Gordon Institute of Business Science
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FACTORS RELATED TO THE ADOPTION OF ELECTRONIC HEALTH RECORDS:

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ABSTRACT

Background

The adoption and use of Electronic Health Records (EHR) is understated, despite the known benefits of Electronic Health Records (EHR) and the availability of health information systems technology to bridge the healthcare supply-demand gap.

Objective

This study seeks to explore and elucidate the complex interaction of factors inherent in the adoption and use of EHR from the perspective of strategic, operational and frontline staff in the private urban hospital setting.

Methodology

This study employed a phenomenological qualitative design to gain a deeper understanding of factors at intrinsic to the adoption of health information technology systems in urban hospitals. The study conducted 21 interviews in two private hospitals with decision makers and computerized information system end-users. The cohort was segmented into three organizational tiers constituted with frontline, operational and strategic staff.

Results

Participants agreed that EHR have relative advantage over paper in the form of operational efficiencies and delivery of care improvements. They did acknowledge existing challenges of using electronic information systems including prohibitive financial requirements, IT & computer literacy, system usability and functionality challenges, miscommunication, organizational processes and culture and increased workload.

Conclusion

EHR hold immense potential for transforming the delivery of care in hospitals. Decision makers need to leverage the organisational human resource potential in their quest to realize EHR value for all stakeholders. However EHR cannot be viewed as the only solution to improving healthcare.

Keywords

Health information technology (HIT)

Health information systems (HIS)

Electronic health records (EHR)

Adoption

Diffusion

Innovation

DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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LIST OF ACRONYMS AND ABBREVIATIONS

Clinical Decision Support System (CDSS)

Diffusion of Innovation (DOI)

Electronic Health Records (EHR)

Electronic Medical Records (EMR)

Health Information Systems (HIS)

Health Information Technology (HIT)

CHAPTER 1: INTRODUCTION AND RESEARCH BACKGROUND

1.1 INTRODUCTION

This project endeavours to uncover the expectations and experiences of Electronic Health Record (EHR) stakeholders to understand how to optimise health information technology (HIT) for healthcare transformation. Globally, there is a seismic paradigm shift in progress, transforming the healthcare system from being volume-based to being value-based (Porter et al., 2013). Information technologies bear immense possibilities for designing, organising and managing the delivery of healthcare to address widespread challenges of upward spiralling costs, discrepancies in quality outcomes and access constraints (Gagnon, Desmartis, Labrecque, Car, Pagliari, Pluye & Légaré, 2012). EHR systems have the potential to unlock existing constraints by improving quality, safety, efficiencies and saving costs (Meigs & Solomon, 2016). However, the field is filled with reports of the healthcare sector still lagging behind technology advances (Zhang, Seblega, Wan, Unruh, Agiro, & Miao, 2013). Current data suggests that the rate of HIT adoption is low (Kellerman & Jones, 2013; Nambisan, Kreps & Polit, 2013) and that purported benefits of HIT may be overstated (Karsh, Weinger, Abbott & Wears, 2010). There is considerable evidence that the digital transformation of healthcare across the entire ecosystem, can reduce costs, improve quality of care and bring about clinical and administrative efficiencies (Agarwal, Gao, DesRoches & Jha, 2010). The ensuing discussion interrogates, how to best position healthcare to leverage information technology and attain universal uptake to meet the needs of the 21st century.

"One reason why there is so much interest in the diffusion of innovations is because getting a new idea adopted, even when it has obvious advantages, is often very difficult" (Rogers, 2003). The complex interactions of factors at play in the diffusion of innovation go beyond the relative advantage of the intervention (Porter et al., 2013). There is no setting where this reality is more evident than in the application of health information technologies in the healthcare sector. EHRs have the potential to improve clinical effectiveness, enhance information portability, reduce medical errors, increase cost savings, improve quality of care and facilitate research (Biruk, Yilma, Andualem, & Tilahun, 2014; Lim, Patel, Lee, Weeks, Barber & Watnik, 2015; Pipersburgh, 2011). Despite the potential benefits and the availability of technology, literature shows slow EHR adoption (Avgar, Litwin & Pronovost, 2012; Keller & Jones, 2013; Nambisan et al., 2013). A US study, found that less than 10% of hospitals had EHR systems and only 17% of physicians were using electronic records system (Jha, DesRoches,

Kralovec, & Joshi, 2009). This negative sentiment also came across in a study that found that 65% of physicians believed EHR had not improved the quality of their patient care (Verdon, 2014).

The US government introduced Health Information Technology for Economic and Clinical Health (HITECH) incentives policies to stimulate EHR adoption and use (Hesse, Ahern, & Woods, 2011). Incentive programs have been known to improve economic relative advantage, particularly if the financial commitment is perceived to be a barrier (Rogers, 2003). Subsequent to HITECH introduction, studies reported a doubling of hospitals that achieved comprehensive EHR status between 2011 and 2012 (DesRoches, Charles, Furukawa, Joshi, Kralovec, Mostashari & Jha, 2013). Similarly, other works observed five-fold increases in hospital EHR adoption and doubling of physician practice adoption from 2009 to 2014 (Meigs et al., 2016). Even though adoption rates have drastically improved, with clinicians crediting systems for the positive impacts on clinical care, practice efficiency and finances, there are still concerns (Jamoom, Patel, Furukawa & King, 2014). There is an increasing number of studies on persistence of barriers, unintended consequences, inconclusive quality outcomes, questionable cost savings and efficiencies, all challenging the HIT diffusion gains (Meeks, Smith, Taylor, Sittig, Scott & Singh, 2014). Even among those clinicians who have come to accept and use EHRs, there is a general view that EHRs have room for growth (Ober & Applegate, 2015). Slightly less than a fifth of those using EHR systems are convinced of the positive impact of EHR on quality outcomes for patients (Meigs et al., 2016). However, while many studies have found associations between EHRs and quality improvement, others have found adverse effects of unintended consequences (Ancker, Kern, Edwards, Nosal, Stein, & Hauser, 2014).

Scholars, policy makers and practitioners are all consumed by the conundrum of how to fully realise the promise of EHR. There is no consensus regarding impacts of EHR on the quality of care improvements according to physician EHR adopters (Meigs & Solomon, 2016). The question of how to transform the potential of EHR into the reality of sustainable outcomes is still highly relevant (Lau, Price, Boyd, Partridge, Bell & Raworth, 2012).

Researchers argue that EHRs are but a tool to enable the delivery of value in the context of a structurally transformed healthcare delivery system (Porter et al., 2013). Therefore, it is a value-based healthcare system that can optimally reap the benefits of health information technologies (Porter et al., 2013). Stakeholder theorists on the other

hand, maintain the answer lies in the strategic management of interested parties so as to align incentives with outcomes (Nambisan, Kreps & Polit, 2013). One study quotes "Healthcare does not exist to create documentation or generate revenue; it exists to promote good health, prevent illness, and help the sick and injured" (Karsh et al., 2010). Similarly, "It is health that people desire, and health technology utilization is merely the means to achieve it" (Karsh et al., 2010:page 620). These views are aligned with those of innovation scholars with jobs theory, who maintain the answer lies in understanding the job that the customer is struggling to resolve emotionally, socially and functionally (Christensen, Hall & Dillon, 2016).

1.2 STUDY RATIONALE

South Africa like many countries globally is inundated with increasing demand for healthcare services, scarcity of health personnel, infrastructure challenges and resource constraints (South Africa, Department of Health [DoH], 2014). The healthcare system is under pressure to provide equitable, accessible and affordable quality care to its population. Health information technologies promise process efficiencies and lower health care costs while increasing access (Fichman, Kohli, & Krishnan, 2011). Furthermore, health information systems have the potential to result in substantial improvements in the quality of patient care and efficiencies in the healthcare system to relieve resource constraints (Biruk, Yilma, Andualem, & Tilahun, 2014).

1.3 PRACTICE RELEVANCE

In the South African context, healthcare system is beset with a quadruple burden of disease, a growing population that is juxtaposed with shrinking health personnel; the need to leverage health information technologies is of utmost importance. Key drivers for facilitating the adoption of EHR will assist healthcare organisations to better plan, implement, and use EHR. In addition, as already stated for the success of NHI, the need for EHR adoption is key. To reiterate, this problem is not isolated to our setting but is a global reality.

1.4 ACADEMIA

This work will contribute to the body of knowledge informing EHR adoption process. In spite of all the regulatory reforms and economic incentives, outcomes of EHRs are vague and beset by inconclusive results and widespread barriers (Burke, Becker, Hoang & Gimbel, 2016). The debate on how do to leverage EHRs to deliver health is

highly relevant. In addition, there have been calls made to expand the scope of EHR research to include countries in the developing world (Najaftorkaman, Mohammadreza, Ghapanchi & Hossein, 2014).

1.5 SOCIAL IMPACT

At the heart of the EMR adoption research is the search for drivers that would optimise use of available information technology innovations for the betterment of healthcare. In South Africa, the issue is made even more salient, given the looming rollout of National Health Insurance (Department of Health, 2015). A functional national electronic health record is critical to realising cost reductions and bringing about delivery efficiencies. The white paper on NHI proposes an electronic information management system platform, linking the NHI Fund membership database and the accredited/ contracted health care providers (DoH, 2015). Information systems will not only be crucial for the implementation of the NHI, but also for mobilising services for the greater population.

1.6 CONCLUSION

There is no consensus on the impact of EHR in the healthcare sector. As much as there are benefits that are both theorized and observed there are also drawbacks and unintended consequences that tilt the scale leaving the debate open as to the overall impact of HIT. Although the health IT evaluation literature base is expanding rapidly, there is concern that there has not been a commensurate increase in our understanding of the effect of health IT or how it can better be used to improve health and health care. This qualitative study aims to extract insights from EHR stakeholder experiences to shed light on this debate. The aim is to uncover factors that would suppress adoption and use of EHR with the end goal of coming up with recommendations for improved EHR use. In addition the author also seeks to uncover the promoters of EHR use for organisations to leverage and exploit for further diffusion.

CHAPTER 2: THEORETICAL LANDSCAPE AND LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this study is to employ a qualitative method to help extract, analyse and synthesise the lived experiences and perceptions of hospital information systems users, managers and decision makers. In the process the researcher aims to bring forth current, relevant factors that either promote or suppress EHR adoption and use in the local private sector setting. In this literature review, the researcher overlays EHR evolution, EHR research, EHR maturity and the diffusion of innovation framework model in order to come up with a clear understanding of EHR adoption and diffusion. The first section outlines the purpose of the review, then, how the review was done and followed by the layout of the chapter. The second part expands on the EHRs Literature. Lastly, the theoretical framework of Rogers' Diffusion of Innovation (DOI) guides the critical review and the conclusion.

2.2 PURPOSE

The purpose of this literature review was to explore the stated topic with literature sources that would shed more light on the puzzle of low EHR adoption in the context of EHR benefits. This chapter will cover (a) evolutionary history and development of EHR systems, (b) policy initiatives to encourage adoption and greater use of EHRs (c) current literature on the adoption of EHRs (d) Benefits of EHRs, (e) underlying diffusion of innovation theoretical framework and literature discussion.

2.3 PROCESS

The article search used for the literature review involved broad databases such as PUBMED, ProQuest, EbscoHost, and Google Scholar. The period of consideration for most of the articles ranged between 2010-2016. There were a few exceptions that included seminal works. This timeframe has been chosen because even though widespread implementation of EHRs started in the mid-1990s, it was the introduction of HITECH in 2009 that encouraged mass adoption and implementation. The six years reflects a balance to include as many papers as possible in this review and maintain relevance for the present technology. The literature was mainly comprised of peer-reviewed journals with some current relevant books and a few reports. The selection method included keywords and subject terms associated with: (1) healthcare provider organisational setting; (2) health IT – EHR/EMR; (3) diffusion innovation process –

adoption, implementation and use; (4) Human, technology and environment/context factors; (5) impacts; (6) HIT stakeholders/decision makers; and (6) diffusion of innovation. The search then snowballed to pursue current relevant cited sources. Given the broad and exploratory nature of the project, an attempt was taken to read as widely as possible.

2.4 STRUCTURE

Literature contains a growing number of studies regarding EHRs, their adoption, barriers, unintended consequences, and impacts/outcomes of adoption and optimal use (Najaftorkaman, Ghapanchi, Talaei-Khoei & Ray, 2013). For this proposal, there are two major sections in the literature review: electronic health records and diffusion of innovation. Electronic health records section is further subdivided into EHR definitions, functionality and maturity model. Then follows the EHR chronological evolution. The EHR research landscape section is further split into EHR impact and EHR adoption. The section ends with a summary leading into the diffusion of innovation theory section. Diffusion of innovation is utilised as the instrument to interrogate current understanding on the slow diffusion of EHRs.

2.5 ELECTRONIC HEALTH RECORDS (EHRS)

For the purpose of this project the use of electronic health records (EHR), electronic medical records (EMR), computerised patient records (CPR) or digital health records are used interchangeably and are all considered to have the same meaning (Boonstra & Broekhuis, 2010; Rahman & Reddy, 2015).

2.5.1 Definitions

2.5.1.1 Electronic health records

According to HIMSS:

> “Electronic Health Record (EHR) is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports. The EHR automates and streamlines the clinician's workflow. The EHR has the ability to generate a complete record of a clinical patient encounter – as well as supporting other care-related activities

directly or indirectly via interface – including evidence-based decision support, quality management, and outcomes reporting" (Atherton, 2011).

2.5.1.2 Meaningful use

Meaningful use is defined by the Department of Health and Human Services (HHS) as using an EHR system in "a manner that improves quality, safety, and efficiency of healthcare delivery, reduces healthcare disparities, engages patients and families, improves care coordination, improves population and public health, and ensures adequate privacy and security protections for personal health information."

2.6 FUNCTIONALITY & COMPONENTS OF EHR

In an attempt to understand this paradox of reluctant implementation in the face of proven benefits, it is important to understand the functions and capabilities of EHRs. It is important to be familiar with what EHRs capabilities aim to achieve so as to compare the promise of EHRs with the reality of observed outcomes in practice. The Institute of Medicine (2003a) has proposed the need for key functions of EHRs to improve patient safety, support the delivery of effective patient care, facilitate management of chronic conditions and improve efficiency. These core functional capabilities form the basis of the Institute of Medicine (IOM) maturity categorisation of basic versus comprehensive EHRs and the HIMSS Electronic Health Record Maturity Model (Jha, DesRoches, Kravolec & Joshi, 2010). Key definitions in this regard are:

- Clinical Decision-making System (CDS) is a computer-based system that aids the clinician to make decisions based on the clinical observations made by collecting the data given by the patient (Rameshwara, Kumar & Raghavendra, 2015).
- Computerised Physician Order Entry (CPOE) receives the numerous patient orders and eliminates paper work such as filing, documenting and, writing (Rameshwara, Kumar & Raghavendra, 2015).
- Health Information Exchange (HIE) System It is a computer-based system that enables the exchange of the medical data about a medical condition or problem of the patient between two or more healthcare organisations, two or more hospitals or between each other (Rameshwara, Kumar & Raghavendra, 2015).

