2-R)**(X2)**, (SR- H2-R)**(X2)**, (SG- H2-R)**(X2)**