EHR Functions Required	Basic EHR without Clinician Notes	Basic EHR with Clinician Notes	Comprehensive EHR
Electrical Clinical Information			
Patient demographics	*	*	*
Physician notes		*	*
Nursing assessments		*	
Problem lists	*	*	*
Medication lists	*	*	*
Discharge summaries	*	*	*
Advance directives			*
Computerized Provider Order Entry			
Lab reports			*
Radiology tests			*
Medications	*	*	*
Consultation requests			*
Nursing Orders			*
Results Management			
View lab reports	*	*	*
View radiology reports	*	*	*
View radiology images			*
View radiology test results	*	*	*
View radiology test images			*
View consultant report			*
Decision Support			
Clinical Guidelines			*
Clinical Reminders			*
Drug Allergy Results			*
Drug-drug interactions			*
Drug-lab interactions			*

Table 1

Table 2 Institute of Medicine EHR Maturity Model

2.7 Evolution of EHRs

It is important to bring this vast area of research into perspective by tracing the development of digital clinical records, reflecting on the intended use of EHRs and thereby allowing today's evaluation of EHR realities and proposing changes into the future. Health Information Technology (HIT) encompasses the processing of information with computer hardware and software for the entry, storage, retrieval, sharing and use of healthcare information. EHR is but one of the HIT applications (Lyles, Schillinger & Sarkar, 2015). HIT is at the intersection of healthcare, information technology and computer science. Healthcare is heavily reliant on the availability of information for practice. The management of data ensures that correct data is captured, stored, analysed, shared and available for retrieval to the right person at the time (Tierney, Kanter, Fraser & Bailey, 2010). Health data is a communication currency that gives value to healthcare transactions and stakeholder exchanges (Caine & Tierney, 2015). Clinicians solicit patient history, perform physical examinations, gather patient vital parameters, interpret diagnostic data, analyse the information for diagnosis, plan treatment and capture clinical notes.

The history of clinical records goes back to the beginning of the medical profession, during the times of Hippocrates in the 5th century BC (Musen & Bemmel, 1997). In the 19th century, clinical records were used in Europe and the trend spread to the United States (Siegler, 2010). In the United States, Lawrence Weed introduced problem oriented medical records in the 1960s; his seminal article on "Medical Records that Guide and Teach," argued for a new format of documentation that focused on clinical problems and how they should be managed and documented (Kuhn, Basch, Barr & Yackel, 2015). One of the innovators, Massachusetts General Hospital launched their Computer Stored Ambulatory Record in 1968, and University of Utah, 3M, and Latter Day Saints Hospital followed in early 1970s. Lockheed Corporation created a computerised physician order entry (CPOE) for El Camino Hospital in 1971. In 1972, this was followed by the development of the first electronic medical records system by the Regenstrief Institute (Chao, Hu, Ung & Cai, 2013). A decade later, the focus shifted to automating hospital administrative and financial systems. It took the leadership of the Institute of Medicine's (IOM) starting with their 1991 published report: "The Computer-Based Patient Record: An Essential Technology for Health Care" to emphasise the need to improve quality and safety of the healthcare system and served as a catalyst for EMR adoption (Krist, Beasley, Crosson, Kibbe, Klinkman, Lehmann & Waldren, 2014). There were many reports by IOM over the next few years that focused

on improving the standard and quality of health care by means of electronic record keeping (Ozair, Jamshed, Sharma, & Aggarwal, 2015).

In 2009 there was a landmark moment that saw a twenty-five billion dollar economic incentive as part of Health Information Technology for Economic and Clinical Health (HITECH) Act, to promote wide spread adoption of EHR (Blumenthal & Tavenner 2010; Pipersburgh, 2011). After HITECH, EHR adoption in hospitals and physician practices increased exponentially between 2009 and 2013 (Adler-Milstein, DesRoches, Furukawa, Worzala, Charles, Kravolec, Stalley & Jha, 2014; Hsiao & Hing, 2013; Meigs et al., 2016). Even though the investment was considerable, it could be justified on the grounds that electronic health record (EHR) functionalities would help to address the problems of efficiencies, quality and safety in the health care sector (Cresswell & Sheikh, 2013).

HITECH was introduced to relieve the EHR related financial and pave the way for nationwide adoption and use of EHRs that would translate to quality and efficiency of care delivered. However, even though such incentives might stimulate adoption uptake, there is no guarantee as to the continued optimal use of the technology by end-users (Wright & Marvel, 2012). In addition, just measuring adoption might be superficial and short sighted given that adoption does not mean optimal sustained use; further, use does not equate to the desired outcomes of EHRs (Karsh et al., 2010). To add to this point, a later study reported that, even though adoption is growing, less than 50 percent of hospitals had basic EHR system functionality and even fewer, less than 10 percent met the stage two meaningful use criteria post HITECH (DesRoches et.al, 2013). Those that meet meaningful use criteria were eligible for incentive payments from the Centre for Medicare and Medicaid Services or were subject to penalties for not using EHRs by 2015 (Meigs et al., 2016).

2.8 EHR RESEARCH

This section gives a summation of this area of study. In the context of slow EHR adoption, the answer to the conundrum lies in any one or combination of the EHRs research areas. Hence, the reviewed articles fall into the various research areas. There are eight active research streams in the literature of electronic health records, covering: design and development, impacts, adoption, integration, evaluation, medical research, EHR data design and management, and policy/standards. Significant challenges are still observed with policy issues in the implementation of standards. The knowledge

base covering EHR adoption is diverse, with multiple research traditions, philosophical assumptions and methodological approaches (Najaftorkaman, Ghapanchi, Talaei-Khoei & Ray, 2015; Greenhalgh, Robert, Bate, Macfarlane & Kyriakidou, 2008; Greenhalgh, Potts, Wong, Bark & Swinglehurst, 2009).

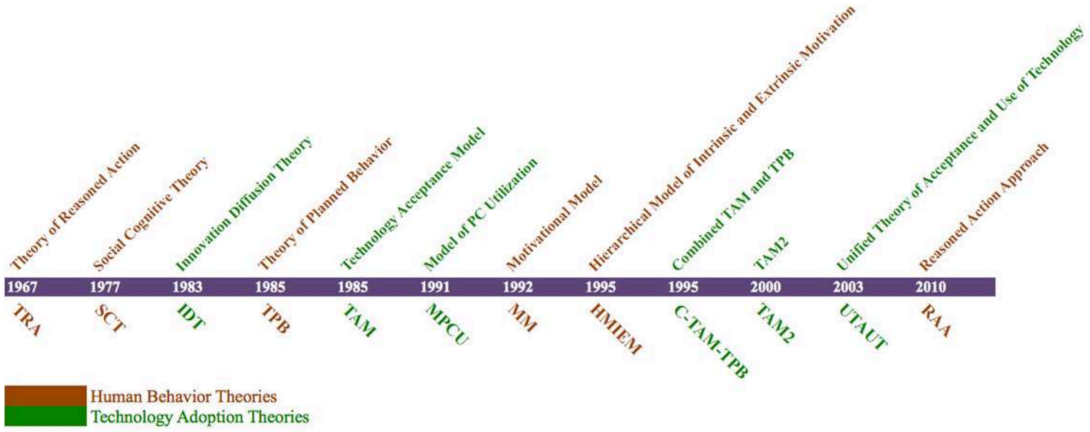


Figure 1

Figure 2.1: EMR Research Timeline adopted from (Rahimi & Jetter, 2015).

2.9 BENEFITS OF EHRS

The persistent conundrum that occupies clinicians, regulators and practitioners alike is the modest diffusion of EHRs in spite of potential benefits (Avgar, Litwin, Pronovost, 2012) and the dichotomy that exists in relation to potential benefits of EHRs versus the reality in practice (Kimble, 2014). In an effort to ensure optimal use and integration of EHRs within the health system, understanding benefits is essential. The benefits of EHRs can be considered from a functional, stakeholder or outcomes perspective. EHRs offer clinical, operational and social gains across the stakeholder spectrum resulting in financial, quality and efficiency outcomes (Menachemi & Collum, 2011). The perceived benefits of EHR include the following categories: cost saving – reduced duplication of medical tests; efficiencies – with improved administrative and clinical efficiency; and quality of care – with improved quality and safety of care (Cucciniello, Lapsley, Nasi, & Pagliari, 2015). Others further corroborate the cost saving and time saved for clinicians (Lim, Patel, Lee, Weeks, Barber & Watnik, 2015) and affirm improvements in practice efficiencies and a decrease in medication errors (King, Patel, Jamoom & Furukawa, 2014). Still other publications have listed improved security of medical data, access to medical information, less documentation redundancy, reduction of information and communication technology costs, enhanced decision

making, better quality of care, and reduction of papers (Najaftorkaman & Ghapanchi, 2014). The continuum from promise to benefits to outcomes is the research matter for this project; to understand and distil the dynamics that will translate EHRs benefits into convincing sustainable outcomes. This study utilized the aid of diffusion of innovation framework to further understand this phenomenon.

2.10 THEORETICAL FRAMEWORK

This section of the thesis focuses on 1) rationale for using diffusion of innovation framework; 2) addressing DOI model criticism; 3) discussing DOI theoretical backgrounds; and 4) using DOI to frame the adoption factors in current literature. “Good theory helps us understand how and why. It helps us make sense of how the world works and predict the consequences of our decisions and our actions” (Christensen, Hall & Dillon, 2016, p.113). Theory-based literature review helps focus and organise the vast growing body of EHR adoption literature. A theory provides a structure to overlay the literature, identify the associations, uncover missing links and construct future direction (Sun & Qu, 2015).

2.10.1 Why Diffusion of Innovation (DOI)

DOI is a widely studied framework to understand the innovation-decision process, elements of diffusion, attributes of the innovation and the pattern of adoption (Oliveira & Martins, 2010; Rahimi & Jetter, 2015). There are many theories used in technology adoption including technology acceptance model (TAM), theory of planned behaviour (TPB), unified theory of acceptance and use of technology (UTAUT), the Technology-Organisation-Environment (TOE) framework and Diffusion of Innovation (Rahimi & Jetter, 2015). DOI is reported to account for 49-97% of the variance in the rate of adoption of innovation (Kruse, DeShazo, Kim & Fulton, 2014). Additionally, the multifaceted nature of DOI is adequately suited to the complex dynamic health environment comprised of multiple stakeholder needs and represented interests (Kruse at el., 2014). Time has a major bearing on processes at any level of the organization (Hatton, Schmidt & Jelen, 2012). The framework takes into account individual, organisational and environmental perspectives (Nambisan et al., 2013). Lastly, DOI spans the full continuum from innovation uptake to include the implementation, review and optimal use phase (Geibert, 2006).

2.10.2 Criticism of Diffusion Research

Diffusion literature is seen to maintain a pro-innovation outlook with researchers studying successful adoption cases to the exclusion of others (Rogers, 2003). This reality speaks to the bias of investigators rather than the limitation of the framework. The framework takes in account non-adoption in the form of innovation rejection and reinvention (Ingebrigtsen, Georgiou, Clay-Williams, Magrabi, Hordern, Prgomet & Braithwaite, 2014).

2.10.3 Diffusion of Innovation

The diffusion of innovation framework argues that innovation information is communicated through interpersonal, organisational and ecosystem channels over time among members of a social system, be it a group, organisation or a wider network (Kruse et al., 2014). There are five elements that determine the rate of adoption: innovation characteristics, communication channels, passage of time, decision processes and the social system context (Rogers, 2003). Features and attributes of a technology that facilitates adoption include early demonstrable benefits: observability, perceived ease of use, relative economic gain, system interoperability process compatibility, and trialability (Gagnon et al., 2012). The five-stage decision process transitions prospective adopters from pre-adoption to post implementation-use stage (Rogers, 2003). Participants exploit communication channels in their social context to create and share relevant information (Angst, Agarwal, Sambamurthy & Kelley, 2010).

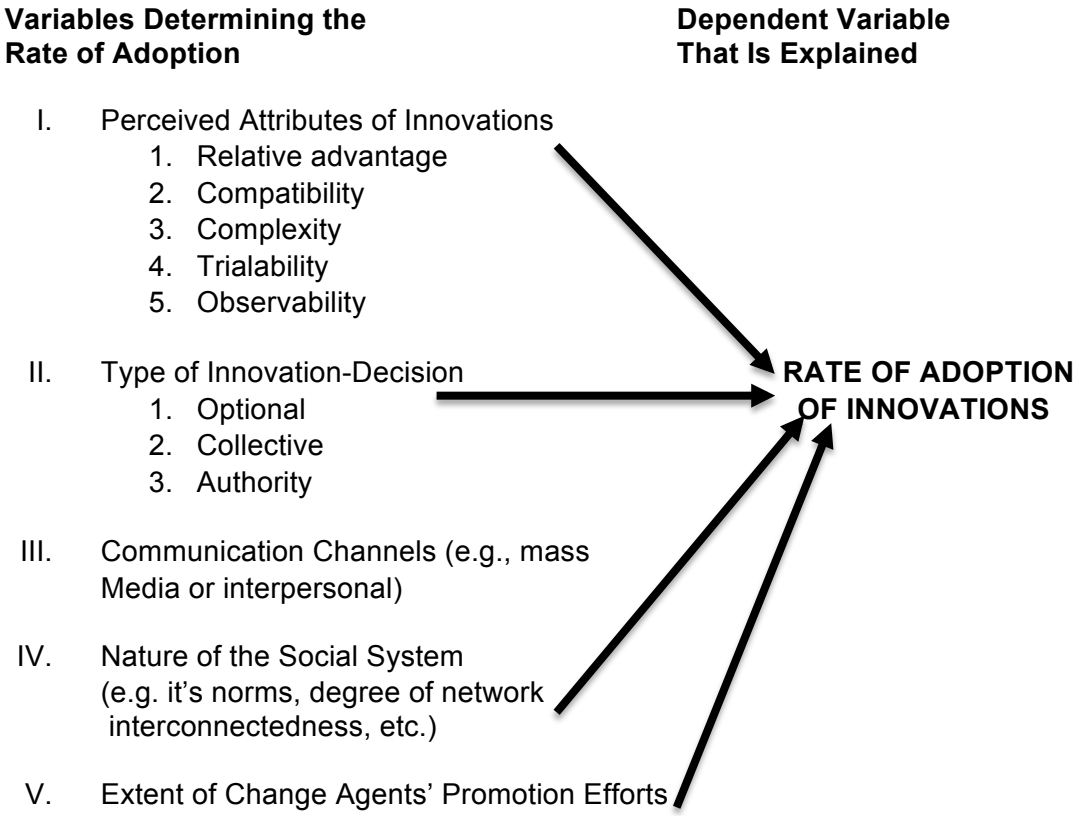


Figure 2.2: Summary of Diffusion of innovation framework (Rogers, 2003)

2.10.4 Innovation Attributes

2.10.4.1 Relative advantage in the context of the jobs to be done

"Degree to which an innovation is perceived as better than the idea it supersedes" (Rogers, 2003, p. 15) is a key-facilitating factor for EHR adoption (Gagnon et al., 2012). Documentation has been paper-based, limiting access and availability (Goetz, Kuzel, Feng, DeShazo & Love, 2012; Ozair et al., 2015). Today, digital capacity facilitates improved access of patient data that was buried in paper file records to now be available for rapid diagnosis and intervention (Avgar 2012; Ozair et al., 2015). Regrettably, the benefit has come at a cost to frontline clinicians, who are devoting more time to date entry (Payne, Corley, Cullen, Gandhi, Harrington, Kuperman & Tierney, 2015). Equally concerning are infrastructure interruption challenges resulting in information constraints risk (Menon, Sing, Meyer, Belmont & Sittig, 2014). Furthermore, system interoperability challenges restrict the capacity to share clinical data among clinical entities and negatively impact on the quality of care provided in the ecosystem (Meigs et al., 2016).

EHRs uptake is credited with patient safety improvements because of decreased medication errors (King et al., 2014), identifying drug-to-drug interactions (Hatton et al., 2012) and diminished duplication of medical tests (Cucciniello et al., 2015). Equally, there is evidence that these systems can introduce safety risks and other unintended consequences (Meeks et al., 2014). Even though, CPOE has been shown to substantially reduce medication errors in hospitals, there are reported challenges with incorrect data entry (Radley, Wasserman, Olsho, Shoemaker, Spranca & Bradshaw, 2013). Equally disturbing are system-use challenges that result in patient misidentification, system interface errors, failure to locate relevant patient data and incorrect item selection from selection lists (Palojoki, Pajunen, Saranto, Lehtonen, 2016).

EHRs have been shown to improve accuracy of diagnoses with real time data access (Kierkegaard, 2011). This view is echoed by physicians' perceptions that using an EHR system has resulted in enhanced patient care (Rahman et al., 2015). However, some pockets of EMR research found mixed results, finding that patients have a shorter length of stay on first presentation only to come back for re-admission within 30days (Lee, Kuo & Goodwin, 2013)

Metrics being used to measure the effectiveness of EHRs have also been brought into question (Kimble, 2014). Some clinicians have cited a time-saving with EHRs allowing electronic communication with staff instead of writing messages and notes (Hatton et al., 2012); other physicians report a significant time burden because of the data entry format (Meigs et al., 2016). It is widely understood that EHRs efficiencies are experienced differently depending on context. Although, a group of clinicians credit the use of EMR with revenue generation from correct capture of services rendered to clients ensuring remuneration (Hatton et al., 2012), another large number cited cost of EHRs implementation, on-going maintenance and support as barrier to adoption (Friedberg, Chen, Aunon, Van Busum, Pham, Caloyeras & Brook, 2013; Hatton et al., 2012). Studies show marked increases in adoption rates post-HITECH incentive period compared to pre-incentive time (Adler-Milstein, DesRoches, Kralovec, Foster, Worzala, Charles & Jha, 2015). The incentive driven uptake is circumspect given the primary motive for adoption is financially inclined (Kellerman et al, 2013). The literature on the relative advantage of EHR is riddled with tensions, conflicts and contradictions that cumulatively paint a picture of uncertainty as yet unresolved and consequently negatively impacting on adoption.

2.10.4.2 Compatibility

The more an innovation can coexist and integrate into existing systems, the faster the innovation diffusion, because of the smaller change in behaviour that is required (Rogers 2003). Foremost, clinicians view their primary purpose as provision of health in the form of disease prevention, diagnosis and treatment (Kruse et al., 2014). It is therefore not surprising that clinicians lament HIT focus to be geared more towards administrative and regulatory requirements than on care processes and outcomes (Karsh et al., 2010). Equally important is the complex patient-doctor communication and trust-based relationship (Lown & Rodriguez, 2012). Clinicians place the patient at the centre of all processes. It is therefore understandable that paperless systems are viewed negatively as they physically, emotionally and cognitively takes the clinician away from the patient (Nambisan et al., 2013). The challenge is finding ways of incorporating the digital medium in ways that enrich the patient-doctor interaction and engage both parties (White & Danis, 2013).

Innovation has to be consistent with previously adopted ideas that form the basis for acceptable practice and create an environment of familiarity (Rogers, 2003). Physicians value the autonomy to apply their training and judgment to best manage their patients. This freedom to make care decisions is encroached upon as a result of the way EHR protocols are designed (Nambisan et al., 2013).

The use of EHRs has brought the emergence of “workarounds”. These are activities that innovation users conceive in an attempt to circumvent system deficiencies and limitations (Meigs et al., 2016). The majority of workarounds are a result of difficulties to integrate the use of systems into work processes (Ajami & Bagheri-Tadi, 2013). The result is that end-users partially use systems, develop "workarounds" or avoid using the system altogether. These coping strategies can result in incorrect use of technology and put patient lives at risk (Saleem, Russ, Neddo, Blades, Doebbeling & Foresman, 2011). It can also not be used at all, resulting in compromised operational functions and patient safety liability (Meigs et al., 2016).
With the limited time that clinicians have, navigating multiple system interfaces is reported as inefficient (Ajami et al., 2013). In addition, distracting alerts have led to information overload that interferes with work (Friedberg et al., 2013). Clinicians point out the imbalance in EHR data structure where it caters more to administrative, financial and regulatory requirements with minimal delivery of care relevance (Kuhn et al., 2015). Further, with standardisation efforts do away with the heterogeneity that

makes each patient encounter unique, EHR has lost the narrative format of clinical notes (Freidberg et al., 2013; Ober et al, 2015). The EHR format may meet system requirements but fails to live up to clinical requirements of records that are used for communication purposes among healthcare professionals (Kuhn et al., 2015).

2.10.4.3 Complexity

This is the degree to which an innovation is perceived as difficult to comprehend and use (Rogers, 2003). The complexity of an innovation as perceived by members of a social system, is negatively related to its rate of adoption (Kruse et al., 2014; Meigs et al., 2016). Scholars agree, perceived ease of use of technology is one of the strongest predictors of IT acceptance among users (Gagnon et al., 2010). Current practitioners did not grow up using information technology, nor did their clinical training require computer proficiency, hence their attitude to computer usage (Bredfeldt, Awad, Joseph & Snyder, 2013). On the contrary, physicians maintain EHR systems need to be more user-friendly and adaptable to individual clinic workflow (Meigs et al., 2016). They point out that data capturing is time consuming and inefficient (Friedberg et al, 2013). Yet another points out that it is not so much technology aversion of healthcare staff, as they use digital devices in their everyday lives. The problem is that of out-dated design of EHRs (Mandl & Kohane, 2012). Implementation complexity has also been mentioned related to system selection, installation, technical support and interoperability (Ajami et al., 2013; Audet, Squires & Doty, 2014).

2.10.4.4 Trialability

Adopters learn through trial use of an innovation (Nambisan et al., 2013). Therefore, an environment that facilitates trying out an innovation without having to commit resources or tamper with existing operations improves the prospects of adoption (Rogers, 2003). Live testing of IT systems in a clinical setting is difficult for both the vendor and hospital given the need to integrate such systems into existing institutional systems and processes. Additionally, EHR technology requires extensive training, hands-on experience and prohibitive capital injections (Bredfeldt et al., 2013. It is for this reason, that vendor simulations attempt to demonstrate how the innovation works to enhance familiarity of EMRs and lower technology aversion (Nambisan et al., 2013). As a result, hospitals resort to incremental models be it pilot testing, trialable modules or maturity staging instead of rolling out a comprehensive system throughout the entire organisation (Kellerman et al., 2013).

2.10.4.5 Observability

Observability entails the extent to which the results of an innovation are visible to others as observations or communication (Rogers, 2003). Although the impacts of EHRs as software might not be visually apparent, accounts of the user experiences are communicated in the social system networks (Rogers, 2003). HITECH rapid EHR adoption (DesRoches, et al., 2013) has facilitated an environment where potential adopters can learn from the experiences of users. Future adopters have the opportunity to observe and in turn communicate their experiences in their networks (Kruse et al., 2014). It follows that the more noticeable the evidence of improved experience, increased functionality, and better outcomes, the higher the adoption likelihood for new users (Rogers, 2003). EHRs were supposed to provide cost savings, efficiency gains, quality and safety improvements, to date these potential benefits are debatable (Zheng, Abraham, Novak, Reynolds & Gettinge, 2016). Particularly unsettling is the vast body of evidence on the unintended consequences related to EHR design, implementation, and use (Meeks, et al., 2014).

Another challenge points to the delayed productivity payoff of an IT investment in the course of intensive organisational changes (Jones, Heaton, Rudin & Schneider, 2012). Regrettably, in an environment of inconsistent and contradictory results, visibility is hampered and uncertainty prevails (Kellerman et al., 2013).

2.10.4.6 Social system and communication networks

The rate of innovation diffusion is enabled by existing communication channels in a social system (Rogers, 2003). Therefore, it is important to understand how the social composition of healthcare professionals drives EHR diffusion (Zheng, Padman, Krackhardt, Johnson & Diamond, 2010). The structure of network channels determines the pace of diffusion. A closely connected community may slow diffusion by blocking introduction of the innovation into the group. At the same time these communities are effective at acting collectively to adopt the innovation. Social contagion theory states that members' behaviour is influenced by the behaviour of their close associations (Zheng et al., 2010). Therefore, in a community the communicated accounts by close counterparts will influence the behaviour of prospective adopters (Angst et al., 2010). Adoption intervention requires deep insight into how word-of-mouth communication affects people's beliefs (Jackson, Rogers & Zenou, 2016). We find that in the healthcare sector interpersonal networks are a powerful source of influence; practitioners who work closely have been found to rely one another as information sources to overcome innovation uncertainty (Zheng et al., 2010). Further, it has been shown that it is more the physician's personal interactions that exert social influential

than professional networks (Zheng et al., 2010). This finding supports social contagion understanding that diffusion is a time-dependent process (Angst et al., 2010). In the hospital setting, half of the communication is face-to-face while the other half is electronic (Nambisan et al., 2013). Rogers argues that if a social system relies more on interpersonal relationships to create awareness knowledge then rate of adoption is slow (Rogers, 2003). Therefore, scholars point out that effective diffusion requires relevant communication in the appropriate channels and targeting the relevant stakeholders (Nambisan et al., 2013).

2.11 CONCLUSION AND TRANSITION

It is with this context that other scholars argue that aiming to reduce costs, improve efficiencies, improve adherence to guidelines and reduce errors although laudable are short-term goals that distracts from the long-term healthcare value of patient outcomes (Porter et al., 2013). In an attempt to reduce innovation uncertainty, knowledge is critical for the decision process (Rogers, 2003). However, in an environment where relative advantage is elusive (Burke et al., 2016), technology deficiencies result in workarounds, there is a culture of paper persistence, patient-doctor relationship is perceived to be at risk, system communication breakdown is widespread, long term outcomes are inconclusive (Radley et al., 2013), technology use has unintended consequences, and innovation barriers persist, there is a need for additional evidence to make the case that supports the innovation of EHR and leads to optimal use. To fully understand the phenomenon, the researcher proposes that real life accounts of those who come into contact with EHR and make decisions about the systems would be in a better position to shed light on the matter. The qualitative methodology followed in the subsequent chapters furthers that end with the sampling, collection and analysis of actual practice accounts of individuals involved in the implementation and use of EHR systems in hospitals.

CHAPTER 3: RESEARCH PROBLEM AND QUESTIONS

3.1 INTRODUCTION

HITECH as an attempt on the part of policy makers and regulators to address the burning platform of EHR adoption (Nambisan et al., 2013) has not led to a utopia of universal adoption and use (Hsiao et al., 2014). It is clear from the literature review that economic incentives alone are inadequate hence EHR ubiquity is elusive. There is still a lack of deep understanding pertaining to the phenomenon of EHR adoption and the interaction of the factors involved meaning research in this area still needs to continue in earnest.

3.2 PROBLEM STATEMENT

The adoption and use of Electronic Health Records (EHR) is understated, despite the known potential benefits of EHR and the availability of health information systems technology to bridge the healthcare supply-demand gap.

3.3 PURPOSE STATEMENT

This qualitative study sought to explore and elucidate the complex interaction of factors inherent in the adoption and use of EHR from the perspective of strategic, operational and frontline staff in the private urban hospital setting. The study uses a qualitative, cross-sectional, phenomenological design to understand these intricate interactions that impact on health technology adoption and use.

3.3 RESEARCH QUESTION

A thorough understanding of people's experiences as they interact with technology will contribute to a deeper understanding of the true impact of technology in practice, academia and society (Cilesiz, 2011). The research question is essential for directing and focusing the research project to ensure the appropriate methods and research instruments are used and that relevant data is collected to answer the research question at hand (Pietkiewicz & Smith, 2014).

The main research question of the project is:

What are the experiences of executive, managerial and frontline hospital staff regarding their exposure to and use of EHR in the course of implementation and use of EHR in the private urban setting?

The sub-questions are:

Sub-question 1: According to respondents, what health information systems were implemented?

Sub-question 2: What are the EHR functionalities and capabilities that their experiences are referring to?

Sub-question 3: What in the interpretation of respondents are the factors that hinder the adoption and use of an EHR?

Sub-question 4: What in the interpretation of respondents are the factors that encourage the adoption and use of an EHR?

The research questions will take us on a journey of discovering the experiences of staff involvement in the implementation and use of EHR in the private urban hospital setting and draw out lessons learned so as to propose recommendations in furthering the adoption of EHR to inform academia and practice.

3.4 OBJECTIVES

The objectives of the study are to:

- Audit the current EHR functional maturity of the private hospitals from information that participants share about the electronic records functionality in use. The maturity argument states that as you move along the maturity curve, factors of relevance change (Sun et al., 2015). Therefore, it is important to know the maturity level, as the level will inform the relevance of factors for that stage.
- Identify factors that influence EHR adoption and how they apply and manifest within and between the organisational levels including strategic, management and frontline.

- Examine and describe the setting of the phenomenon hospital diffusion network structure and seek to identify staff networks and how these could impact on EHR adoption.

CHAPTER 4: METHODOLOGY AND DESIGN

4.1 INTRODUCTION

The purpose of this study was to employ a qualitative method to help extract, analyse and synthesise the accounts of end-users, managers and decision makers as they relate to their work interactions with health information technology. In the process, the researcher aims to bring forth relevant factors that would either promote or suppress EHR adoption and use in the local private hospital setting.

4.2 METHODOLOGY AND RESEARCH DESIGN

The phenomenological research approach was appropriate for the purpose of this study, which was to explore and unpack participants' experiences of EHR operations. Phenomenology emphasises a focus on how the world appears to others (Pietkiewicz et al., 2014). This approach made it possible to discover knowledge from accounts of respondents in their social environment (Saunders & Lewis, 2015). The semi-structured interviews facilitated an environment wherein research subjects could freely express their views and interpretation of the research matter and provide insights. The work endeavoured to make sense of observations and findings in an effort to come up with a deeper understanding of the issues that relate to EHR adoption and use. The cross-sectional nature of the project meant that the phenomenon of interest could only be studied at a single point in the constantly changing life cycle of the unit of analysis. However, the research instrument was tactfully used to bring up insights that would juxtapose the period before and after the implementation of EHR.

4.3 POPULATION AND UNIT OF ANALYSIS

The population of this study comprised hospital personnel whose work activities were impacted upon in one way or another by electronic health record systems. This included health professionals, administrative staff, IT personnel, management and executives. In the South African setting, the healthcare sector consists of public and private healthcare. The private health sector is comprised of Mediclinic, Netcare, Life, and National hospital networks in addition to the independent hospital groups. The study was limited to one of the four major hospital groups. This was to avoid incorporating unique policy variations that would prove difficult to account for and invalidate the results of the study. The participating hospital group is comprised of 55 owned hospitals with 9,052 registered beds, 338 operating theatres, and 87 retail and

hospital pharmacies and an emergency medical service. The two hospitals included in the study structurally report to the regional structure that in turn reports to highest tier of the hospital group.

For the purpose of this study the unit of analysis included EHR decision-making personnel and end-users within the three stipulated tiers of the targeted hospital group in Gauteng. The hospital participants were divided into three tiers being executives, operations management and the frontline staff.

4.4 SAMPLING METHOD

Healthcare professionals serve an essential role as EHR stakeholders and their relationships and interactions result in network structures that influence EHR diffusion (Kreindler & Young, 2014). This study sought to have representation across EHR stakeholder continuum from clinicians, healthcare practitioners, administrative staff, IT personnel and hospital decision-makers. It was important to include participants that use the system and those who make decisions about the system.

The hospital group in question was identified on the basis of convenience sampling given it was the one hospital group that the researcher had access to. Subsequent to that choice, the hospital group website was used to locate fifteen hospitals in the Johannesburg metropolitan area to serve as the target sample for the study. A process that involved sending out letters of request for permission to conduct a non-trial study at the fifteen facilities followed (See Appendix 12). Three hospitals responded acknowledging their willingness to have the study conducted at their facility. Upon securing the three sites, a final approval from the hospital group level came through and granted permission for research interviews to commence. In the course of the data collection process, one of the hospitals pulled out of the study citing deficient research subject matter (See Appendix 11).

The richness of the data hinged on collecting insights from a broad range of electronic health records users and decision influencing stakeholders. The two hospital sites were segmented into strategic, management and frontline staff layers. Again, due to the hospital time constraints the second hospital expressed difficulty with allocating six unit managers' time away from work for the interviews. A compromise was reached that included changing from individual six interviews for the second hospital to a focus group of the six unit managers. In total the study interviewed 16 respondents with 11

one-on-one sessions and one focus group. This translated to 11 unit managers, two hospital group managers, a nursing manager, a regional director and one executive director constituting the study sample. In their study, Sharp, Grech, Fielder, Mikocka-Walus, Cummings & Esterman (2014) identified 5 to 25 participants as an adequate sample size for a qualitative research study. The sampling method used in this study was therefore purposive (Palinkas et al., 2013). The study design was structured to have representation from the three tiers already stated above and with participants that would contribute to the study with their experience and knowledge of the subject.

4.4.1 Inclusion Criteria

Suitability was important in order to ensure the ability to contribute quality input. Criteria were used as a guideline of what interviews to include in the study.

a) Participants must have been part of the organisation for one year or more.
b) Participants needed to be either in upper management, middle management or professional layer.
c) Participants also needed to be an EHR stakeholder in the form of a decision maker or end-user.
d) The ideal situation would be that a participant would be willing to participate in the interview voluntarily and set aside 30 minutes to 45 hour. This time would depend on the participant' availability and work responsibilities.

4.5 PILOT

Given the difficulty in securing interviews with time constraints of health workers, all clinical participants were included in the study. The end result is that the personal assistant interviews that were the first ones to be done were excluded from the study because of deficient subject knowledge.

4.6 DATA COLLECTION TECHNIQUE

The data collection process was adaption from Mascia, Di Vincenzo, Lacopino, Pia Fantini and Cicchetti (2015). Semi-structured interviews were used to elicit information from participants allowing them to reflect on their experiences and freely express views and insights. Interviews were conducted with the guidance of the interview protocol (See Appendix 2). This is a qualitative data collection method used by the researcher to direct the activities of an interview. The flow of the interviews was highly fluid and

was directed by the participants' responses. This meant that participants were not presented questions in the same order or wording. The scope of the open-ended thematic interview questions in the interview protocol was informed by the literature that had been reviewed. The questions were focused on discovering insights into the phenomenon of study.

The interview process was structured such that the respondents were emailed the consent details and purpose of the study prior to the day of the interview. On the day of the interview participants were again reminded of the purpose of the study. Going through the details of the consent then followed and voluntary participation in the study was explained, the research process and participant involvement was stated, the study benefits outlined, information about ethical approval processes given and contact details given in case of queries (See Appendix 1). Informed consent for study participants is an essential practice that reinforces the ethical research process (Bernard, 2013). Once the consent was signed, the participants' demographic data were collected. The research subjects were then made aware that the interview would be audio-recorded with their consent. An Olympus digital voice recorder was used with a cellular phone recorder as backup. In the course of the sessions, the researcher listened attentively and created a rough understanding of issues raised. Unit manager sessions took about 30 minutes in their respective wards with multiple interruptions in the form of ward staff, phone calls and staff from other wards. The digital work distribution in the ward involved clerical data capturing of ward personal assistants (PA) with the nursing staff responsible for patient care. In most of the wards, the data entry was done by the PA making them system experts while the clinical staff utilised the system output. This meant that PAs were interviewed in addition to the unit manager. The PA interviews were then withdrawn from the data set to represent the pilot sessions. The reason for the exclusion was as a result of the inability of PAs to talk to the study subject. Given that innovations are adopted as closely related yet distinguishable elements in technology clusters (Rogers, 2003), in the course of the interview, other systems not necessarily EHR that participants use as part of their work surfaced and were incorporated into the interview.

The nursing managers and hospital managers' interviews were conducted in their offices at the hospital and lasted about an hour. The regional director and executive directors' sessions took place at the headquarters boardroom and lasted little over an hour with minimal prompting from the researcher. The interview format gave the researcher space to manoeuvre and allowed for opportunities to bring out relevant

information and even discover information that was not previously thought of but is actually relevant to the study (Saunders & Lewis, 2012). The researcher reviewed the audio-recordings concurrently with the notes after each interview so as to be better acquainted with the issues and context. Researcher observations and comments taken during the interview sessions were compiled for use in the analysis session so as to enrich the session content by giving visibility into the context. The audio-recorded data was labelled, transferred to and saved to the cloud DROPBOX file that is password-protected. The recordings were then transcribed and transcriptions saved on both the internal laptop drive and the cloud DROPBOX file that are both password-enabled where they are to stay for the stipulated five years in terms of the university's requirements.

4.7 COLLECTED DATA ORGANISATION

To organise the collected data of transcribed audio recorded interviews, coded identifiers were used to ensure the confidentiality of identities of participants and make it possible to access the transcript data expeditiously. The identifier for each research participant consisted of their position in the hospital, followed by their age**,** then a two-letter abbreviation of the hospital, abbreviation representing the corresponding ward for frontline staff or organisational tier being strategic or managerial for other and lastly their gender**.** As an example, UM50MCW5F means unit manager who is 50 at Manymore Clinic in ward 5 and female. The data was continuously backed up to mitigate any risk of lost data.

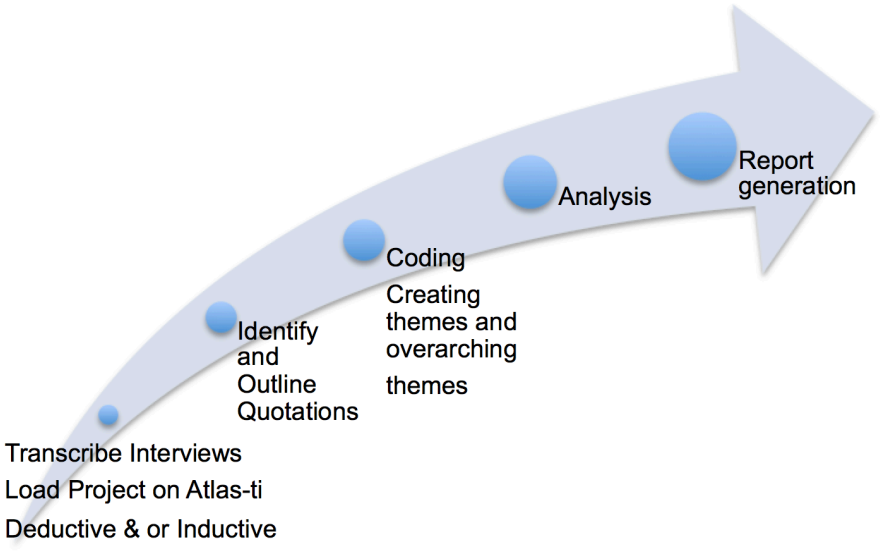


Figure 4.1 Data analysis process.

4.8 DATA ANALYSIS

The data analysis was performed on the collected data output of 16 participants who contributed to semi-structured, audio-recorded and transcribed individual and focus group interviews. The transcripts were quality reviewed against the audio recordings. The files were then uploaded into qualitative analysis software called Atlas-ti to organise, manage, analyse and store the data. After uploading the files onto Atlas-ti, the project was then given a name to be saved under. This study used an inductive approach to Computer Assisted Qualitative Data Analysis (CAQDA) to generate emergent themes. However, these themes were then tied to the theoretical framework in the analytic report. All transcripts were read again to extract words, statements, expressions, sentences or paragraphs that related to the phenomenon under study. The goal was to identify and draw-out themes in the subjects' descriptions of their experiences. These excerpts were then marked as quotations and stored in Atlas-ti. This process was done for all the uploaded files and saved.

The quotations were reviewed again and labelled with a phrase denoted as codes, which capture the extracted meaning of the quotation. This labelling of quotations is the process of coding. Codes were used to label all the relevant excerpts of the qualitative data. The codes would again be grouped into a higher level of hierarchy called group codes with identification of common themes in the respondents' descriptions of their experiences. These codes would be grouped, regrouped, linked and relinked depending on associations and relationships with others expressing similar meaning. This analysis process was repeated in a sequence that included reading, reflection, discovery and grouping of related and relevant phrases. These phrases were then distilled into relevant themes describing the participants' experiences or perspectives and relevant to the study question.

4.10 ETHICAL CONSIDERATIONS

The relationship between researcher and participant has to be appropriately managed. Researchers have to maintain respect of privacy, have open, honest interactions and avoid misrepresentation. In addition, issues of anonymity, confidentiality and informed consent are essential (Sanjari, Bahramnezhad, Fomani, Shoghi & Cheraghi, 2014). Research projects are evaluated by the ethics committee of the university to ensure that the investigator is adhering to ethical principles and for the protection of research participants. This research proposal was first reviewed and assessed by the Gordon

Institute of Business Sciences (GIBS) Research Ethics Committee (REC). This was then followed by health ethics clearance from the University of Pretoria Health Ethics Committee owing to the involvement of healthcare staff. Lastly, the proposal had to be approved by the hospital group's research operations committee. Copies of those documents are included in Appendix 3-8.

4.11 LIMITATIONS

In research limitations are potential influences, which a researcher cannot control for. (Kirkwood & Price, 2013).

4.11.1 Selection bias

The study identified one out of the three hospital groups existing in the private health sector. Questions could arise about whether observed patterns were a result of the specific organisational factors. Conclusions might therefore not be transferable to the entire healthcare sector.

4.11.2 Cross-sectional nature of the study

The study took a cross sectional approach of collecting data at a single point in the adoption cycle of the hospitals. The study did not have the benefit of incorporating the element of time. The benefit of a longitudinal method is to allow for evaluation of a phenomenon at various points in a study, for example, at the start of a project and then at its completion.

4.11.3 Private vs. Public Hospital

Private hospitals were the focus of this study. The best scenario would be to have both private and public hospitals represented to eradicate any bias that might be a result of private ownership. Due to time limitations and approval requirements the private sector proved to be the fitting option.

4.11.4 Geographic Selection

Geographic limitation is a relevant consideration given that the selected hospitals were all in Gauteng. Studies have shown that the urban-rural divide to a greater extent is resource-based and does play a role in adoption (Jones & Furukawa, 2014).

4.12 SUMMARY

Using semi-structured interviews, the study sought to understand the subjective interpretations of decision makers and staff who encounter EHR systems in their daily work. These assessments will shed light on the issues involved in the adoption of electronic medical records in the context of a hospital. The following chapter reports on the study findings.

CHAPTER 5: FINDINGS

The purpose of this qualitative study was to uncover emergent issues relevant to EHR adoption that were elicited through the perceptions of EHR end-users and decision makers regarding the implementation and use of EHR in the private urban hospital setting. Chapter 4 described the qualitative phenomenological methodology and design of how the population was identified, the unit of analysis defined, the sample drawn, data collected and the computer assisted qualitative data analysis performed. Sixteen semi-structured interviews were conducted comprising of 15 one-on-one interviews and one focus group made up of six unit managers. The other fifteen interviewees included a medical oncologist, infection control sister, clinical facilitator, unit managers, two hospital managers, regional director and an executive director. This chapter presents the findings from the interviews.

5.1 DESCRIPTIVE ANALYSIS

Table 5.1 exhibits the characteristics of study participants listing organisational level, gender, age, organisational tenure, duration of held position and computer competence. Literature does show that demographic identifiers like age are correlated with EHR (Porter, 2013).

Table 5.1: Descriptive Analysis

Characteristics of Participants	
Total number of participants	21
Organisation Level	
Strategic	2 (1 Female 1Male)
Managerial	3 (3 Males)
Frontline	16 (16 Females)
Female : Male	17:4 (33%)
Age in years	
30-39	5
40-49	7
>50	9
Organisational Tenure	
1-4 yrs.	5
5-9	7
10	9
Position Tenure	
<1	3
<5	10
More	8
Computer Literacy	
Minimal	3
Moderate	6
Advanced	12

Table 5.3 is a representation of the organisational context in which the technology is embedded (Lipsky & Avgar, 2012).

Table 5.2: Hospital parameters

	Hospital 1	Hospital 2
Number of Beds	204	279
Number of ICUs	1	**3**
Ward specialities	Gynaecology, Obstetrics Neonatal & Paediatrics	Multidisciplinary
Emergency room	None	Present
Ownership	Private	Private
Setting	Urban	Urban

The interviews and focus group were aimed at answering the following two sub-questions:

Sub-question 1: What according to the respondents were the implemented and used EHRs?

Sub-question 2: What are the EHR functionalities and capabilities that their experiences are referring to?

5.1.1 EHR Maturity

It is important to understand the functions and capabilities of EHRs to give context to participants' responses. This study did not focus on one EHR application but rather looked at the technology cluster of all the other systems that are related to the work experiences of participants (Sun et al., 2015). This, according to literature, is the closest representation to how these systems are in real life (Weber-Jahnke et al. (2012).

Research subjects reported on the system capability to include: administrative systems, hospital process systems, billing, electronic patient demographics, medication lists, pathology and radiology results management and antibiotic stewardship clinical decision support system with clinical guidelines and reminders. When measured

against the Institute of Medicine EHR maturity model, this system is basic with elements of decision support that fall under comprehensive category.

5.1.1.1 Hospital systems' technology cluster

- SAP

> *"It entails from admission to, wards movement, if a patient is being moved from one ward to another. For example, if a patient is having a gynae procedure they will go to a normal gynae ward and once the patient moves from that ward to an ICU ward, the patient is transferred. If the patient has complicates and takes us to the lawyers we have to know from which ward she was initially admitted and then when was she moved to that certain ward so anything that has to do with the patient's stay in the hospital, we use SAP".*

- Bluebird – Antibiotic Stewardship clinical decision support system.

> *"It is a system which is actually linked to our pathology labs and if there is anything, for example that we have sampled from a patient for investigation the result will automatically be sent to different sites. Infection control will get the results, head office will get the results, the doctor can access the results. There are different systems for managers and different systems for PA's. Because PA's need to capture the devises on their system, e.g. central lines, catheter, if the patient has a surgical wound, they need to capture when the patient was operated to track for pose operative infections (SSI), surgical site infections. Any infections can be tracked on BlueBird. Catheters are logged, what time they are inserted and what time they are taken out so that we can track that. Pharmacy also gets our results, even from blood cultures, for the appropriate antibiotic to be given which is not resistant to the antibodies in the culture" (UM50PLW6F).*

- Mobit

> *"There are two processes from pharmacy, which we have introduced. It's called MoBil and MoBit. Previously you would have a charge sheet: This is Jason who is admitted to this ward and we've used 1 syringe, 1 needle and charge it in accordance with that. Whereas now we work on a scanning system, so you are automatically billed. If I'm taking this device I type in your case number, apply it, it has scanned in the barcode and it is automatically onto*

your account. So, that's been going well" (NM32SHMM).

- Kronos

"There if Kronos which is our time keeping and attendance and you register yourself when you arrive in the morning. The systems are Kronos, BlueBird, SAP, Mobil and VisionX for leave and salaries".

Mobil

"So, further electronically what we have done in Netcare now is enhanced our medication charging, usually it was done on paper before, it has been changed over to a barcode system. So they have got an iPad in the wards and in the ICU with scanning capacity so they will just scan the barcode over the item, or they will just select the item if they can't find it on the barcode and then bill that directly to the patient. Or if the patient didn't use it then credit it back out of the patient's account" (HM45SHMM).

- VisionX

"With Visionex you have so many different aspects now where employees should actually write a letter or a document that I need to take leave. You're now doing it online, ok" (NM32SHMM).

- Laboratory information system

"It is a system which is actually linked to our pathology labs and if there is anything, for example that we have sampled from a patient for investigation the result will automatically be sent to different sites. Infection control will get the results, head office will get the results, the doctor can access the results" (UM50PLW6).

- PAC

"Then we also make use of a PACC system, which is our radiology system. Those systems are at every unit, including in the doctors' rooms. So, you will be able to pull up reports. You will be able to pull out actual X-rays, CT-scans, MRI's and attach them in a bundle" (NM32SHMM).

- Pharmacy system

  "Pharmacy also get our results, even from blood cultures, for the appropriate antibiotic to be given which is not resistant to the antibodies in the culture" (UM50PLW6).

- Staffing tool

  "The other system that we are using is automated to an extent: staffing tools. So, we have your theatre and you have your ward and your ICU staffing tools. So, by just entering the patients it's very interactive. By entering the patients, you can determine how many nurses you need for a shift: for night shift, for day shift --- So, it's very interactive on that point. Lovely reports that are automated from there and pulled through to the Nursing Managers, Hospital Managers - telling us where we are on staffing, what our skill mix across Registered Nurses, Enrolled Nurses, Health care Workers and {inaudible} are sitting at" (NM32SHMM).

- **Case management system**

  "So there is a system that tells the case manager that certain cases have not been updated with the medical aids, there are no authorisations and queries have not been answered" (HM52PLMM)

- Maintenance System

  "The latest system implemented is in technical department, if something wrong is identified, I fill in a SAP PM request to technical and property to report structural building issues, e.g. lights not working etc. A reference number if received stating that the query has been logged. Then technical, the clark, prints out the job card and given to the appropriate technician with set time limits based on tracking of when requests are made and this can be tracked for performance" (HM52PLMM).

The next section provides answers to sub-questions 3 and 4.

Sub-question 3 & 4: What are the factors that encourage (benefits-enablers) or hinder (Challenges-barriers) the adoption and use of an EHR?

The answers were codes and gave rise to the themes shown in Table 3.3 which are discussed below:

Table 5.3: Predominant themes

Theme 1: Benefits of Electronic health records (+Relative Advantage)
1.1 Operational process efficiency
1.2 Data analytics benefits
1.3 Quality of care delivery
Theme 2: Electronic health record Benefit erosion (- Relative advantage)
2.1 Acquisition resource investment (Cost)
2.1.1 Human Resource investment
(1) Training & Support (2) IT & Computer literacy
2.1.2 Technology, Equipment & Facilities Investment
(1) Infrastructure (2) Access terminals (3) IT Equipment (4) Facilities
2.2 System related factors (Usability & Functionality)
(1) User-interface (2) System functionality(3) Training & support
2.3 Networks & Communication channels
(1) Mis-communication (2) Lack of Staff engagement
2.4 Increased workload, duplication & redistribution (Work flow)
2.5 Organisational culture & process alignment
(1) Paper persistence (2) Centralized decision making
2.6 Data management
(1) Safety & security (2) Data load & value
Theme 3: Promoters of EHR
3.1 Leverage human resource
(1) Communication channels and Networks & super users
(2) Staff engagement & empowerment
(3) Positive training & support
(4) System utility & Resource knowledge & Champions - super users
3.2 Paperless outlook
(1) Digital trend

(2) + EHR attitude
(3) + System view
(4) + Paperless view

5.2 THEME 1: BENEFITS OF EHR

The participants' experiences were very much in line with the current literature indicating that health information systems have numerous benefits in the hospital setting for patients, staff and management. The identified benefits were grouped into four categories: (a) organisational process efficiency, (b) data management associated benefits (c) quality of care improvements and (d) system feature associated benefits. There are advantages of transitioning from paper medical record to an EHR.

5.2.1 Sub theme 1: Operational process improvements

The interviewees noted that the use of electronic systems allowed them to improve on certain operational activities and perform the faster and more conveniently. They reported that the barcode scanning system had simplified the process of billing patients for their use of medical supplies.

> *"Now we work on a scanning system, so you are automatically billed. If I'm taking this device I type in your case number, apply it, it has scanned in the barcode and it is automatically onto your account. So, that's been going well. For XXXXXXX 95% of our billing and charging is done online, however you do have system issues and we do revert back to manual"* (NM32SHMM).

The stock control systems helped the wards to manage and properly bill clients.

> *"We would charge things individually, sometimes we were undercharging, and sometimes we were overcharging and sometimes and there were lots of discrepancies. Stock losses were bad"* (UM48PLLWF).

One of the unit managers attested to the Mobit systems added advantage when it comes to managing stock in the ward.

> *"With Mobit it helps to reduce stock losses. Because we don't have to charge manually"* (UM48PLLWF).

The hospital manager was in agreement.

> *"In the short time that we have introduced these systems, in the wards and theatre, we have found that we have a 25% improvement on stock control"* (HM52PLMM).

Participants narrated the convenience of using the Mobit system that allows for pre-packaged billing of theatre supplies.

> *"They will charge the doctor and not the individual items. They will all be loaded instead of individual charged items and credit what is not used…. Unlike in that side when we had to charge one by one. If you scan you know and you are sure you have scanned the right thing. Manual punching in is not always accurate"* (UM48PLLWF).

The hospital manager attested to the benefit of Bluebird system in informing process improvements:

> *"The process though BlueBird has taught us certain short cuts and how to be proactive in certain areas. Plus, we have a monthly meeting with the HOD where we present an operational document which is balances scorecard based and on BlueBird stats are presented there. Anything seen from BlueBird is used in training and education and urgent risks are communicated immediately on a daily basis. The system has helped us manage infection rate and given information related thereto. It is an early alert system and has helped understand infections"* (HM52PLMM).

Bluebird use can even result in cost savings for the patient if antibiotics are prescribed appropriately.

> *"There is obviously a cost issue to abuse of antibiotics because someone pays for them eventually. So the patient pays for something that actually has no efficacy, is not indicated, the medical aid ups your premium next year by 15% because the health care costs are out"* (RD35NCSM).

5.2.2 Sub-theme 2: Data management benefits

Participants highlighted the benefits associated with the value of electronic data including availability, access, time saved, avoiding duplication, retrieval, sharing of information, real-time date, and the associated benefits of data in performing their duties.

The hospital manager outlined the benefit of saving time and avoiding duplication of activities as a result of system communication.

> *"So for instance, if the data is captured from the doctor's rooms already, we will already have that, so when the patient arrives at our reception they will immediately be assisted, and instead of taking for instance half an hour to get the data captured on the system, it will already be there"* (HM45SHMM).

It does not matter which hospital a patient went to; if it was part of the hospital group the patient's information would be accessible.

> *"....all the information is on the system and this is linked throughout the Netcare Hospitals.....With SAP information can be transferred to other departments as well"* (UM38PLSAPF).

The hospital manager also reported on the convenience of real-time data.

> *"On a daily basis, I get our revenues, our patient days, our occupancies etc. and then there is a specific section which indicated that discharge is not yet billed, meaning the final bill is not yet sent to medical aid"* (HM52PLMM).

The infection control person expressed the convenience of being able to retrieve and manipulate system information.

> *"With Bluebird I can get information and filter it from the previous year and maybe 2 years back, I can get that information from Bluebird. Even maybe I want to trace something maybe I suspect this thing has been there for some time and maybe we didn't know"* (ICS43PLFF).

One of the hospital managers spoke to the use of data intelligently.

> *"For instance, if we can show efficiencies in something that you can measure like the bills coming down from three days to one day, or half a day, I mean that is something we can measure. At reception, we have certain hours that are really busy times, and if we can maybe see that during those times there are less queues of people, or less unhappy people because they have to wait in queues, that is perhaps also something that we can say you know what we have achieved what we wanted to achieve"* (HM45SHMM).

There is associated enhanced mobility with the system.

> *"You can even work from home if you are comfortable doing that because you can take your iPad with you and sometimes you can even call the wards to find out what is happening with this"* (ICS43PLFF).

5.2.3 Sub-theme 3: Quality of care and delivery

Respondents pointed out that the Bluebird clinical decision support system promotes rapid diagnosis, early intervention, evidence-based antibiotic management, best practice and adherence to infection control clinical guidelines.

The Bluebird system has simplified the infection work-up process.

> *"Before those results come out in the lab, they print it, they put it either in the patient's file when the doctor comes in 24 hours later and says, oh, you've got this super-bug. Then informs the nursing and say what do we do then the nursing says these are the protocols, but currently with a system like Bluebird it sends an alert electronically – there's no printing, they still do the extra measures of sending an SMS, which I think is system-generated and make a call to the doctor to say by the way you've got a highly infectious or a highly resistant bug in your ICU, before it spreads to everyone, please be aware"* (RD35NCSM).

Clinical guidelines embedded in the EHR promote consistent use of evidence-based care.

> *"It's about surveillance, monitoring. It's about appropriate utilisation of antibiotics in terms of your patient and their stay. It's about information at hand, informing your multidisciplinary team" (NM32SHMM).*

> *"When I open Bluebird, I see that she has an infection, I have to check here what is the bug sensitive to. Every bug has an antibiotic that it is sensitive to, so now I go onto the antibiotic stewardship preventing the abuse of antibiotics"* (UM60PLWICUF).

The system generates real-time infection-control data on patients.

> *"It shows you all the ward patients and what they have, catheters or infections… The system tracks when a catheter is inserted and in which theatre. If there is an open wound this is also loaded before an audit can be done"* (UM53PLW7F).

According to the unit manager, Blue Bird promotes early intervention.

> *"If anything, it is your response time because if there is anything that has been cultured that needs isolation. If the infection control sister is getting the results rather than having to wait for the print out. You are able to act much faster" (UM50PLW6F).*

The regional director viewed the system as helping staff to adhere to clinical guidelines.

> *"It gives us at least a bit of lead time, but better advance timing and then they put in the right protocols. But once you do that you're also recording on the system what you have done and it gives you the guidelines based on what bug and what strain it is: is it clinical, is it blood-driven infection, or whatever it is what you need to be doing as an infection control"* (RD35NCSM).

Computerised records are not only legible but also able to be stored for a long time.

> *"Paper fades and we have to keep records of birth for 20/21 years. Imagine putting papers away for 21 years, they fade, you know, so if you have it*

electronically, your visibility and reading factors will be much better. All of us don't have the neatest handwriting" (UMSHFG).

The computer can also be viewed as interfering with the doctor-patient relationship.

"I am sure that they don't want you to be on the computer, in fact, they complain to me about other doctors that whatever they do on the computer, I don't know for that can be to go to the conversation with the patient but the fact that they don't pay attention but they look at the screen and not at them" (DR67MPFF).

5.3 THEME 2: EROSION OF BENEFITS OF EHR

These section deals with issues that were brought up and believed to be contributing to the erosion of the previously disclosed advantages of health information systems. These themes have been sub-divided into a further six subthemes.

5.3.1 Sub-theme 2.1: Acquisition resource investment

Participants reflected on the financial commitment that the organisation has to make for technology acquisition. According to participants, cost is an important consideration in the decision-making process related to systems acquisition, implementation and on-going operating. This cost is not limited to technology acquisition but includes training and support.

The executive director indicated that a cost benefit analysis was crucial in making decisions about systems.

"The number of dosage errors that we pick up, would you really invest R7bn in a system to do this. And does this system really prevent those or not because of this pop up sort of story" (ED54NCSF).

The regional director agreed pointing out the delayed returns of IT investment.

"the initial capital cost of putting the systems is quite prohibitive, many times, and the return of investment is not instant so it fights for attention and capital with other resource requirements" (RD35NCSM).

The unit manager pointed out the cost implications of bringing the whole organisation up to date.

> *"I said, this has only been happening for like 5/6 years that Netcare has been taking care of such a big stance in computers. So, you must know, to catch up is a huge outlay of cash whereas with radiology computers and interventions and systems and the memory and stuff that it requires – they have been updating all the time"* (NM32SHMM).

The hospital manager eloquently reminded the researcher that at any one time there was always the scarcity of resources to contend with.

> *"Money is also a challenge and capex so you cannot just change everything. In 2000 there was a changeover of computers and there was an understanding that everything would be updated for the new systems, then you move to a new hospital and find a number of computers have not been upgraded. When you ask why you get told that at the time those were not thought to be important and we don't have enough capex now, we'll do it late"* (HM52PLMM).

5.3.2 Sub-theme 2.2 Human resource investment

In organisations, the decision to implement and acquire health information systems goes hand-in-hand with the training and support of staff. A hospital has to ensure that resources are available for both technology acquisition and to train and support staff in the use of the technology.

5.3.2.1 Sub theme 2.2.1: Training & support

It is clear when one listens to staff accounts that training and support are pivotal to the success of electronic health information. Training can lead to success or failure of system rollout. Training and support qualities relating to quality and quantity of surfaced in the course of interviewing.

Interviewees raised the need for onsite support post training.

> *"But I will tell you that our problem here the training is conducted by people that are external, say they come from head office or whatever and then we are left on site with 2, 3 HR officers, who are not lime managers, who do not know what*

> *we do on the system as line managers and therefore find it difficult to offer assistance to our staff members when they go to HR. because they are not line managers they do not do what we do so when people go to them for help it is minimal it does not go the full length because they don't know what else to do"* (UMSHFG).

The training site has bearing on hospital operations, particularly if carried out at a remote location.

> *"I just feel the pitfall in business today is that the training is not hands on at the hospital, so what is happening is we need to send our staff to Aucklandpark that is our training centre, so they are for a full day out, or two or three days depending on how long in Aucklandpark for the training"* (HM45SHMM).

Training is part of using the system.

> "Yes, you can't use Blue Bird without training. It's not that easy" (ICS43PLFF).

The need for training cannot be divorced from implementation.

> *"Netcare does things for window-dressing. It looks good, but the actual implementation and the results are just junk. Because they don't train their people properly and don't focus on what is relevant"* (CF50PLNNUF).

Failure of training will have effects operations.

> *"So with rolling out of that system I don't think the staff got the grasp of what they are supposed to be doing because they just expect the managers to do it"* (UMSHFG).

The quality of training and applicability to work is vital. UMSHFG was quite vocal about this and said:

> *"Training is conducted by people that are external, say they come from head office or whatever and then we are left on site with 2, 3 HR officers ... left on site with 2, 3 HR officers, who are not line managers, who do not know what we*

do on the system as line managers and therefore find it difficult to offer assistance to our staff members when they go to HR".

"*Unit managers come and unit mangers goes you know, people come and people go and remember we have been with Mobil for about a year and the last physical training was done a year ago..... How many new employees, how many new unit managers, Valentia has been here for 10 months and she never had that training, not even the Bluebird training*".

"*Even our IT person has no knowledge about these things, so if he was supposed to support us in any of these systems he does not know the systems he only knows his systems and maybe with SAP and that but he is not involved with Mobil, Bluebird, VisionX. Our computer liaison is not even*

"We had a system failure where the unit in my unit gave up, so that's what happened it took so long I had to get another one from her, our IT person couldn't do anything and for all that time, it must have been a week, we had to do manual charging on SAP. So there was no technical support, no back up".

5.3.3.2 Sub theme 2.2.2 IT and computer literacy

Interviewees agreed that computer literacy is an issue among frontline staff, particularly the older generation. IT and computer literacy is a cost that needs to be taken into account because if staff are computer illiterate it would even take many more and longer training sessions.

"A lot of the nurses are not computer literate and the level of skill especially with respect the elderly people who have been on the floor for many years" (UMSHFG).

Also, a lot our older staff is not computer literate. I started as a nurse and there were no computers. When I had to start on computers I taught myself.

"We have created kiosk for staff on the leave issues, in the staff dining room but it is not used because the people are not computer literate, yes they can use their smartphones but when it comes to using the computer, the transition if difficult" (HM52PLMM).

It is not just illiteracy with computers; there is also an element of age and lack of job mobility.

> *"The thing is for the older generation, the ENSs the RNSs that haven't moved up they are stuck they can't, they don't know, they are 60, 65, 70 years old. With respect, they don't know how to access computer systems. They are nurses, that I think is the biggest challenge in my opinion"* (UMSHFG).

The clinical facilitator witnessed the lack of computer literacy even in the nursing school.

> *"I think nurses, on the whole, nurses are very computer illiterate, especially here in SA. I know, because I have students and that is across the centres of the younger ladies, the older girls, the more senior qualified nurses are just not very computer literate"* (CF50PLNNUF).

The regional director agrees there is a need for formal computer instruction as part of the nursing curriculum.

> *"Training for the health care professional needs to be much more IT-inclined than I feel it is currently*" (RD35NCSM).

The inability to use computers can interfere with work functions.

> *"Like with the Mobil thing it is computerised and they have to charge things on the system but you still find people who are struggling because they are not so familiar with computers and they need assistance when the system has frozen"* (UM37PLWANCF).

> *"In general, regarding electronic health records, I think the major hindrance will be your age analysis of your staff. Generally, our if you look at your age analysis - it's our old staff that really battle with the computers and accessing data, because it's not something that is part of their everyday lives"* (NM32SHMM).

5.3.3.3 Sub-theme 2.2.3: Technology, equipment, facilities

Alongside investing in the hardware and software, there is still a need to have supportive technologies that enhance the use of the EHR platform like printers, backup computers, internet and facilities where staff can go to get onto the system.

- Infrastructure

> "*Sometimes there is no WIFI connectivity [and] the programmes don't work because they are internet based and we are then offline but it is better now. There is support for both systems. IT will come and help and sort out the internet problems*" (UM53PLW7F).

> *"The other is that we're also dependent on internet connectivity. We have issues with Telkom or we have issues with Mweb, etc. So you do have downtime*" (NM32SHMM).

> "*In order to drive that you need an appropriate IT infrastructure, like, as you said it's no use doing the radiology intervention and then you can't even have it in the doctor's rooms. So, the IT infrastructure needs to be there. It's like me giving you a Ferrari and saying go for a spin, but I've got the keys in my pocket. That's never going to work. So, they both have to complement each other and ja, we've spent a lot of money*" (NM32SHMM).

- Access terminals

There are not enough terminals to get onto the system.

> *"My issue is it's brilliant that you're allowing people to capture leave online, but make sure that there is appropriate resources available. You have accessibility issues. Like this same hospital, for example. Staff have to come through here and fill out leave and check their payslips because it's all automated. And I'm saying, yes, there is an option of actually saying you can do it in the ward. But there are accessibility issues there as well. When you're talking about systems talking to each other, I think we first need to start with the resources"* (NM32SHMM).

"There is only 1 computer for staff access to VisionX so myself or my PA have to sometimes sacrifice our time on the computer. If they could get another 1 or 2 computers for VisionX then it would be better" (UM48PLLWF).

"I came from a hospital were each department had its own printer, I came here and there is a computer on every floor and we aren't allowed to use the printers. So for me this is a big problem and you have to run around to get your printing and for the staff with the confidentiality, the staff could come print from my office and it was confidential" (UMSHFG).

"There is only 1 computer for staff access to VisionX so myself or my PA have to sometimes sacrifice our time on the computer. If they could get another 1 or 2 computers for VisionX then it would be better" (UM48PLLWF).

IT equipment

"*The other thing that I find difficult is equipment wise, I don't think there is enough computers or desktop with the systems. My staff use either the stock controller or the PA, so there is not enough equipment for the staff to do that or they must go up to HR which only has 1 computer*" (UMSHFG).

"...but this is going to be a costly affair. E.g. you cannot just have 1 computer, you will need mobile computers, which can be carried around with the nurses to input data immediately e.g. vital signs being checked" (UM53PLW7F).

"Just the other day one of our Nursing Managers was telling me that 2 of our Unit Managers doesn't have a computer. In this day and age. Really?! So, resources is one thing" (NM32SHMM).

"*The other thing that I find difficult is equipment wise, I don't think there is enough computers or desktop with the systems. My staff use either the stock controller or the PA, so there is not enough equipment for the staff to do that or they must go up to HR which only has 1 computer*" (UMSHFG).

There is no equipment, no extra mobile tablet to say, yours has given up now, here is one in the meantime, lets send this one away for repairs. That's what I have been saying about equipment there is no back up equipment" (UMSHFG).

- Facilities

> *"I think there needs to be a hub with a couple of computers where they can go during lunch or tea, with an HR person that can assist them with that kind of thing because it is going to take a lot of load from us, with a printer*" (UMSHFG).

5.3.3.4 Sub-theme 3: System related Factors

The system-related theme emerged in the responses of participants with X% of the sample.

User Interface: Access

There was a need to improve system mobility.

> *"The one downside is that you have to log on or you won't see what is happening. So I think that is one sad thing"* (UM50PLW6F).

- Log-in process

The login process was perceived as time consuming by doctors.

> *"They want to walk in the room and it needs to be ready there waiting for them to review, they don't want to enter a password, wait for the screen to accept the password and change the screen over so that is a bit of an issue currently that we are having"* (HM45SHMM).

- Passwords

There are many passwords and they change constantly.

> *"Like the password resets every 30 days and they will come to me to help them reset the password"* (UM48PLLWF).

> *I think for me the biggest downfall is that every system's got a password, so you as managers have twenty passwords to remember. And those passwords*

expire after a certain date. So you have to keep on renewing these passwords, and they don't expire on the same date, so for instance, if you try and use something generic then this one doesn't change over at the same time, so that is one of the biggest frustrations that you have. No one that I know of knows all of their twenty passwords, so either it is written down somewhere or it is kept on your phone or wherever so that you can access it easily, all the different passwords" (HM45SHMM).

- Selective access

For security reasons, there is a selective access system but that also has its drawbacks.

"Our system is blocked, so you get selective areas that they open up for you to use. Say for instance you are a receptionist down at reception, you will have a specific area that you can work into SAP, and all the other areas are blocked off" (HM45SHMM).

"Bluebird: There are quite a few people (it's not the entire nursing workforce) that works on Bluebird. You have PA access, so your personal assistant's access for the wards. You have your Unit Manager access, you have your IBC support, you have your Hospital Manager, your Nursing Manager and your Control Practitioner" (NM32SHMM).

"Only myself and my PA have access to BlueBird. If we are both not here then everything stands still. That is one of the downfall with both BlueBird and Mobil" (UM53PLW7F).

- System Reboot

"*We log on in the morning and synch the system just to avoid overloading/congestion of the system because then it does not work ... Yes and even now there are people that are not aware when they are supposed to synch and if the system gets stuck you have to switch it off ... The effect now is that there is no stock because it is said that people are not charging. I don't know if people are forgetting to charge or the system is not recording what we are charging. We do not know what the problem is but I think they are not*

charging or if they don't know how to operate the system. People will just use the system as they think is correct just to tick the box even if they are not sure" (UM42PLW1F).

"Sometimes with the Mobil and SAP they do not interface and then with the tablets you have to refresh 3 to 4 times a day. If you don't refresh it goes slowly and it will crash. So I know it will be a challenge this side because it was a challenge that side" (UM48PLLWF).

"*Sometimes with the Mobil and SAP they do not interface and then with the tablets you have to refresh 3 to 4 times a day. If you don't refresh it goes slowly and it will crash. So I know it will be a challenge this side because it was a challenge that side*" (UM48PLLWF).

- System design

A lot of thought has to go into the design of the system, otherwise the system can end up having no relative advantage because it is not operating optimally.

"The problem I am experiencing is with the staff either not charging or charging the incorrect items." (UM53PLW7F).

"The cards are supposed to make it easy but there are just too many and the practicality is a hindrance on the system. The bugs have not been sorted" (UM50PLW6F).

"*The other complication or set back we have is when we get students in because sometimes we find they have not been loaded on the Mobil system. Then we have to log a call on Sigma, get them a password and then only can they use the system and in the interim they need to ask another staff member to charge for them and this cannot be guaranteed to happen..... in the interim they need to ask another staff member to charge for them and this cannot be guaranteed to happen*" (UM53PLW7F).

"*The one downside is that you have to log on or you won't see what is happening. So I think that is one sad thing"* (UM50PLW6F)

"*Let there be a way to prompt you to update. You need a prompt to tell you to update details especially with risk factors which can develop from one time to another from when you were last at the hospital*" (UM50PLW6F).

- System development

"We look at all the best care bundles, so we look at things like central line associated bloodstream infections, urinal intract infections, any device that goes into a patient. What the infection risks are. I think that the questions have been created by someone that's not in daily contact with the patients, because some of the questions are irrelevant and are not an indicator of an infection..... We are also forced to use an adult questionnaire, which is not really relevant to neonatal, so I think they can fine-tune it so it's more applicable to our group of patients. Some of the information is just too vague and not relevant, so I think it could be better..... they're not consulting the people who are … you know, we put in pick lines. A pick line can be put into any number of vessels. All of our pick lines, the vessel that it goes into is "other", which is very vague because pick lines that are classically used in children are not used in adults, so we don't even have a choice. We're very limited because Bluebird has been created for adults" (CF50PLNNUF).

- System improvements

"*Automated in the sense that I would prefer if the staff actually were given their own usernames and passwords, etc. so that they could go in and say I've given you an audit, this is my expectation for the month {inaudible} … because … or when I put in device, like a catheter for example, then I need to do an audit*" (NM32SHMM).

"*Then from a patient point of view, there are definitely areas that we can improve on electronic. I don't know what kind of product we can use, but you know for instance the notes that the nurses are writing, if it is in an iPad format or electronic format it would be most helpful because the doctors are using that data as well to generate their invoices and their costs and also for their patient records*" (HM45SHMM).

"So I think your systems needs to integrate, there is a huge need for that, and I think you need to have adequate backup so that the system can run, I mean we, in the past year, the whole of the company was down for one week, and it was disastrous" (HM45SHMM).

- System integration

System integration was identified as a challenge to using EHR. Inadequately connected systems were not able to communicate leading to an inability to share data between systems and therefore suboptimal use of the system. Lack of sharing eroded the relative advantage of EHR over paper and limited coordination or collaboration or access or availability of information. Information resided in multiple systems instead of one central location. This impeded the usefulness and effectiveness of EHRs.

"*Yes it is, but it is when you have to look up certain patient, but till it is because, not all of the patient information is in one package, so when you have to look up certain information then you have to go actually to each provider, the pathology report, the lab report, so you have to go through, that is why it is still easier to find all of the patient information in that file..... Well, you have to put everything together otherwise it doesn't make sense, in like that if you want to prepare an omelette and every product is in a different room in your house*" (DR67MPFF).

"*Also, if there is proper integration across different systems and across different domains, then you get efficiencies and unfortunately it's not always the case in many areas which then we lose the potential that health and electronic systems come with the full potential, because there is no similar integration between systems, there are no proper interfaces, there is no interface across domains*" (RD35NCSM).

"*So I think there is a great need to refine the current systems, if we say we really want to use technology effectively. Once you get to the ward all that information should be there and we should just get going with what needs to be done but we waste a lot of time asking the same questions.....The anaesthetist will come and ask the patient the same questions you have just asked. You know like past medical history, allergies but you have already entered them on the admission form but the anaesthetist comes in with his own form and asks the same question*" (UMSHFG).

"*So I think your systems needs to integrate, there is a huge need for that, and I think you need to have adequate backup so that the system can run, I mean we, in the past year, the whole of the company was down for one week, and it was disastrous*" (HM45SHMM).

5.3.3.5 Sub-theme 4: Communication misalignment (lost in translation)

There was some disagreement among the staff about various EHR issues. Management saw them one way and frontline another and even among the frontline XXXXXXXX did not view issues the same way that XXXXXX did regarding the extent to which their EHR systems saved time for users.

"We used a lot of benchmarking, we did put resources to the change process, we invested in people learning the why underneath the system. We did all the good change management things that you need to do. We also kept out ear to the ground all the time around any risks that were emerging so that we could go back and deal with them, and we would take that learning to the next roll out phase. It took us one and a half year to roll the whole system out. And now we have to orientate new people. The other thing we changed, a lot of this depends on knowing which bed the patient is in, now in the paper system and the old billing system it didn't really matter that you were in ward A and ward B tomorrow as long as on day three I said that" (ED54NCSF).

Real-time data is elusive according to accounts of being so busy with other clinical activities that users are only able to get to the system once in days taking away from the real-time data; however, from the executive vantage point, it is still theoretical hence the need for staff engagement and collective decision making.

"In clinical and electronic health records you actually want to know that you are in the high care today, so what we had to do was make sure the night staff do the census properly and capture the census properly every night and don't leave out Saturday and Sunday and don't say the night person is on leave so the person who normally does that is the receptionist but she is not there, and so we haven't done it for three days. That brings chaos into the system. So we had to go back and bring some discipline into the key processes and in some cases they were doing the census the next day, and they had to get someone

in at night, one of the staff that is on duty at night to actually do this little task. And do it well, so that we had a proper record of who was in what bed tonight" (ED54NCSF).

The computer can also be viewed as interfering with doctor-patient relationship.

"I am sure that they don't want you to be on the computer, in fact, they complain to me about other doctors that whatever they do on the computer, I don't know for that can be to go to the conversation with the patient but the fact that they don't pay attention but they look at the screen and not to them" (DR67MPFF).

5.3.3.6 Sub-theme 5: Increased workload, work duplication & redistribution

The increased workload takes away from the ability to interact with the system in a real-time format. Because of the number of responsibilities they have, staff are not able to take advantage of the real-time data.

"*But the problem currently, when do you go to the computer and open (exactly) so you go there but it is 6 hours after they sent it to you, so, you should have acted 6 hours ago but you are only seeing it now*" (UMSHFG).

"*So when a patient is discharged we need to go through the entire file and check that everything has been charged and the PA still has to charge some things manually*" (UM53PLW7F).

"*Look it is double work because we still have to do our audits and we have to capture. We used to do the audits and send it to the infection control sister. Her work has become lighter because she does not have to load it onto the system and compiles the reports*" (UM53PLW7F).

"*it's an issue where the take-up and they expect the unit managers to actually do their part and alert them. It's almost like the doctor just wants to practise and wants everything at their fingertips. Not to stop and go to the computer and check information and results on their patients. They want everything on the file, when they see the patient, it's there*" (RD35NCSM).

"*So, I find it's a lot of double reporting. Because you're doing that and then you've still gotta do your Nursing Managers Report to a regional and national perspective*" (NM32SHMM).

"*There are other staff members that I have to do everything to do with computers for them. There is not a lot of them but I can't expect them to learn to use the computer now and they will make lots of faults so I do for them*"(UM48PLLWF).

"...there's very little assistance from our HR with staff putting in their leave on their own. So the burden is on us because we have to do everyone's leave and I find that a bit of a con at the end of the day. There is a lot of stuff that we need to do that is increasing our workload" (UMSHFG).

"*The reason why we get to it to late is that we have to make sure the patients are fine, do doctors rounds, get involved on the floor before we go to out units and do our computer work*" (UMSHFG).

"*There is system overload as a result of the number of systems that users have to work with*" (UMSHFG).

"Other systems are in place for other matters, timekeeping, stores and stationary orders, leave and HR systems but all different systems" (UM53PLW7F).

5.3.3.7 Sub-theme 6: Organisational process alignment

- Process and attitude change

"*Another challenge is that we don't give enough time to implement things and to respond quick enough to challenges or probl*ems" (HM52PLMM).

- Incremental EHR

"So now, what we did in Netcare was recognise that we had different disparate systems that weren't being fully utilised, so we created an electronic data warehouse in which we pool together a whole lot of information that we already

had.....We drew the sort of building blocks of an electronic health record that we believed could be a journey we could go on. Let's build the first building blocks then build the next building blocks and we would end up with a product that we understood the value at every point in time, and that is the strategy that we have taken on" (ED54NCSF).

"*Doing it this way: let's do Mobi, right now everyone can do Mobi. Now, let's do Blue Bird, right. I think if you introduce it and build on that, you're gonna be much better than where you have a situation where they say: we're changing over to paperless today..... If you had a computer-based medication system linked to Mobi and linked to Blue Bird and SAP – you can add bits and pieces like that. So this year we're going to do pharmacology and doctors shouldn't have to order their medication on a script*" (CF50PLNNUF).

"*I think Netcare is trying to design such a system and the challenge is that it is being done in bits and pieces and hasn't been started at the beginning and flowed through*" (HM52PLMM).

- Paper persistence outlook-attitude

The problem of computer literacy is made even more serious when the attitude and outlook of continuing to use paper over electronic means is taken into account. Even though respondents use technology and believe in the importance and benefits, their nonverbal mindset is very much paper-aligned. There is a form of psychological inclination towards paper. Issues of familiarity were evident where the paper method had always been in use and it was difficult to kick an old habit that had really become a culture that was ingrained in people's minds. There was a deep-seated organisational culture of paper. There were situations where, because of system failures, the relative advantage of paper prevailed. The system capabilities could not accommodate some of the complex set of activities that are unique to the health care setting.

"*They revert to the old charge sheet*" (UM42PLW1F).

"*We then have to still complete the physical audits and physically check the patient's file and confirm that what needs to have been implemented and done has been done*" (UM53PLW7F).

"*We then have to still complete the physical audits and physically check the patient's file and confirm that what needs to have been implemented and done has been done"* (UM53PLW7F).

"*We will go mad us nurses want paper; we want to w*rite" (UM50PLW6F).

"*We should capture things that we are going to do something with, and because we still have a paper system by the way, we don't have to capture this paper into here*" (ED54NCSF).

"*Initially we were not happy but I see that it saves us a lot of paper, even though you still see the offices full of paper. We like making photocopies*" (UM60PLWICUF).

"*It is really a hassle, we are still a long way from being fully computer-based*" (UM37PLWANCF).

"*There is still a lot of manual because in nursing we still have that belief that what is written was done*" (UM37PLWANCF).

"*You know with Netcare, it likes paper, they bring something new everyday with changes and sometimes you can't keep up. As you get used to something they bring something new. We get new papers on something and it has already been changed. The amount of paper is overwhelming. It would be easier if it was computerised and the more you have to use the computer the better you get on the systems*" (UM48PLLWF).

"*In the case of a resusc. there is no time to scan then, it is written down and scanned at the end.....the issue for me is that, first of all there is no proper data software that really takes care of the dynamics in the medical field*" (HM52PLMM).

- Dual: manual paper leads to process duplication

There is also the approach of partial system adoption meaning some activities are digital but others in the same process are manual. Paper serves as a form of backup system.

> *"...think we do well in the sense of reverting back to manual as well, because those items cannot be lost and when the system does come online again you have to capture that"* (NM32SHMM).

There is also the approach of partial system adoption meaning some activities are digital but others in the same process are manual.

> *"For example in my ward, we have Mobil which is paperless but I have got a form which I have devised on my own to make sure the staff are charging. So each staff member will get a form in the morning with every stock that I have on hand and every time they use something they've got to tick it off because I am so afraid that they are not going to charge. So that is the fear as well because if it's not charged we are answerable. So it is a paperless system but we have to put the loss"* (UMSHFG).

There is duplication of work manual and electronic.

> *"So when a patient is discharged we need to go through the entire file and check that everything has been charged and the PA still has to charge some things manually"* (UM53PLW7F).

There is an ingrained belief that in nursing manual work is superior.

> *"Nurses, we use our hands most of the time, we don't use computers, computers are when you sit there and do stats and whatever"* (ICS43PLFF).

The design of the system allows for manual input.

> *"The extras as standard are charged manually*" (UM48PLLWF).

The organisational processes allow for the back and forth between the two modalities.

> *"In the one system you still have to print an output and scan it for the next one to absorb and in the process which means the human resource efficiency, the data transfer and the deed of accessing information and the analytical part of it sometimes if not properly implemented has to be manually"* (RD35NCSM).

"Yet, the system is there. I've inputted the information - that should actually generate a report for me to tell me, ok, this was my absenteeism; this was my financial contribution; these are my adverse events; this is how many students I have, etc. But yet again we're relying on Excel spreadsheets" (NM32SHMM).

"But if there's anything that interests me that I want to maybe investigate more, then I can ask her print something out for me" (UM37PLWANCF).

- Collective decision type – decentralised

"*Management decide and they just let us know what the new system is and that everyone has to go for training*" (UM42PLW1F).

"*This is from Netcare head office. There are no discussions with us, the decision gets made and implemented*" (UM53PLW7F).

"*So we made this decision, look let's try and work out what would be high value for all the different parties involved. High value to us, high value to linked to risk, linked to so how would this bring data, bring intelligence to what we would actually do differently*" (ED54NCSF).

"*That Netcare was imposing Bluebird and it was an infection-control computer-based programme and that ultimately we would all have to bite the bullet and learn to use and deal with it*" (CF50PLNNUF).

"*We do have an electronic system of charging for stock only. And the training was a very … it wasn't incentivised at all, it was: you've gotta do this, we don't care about how you do it. You're gonna do it because that's what we've decided and you have to comply and if you don't. It was just threats, threats, threats*" (CF50PLNNUF).

- Lack of staff engagement and empowerment

Systems cannot be designed in isolation. The end-users need to be part of the process for context. End-users know what will work for them and what will not. Positive change in power structures = true innovation.

"*I think that they should really consult people who actually nurse patients and then I think they'd get more useful data, because we do capture some data which is irrelevant.....So, I think that people sitting in offices are far removed from what is happening at the coal face. They create something that looks brilliant, but actually it could be improved a lot. So, Bluebird is not an exception to this*" (CF50PLNNUF).

"*Yes. When you are going to show me the perfect, or almost perfect program I will be able to tell you what I like and what I don't like,..... we are not computer programmers, but definitely I would know what I would like to have in the computer for my patients*" (DR67MPFF).

"*To get them involved I showed the results and the losses at stock take. Losses of R800,000 went down to R9,000 at the next stock take post implementation of the system. The current loss is about R6,000 which is negligible.....Training involves showing people the outcome or effect of their action to see how to cope and change. This allows me to mentor people in terms of the outcome of their specific action*" (HM52PLMM).

"*It often happens that people develop programs, and most of the time they are computer knowledgeable ... So you come out with a program and what maybe most of us start with is at the end of your program, and things like that"* (DR67MPFF).

5.3.3.8 Sub-theme 7: Data management

- Data safety & Security

"*There is so much fear in allowing access and transmission of private information in the IT space, because once it gets out there*" (RD35NCSM).

"*On passwords, that I find is quite difficult with the doctors, they don't have time to put in passwords, so we often have fights about that. To have things password protected and that they need to access that themselves*" (HM45SHMM).

"*When you are dealing with patients, you have the issue of confidentiality. The lab cannot send the reports anywhere, they have to be sure that the lab, if it is my patient, comes to me, or whoever the patient wants the results to go. It cannot go to the front*" (DR67MPFF).

"*Yes, but then I should be able to log into the system, and then what is happening is there might be a big problem with confidentiality, because if all of us can log into the system; whoever is can get access to physiotherapist or whatever, and you can log and find out about patients that you might not even be involved*" (DR67MPFF).

- Data quality & value, overload

The amount of electronic data generated can be overwhelming.

"I think for me the biggest challenge in electronic patient records is how much data it generates, and how you translate that data into the frontline work that you do, and what parts do you do "(ED54NCSF).

"*The first obstacle that those in our pilot four hospitals that we found was this enormous amount of data that suddenly is landing on your iPad and on your phone. In a manual system you pace your work, you go from bed to bed to bed and you write things down. In electronic systems the data is coming at you faster than what you can actually deal with*" (ED54NCSF).

".....electronic systems the data is coming at you faster than what you can actually deal with, so we created, we did this risk matrix, we created a set of alerts that said look we want this information when this happens we expect the infection prevention practitioner or the unit manager of that ICU to get an alert" (ED54NCSF).

"*The actual recording of that on a minute by minute basis is less relevant than me having the narrative of how you are doing and whether you are making progress and what our goal is and where you need to go, and that is a different process altogether" (ED54NCSF).*

"*We are also forced to use an adult questionnaire, which is not really relevant to neonatal, so I think they can fine-tune it so it's more applicable to our group of patients. Some of the information is just too vague and not relevant, so I think it could be better*" (CF50PLNNUF).

"*I understand it's not an accountability tool to measure performance – it is an infection control thing – but nevertheless, it has to be accurate information. So, it's just junk-in/junk-out. If people capture rubbish, it's still being used as valid data. I don't know statistically how accurate that is*" (CF50PLNNUF).

"*Well definitely that one size fits all. That's inappropriate, because our patients are very different to a lot of other patients*" (CF50PLNNUF).

"*But there is still a lot of ironing out, alert me on genuine alerts, don't alert me on provisional alerts and repeats and cancellations. I have a 23 bed unit, I get 80 alerts a day, I need to close 80 alerts a day*"(UMSHFG).

5.3.4 Theme 3: Enablers – emergent factors for the institutions to leverage and exploit for successful incorporation of EHR into work processes

5.3.4.1 Sub-theme 1: Leverage human resources

Hospital staff + communication channels and networks: communication content, channel, how it is done, who is involved.

Use of the EHR has improved communication among providers, led to better-coordinated care, more accurate communication between providers within the hospital and between ambulatory and hospital settings. The infection-control sister can investigate cases and can access longitudinal information for treatment and discharge planning. The EHRs also have improved the peer-to-peer networks.

"*The Hospital Manager Kobus is open and easy to deal with and I can make my recommendations to him. Head Office must be involved in the approval if and actual implementation of any changes on SAP because of the link throughout the Netcare group*" (UM38PLSAPF).

"*Yes most people can use it and we help each other when we get stuck*" (UM42PLW1F).

"*Only if we cannot get it to work we then check with other wards if theirs is not working" (*UM42PLW1F*).*

"*Bluebird is connected to pharmacy as well, they also get the alerts and see that they patient is on the correct antibiotics. It's all linked together. It is not linked into the doctors yet because the doctors rent their rooms from the hospital and these are specifically Netcare systems" (*UM53PLW7F*).*

"*We are lucky to have a clinical pharmacist, which most hospitals don't have and they are able to contact the doctors to advise about recommended medication depending on the outcomes from the labs. This has offered a link between the doctors and pharmacist" (*UM50PLW6F*).*

"*We have the benefit that if you do something in this hospital and it works you can share it with another hospital so that spread happens quickly*" (ED54NCSF).

"*The channels in which we transmit strategic processes back and forth between the hospitals and ensure implementation*" (RD35NCSM).

"*The doctors do have but the take-up isn't there. The unit managers can make decisions, but obviously because the doctor has administered the patient and so forth there is a protocol and now they engage with the doctor what to do with the patient once there's information that warrants that the management of the patient needs to change, the doctor can't just come and find out my patient's no longer here and is now in full isolation, cubicle, etc"* (RD35NCSM*).*

"*You're not the subject expert, but you make sure the 2 parties get together – pharmacy, IT and your team – in terms of successful implementation. You make sure that people are available, that people also have a platform where they can air their views on what the frustrations are and what doesn't work and maybe"* (RD35NCSM*).*

"*Nobody is working in isolation now-a-days. It is done as a proper team-approach so that everybody is kept informed"* (NM32SHMM*).*

"*And then I attend meetings, obviously, to keep abreast with staff in Netcare and at XXXXXX level, and also teaching of staff. Junior staff, but I have my shift leaders who are mostly doing that, the teaching part*" (UM60PLWICUF).

"*We have got an advantage when you have got unit managers that are coming in, or you have got a PA that is ok with technology, even when you struggle and you can always go to another unit manager and ask them do you do it like this that that that. I want to believe that you learn as you go on"* (UM60PLWICUF).

"*But luckily she invented a WhatsApp group where you can write whatever challenges that you face so whoever knows will answer you and if she is not available or they don't give you the right answer she will respond"* (ICS43PLFF).

"*It is much better because it links everybody and we work as a team*" (ICS43PLFF).

"*They said when you have challenges you go to the champion. They are very helpful. This is known at head office, who they are and what they can access"* (UM48PLLWF).

"*.....so I'm responsible for all the teaching of the students - both in a classroom situation where I lecture at Wits, as well as at the Netcare Training Academy. But, I am also hands-on here where, if students come into the Unit on a short-term basis, I support them*" (CF50PLNNUF).

"*Well, I'm a Netcare employee so I go to neonatal forum meetings and these meetings are for all the Unit Managers in various areas"* (CF50PLNNUF).

"*I ended up going from one unit to another to see what they were doing, so I kind of trained myself on it and it's been experiential learning"* (CF50PLNNUF).

"Well, there are a lot of exchange of ideas at neonatal forums; if we have problems; if there's some confusion; if we are taking a stand and refusing to do something – it happens at the forum meeting. The neonatal forum is very valuable in that regard and the unit managers within their own units" (CF50PLNNUF).

"*So the thing is who supports her, the guys sitting round the table. So it's us who is training each other and supporting each other, because that support we get from the IT side or training side or HR side, or how do you say it" (*UMSHFG*)*.

"*Now we have VisionX for everybody, and there were a few that didn't know so I helped them to apply because if they have set up a computer for them at HR then they come to me for help" (*UM48PLLWF*)*.

- Staff engagement and empowerment

These are lessons on how to engage and communicate with staff to ensure their involvement and part of the process and decision yields better results. Internal networks and peer-peer networks are important.

"*They said when you have challenges you go to the champion. They are very helpful. This is known at head office, who they are and what they can access*" (UM48PLLWF).

"*I believe that innovation comes from the hospital's side. Because we are the ones that are working on these systems on a day-in-day-out perspective. So, we generally give feedback to that, but coming back to that systems and working and sharing together, they are a lot of systems and there could be better integration. Absolutely" (*NM32SHMM).

"*Mobit, we had to get a recipe from each doctor, so we will go to Dr Barrow and say Dr Barrow you are an orthopaedic surgeon, you have got a knee replacement, give us your recipe of a knee replacement, what do you require" (*NM32SHMM*).*

*"true innovations decentralize power allowing the nurses to do better and faster that which used to only be reserved for the doctor(*NM32SHMM*).*

Mobit, we had to get a recipe from each doctor, so we will go to Dr Barrow and say Dr Barrow you are an orthopaedic surgeon, you have got a knee

*replacement, give us your recipe of a knee replacement, what do you require" (*HM45SHMM*).*

"*Therefore, having a tool like Bluebird helps nurses to approach the clinicians. You know doctors always want to be right in everything so if they will have access and they see I write here that a patent had infection they can query that because they want to be on the clean side all the time" (*ICS43PLFF*).*

"*They will run with the programme and give the person credit who gave them that idea. Like for instance, patient cost estimate, I used to before you will get throughout the night any time of the day you would get calls of people from reception asking you how much does it cost for this, how much does it cost for that, how much money must I take for this patient. And I initially thought, gosh, you can't take these calls all the time, I mean you have to work tomorrow, and by just generating a generic sheet where they will fill in, they will ask the doctor, how many days will the patient be where, how many days in theatre. Just to add generic things that calculate more or less a value. By putting that into system it changed a lot of things, I mean they didn't have to" (*HM45SHMM*).*

"*So when you do have time which is a scarce commodity you then call each individual to say, fine your employee number then you go and check for the past week what they have charged, and ask them how it is possible. And you make them go and charge"* (UMSHFG*).*

"*So have made a notice and had a meeting and I have made it very clear that the person responsible for the drug cupboard, who keep the keys and is responsible for the drugs in totality. So if I take a drug it's that person's responsibility to make sure that I charge the drug. So I will hold that person responsible for the drugs that are not charged and our charging has improved 100%. So people are afraid and it was clearly said in the meeting that if the drugs are not charged she will get a written warning. Not even a verbal or counselling but a written warning end of story. And this is kind of working at the moment. I don't know for how long" (*UMSHFG*).*

"*Giving data on processes and activities. Some UM give staff reports on the extent to which care for their patients meets recommended standards"* (UMSHFG*).*

Mobil, it has a system, going back a while where every month it sends us our records showing how we have billed and where we are failing at and it will give you 10 best charges in the ward. So what I normally do is call them and say who the best chargers are. So I always show them nowadays and we applaud them and I have seen improvement but as you said I don't know how for how long but it does help. … "I think when Netcare goes over to a total paperless system, they need to ask the people on the floor, they do not need to spend time with the people, don't speak to the IT specialists, don't speak to the head office, speak to us, we are the people that know what will work and have an idea of" (UMSHFG).

"*It's like when people are designing a new hospital or ward, don't speak to the architect, speak to us because we are the people that are going to use the stuff and system and we are going to work with it for the next 10 or 20 years*" (UMSHFG).

"*I think the other professionals have been thinking for the health professionals for too long so now the health professionals have to start. We must be deeply involved in the planning of these systems and they must not plan on behalf of the health sector because what they do they expect us to fit in this situation and more often than not we don't fit and they are gone" (*UMSHFG).

"*I also just want to support this, they must really, we are told we must empower our staff and nursing must have a voice but no one gives nursing an opportunity to voice their opinion and I think that is very, whatever the system go to the people that are going to use it every day, 24 hours a day and find out because there is better ideas in the floor than in offices because they will know how it will function better" (*UMSHFG).

- Training & Support (+) continuous training, preferably onsite at hospital)

"*So, for me, the XXXXX point to that is, yes - it's automated. You're simply logging in, but let me give you the tools. Let me take the time to train you. Right, I call it a hand-holding session. Even for my Unit Managers, as well. I make sure we do a hand-holding session, like for three months if you're a new staff member or it's a new process - we'll do it together. We will understand it,*

we'll learn it together and if there's issues we'll escalate it. So, my role is to ensure that my team has the resources for training and development" (NM32SHMM).

"*The support is quite good, in that when I send them emails to say what the problem is, they've explained it. It's immediate and that's quite a nice thing. You don't have to wait 3 or 4 days for somebody to get back to you. You get an email back immediately, so that's very useful"* (CF50PLNNUF).

"*There is a helpline and you just email them. As you log on there is an email there that you can just click on for supprt and they respond quick"* (UM50PLW6F).

"*There is support for both systems. .... IT will come and help and sort out the internet problems"* (UM53PLW7F).

*"And now we have to orientate new people" (*ED54NCSF).

"*it was the older generation that really suffered and as a result you had a lot of situations whereby stock issues training were supposed to be for a month and it ended up being for much longer and there is associated costs when it comes to things like that"* (NM32SHMM).

"When there are people who are not computer literate and you need to train them and get their buy in so it can take long" (UM37PLWANCF).

"I think for me, my role will be more with the doctor's point of view if there is any new equipment from a doctor's point of view to involve the doctors, make sure they get training, make sure the data is loaded on their machines, and those kind of things" (HM45SHMM).

"*Yes, it is a continuous training as I say some of the things on Bluebird are changing and you need to train them on how they need to do it"* (ICS43PLFF).

"*You're not the subject expert, but you make sure the 2 parties get together – pharmacy, IT and your team – in terms of successful implementation. You make sure that people are available, that people also have a platform where*

they can air their views on what the frustrations are and what doesn't work and maybe" (RD35NCSM).

- System utility and knowledge resource

This mitigates the pain of complex systems but underuse also leads to lack on input, underutilization can also mean you are not able to see the down side of system compare two hospitals

"I can't really say because it is not a system I use all the time" (UM37PLWANCF).

- Continuous learning

"*I ended up going from one unit to another to see what they were doing, so I kind of trained myself on it and it's been experiential learning"* (CF50PLNNUF).

"*I think it's an issue of, just keep doing it. In the beginning, particularly it just becomes too overwhelming. But once you get there and log on, you action it and it is done. You will get more comfortable with it once you use it"* (UM50PLW6F).

- Continuous use

"*We also kept our ear to the ground all the time around any risks that were emerging so that we could go back and deal with them, and we would take that learning to the next roll out phase"* (ED54NCSF).

"*I can go to school now and they teach me too many things, but now here, as I see things and I get somebody to come, my PA comes and says okay let's do this, and I learn also for tomorrow. For me it's a learning curve daily as we go along"* (UM60PLWICUF).

"*Once of our challenges is that the technology is not user friendly, the ongoing need for training, so the challenge is knowledge and experience, also because the systems are not used regularly they people forget and need to be reminded every time they do" (*HM52PLMM*)*.

"Initially I was not computer literate in August 2015, I even told them in the interview but shame they took me through and my Matron shame, she understood and helped me. At the moment I call myself a champion from where I started. They are good, HR they know when I call them they know I grab them. Even for myself I am much better, I even don't know Microsoft Word. There are always a number of queries and these can be addresses via email. Even when I get a query and they CC "Mo" by the time I log onto my computer I find out that Mo has sorted it already. It helps that we don't have to go to the different departments to address queries" (UM48PLLWF).

- Experience

"*I don't know about Bluebird specifically, but when it comes to excellence in Neonatal Care, I do believe that Wendy is a champion of that. That is by virtue of the fact that she has had many years of Neonatal Care and we have a core group of people who have been looking after babies for 30-35 years. There is a lot of depth in the Neonatal Care that a baby gets here compared to another hospital where there are very newly qualified people who really don't know that much. I think that Wendy, and by extension this Unit, has always been seen as providing that kind of really excellent nursing care. I think we do have a unit where there's a lot of ongoing education. Two of us lecture part-time in various respected institutions in SA and so I think that Wendy is overall, globally, seen to stand out head and shoulders above a lot of other people. And I do attend a lot of forum meetings and I understand that. Nothing happens until Wendy's been consulted and she's given her stamp of approval. And rightly so. This is a big unit, it may not officially be the Netcare flagship for Neonatal Care, but we're a big unit. We have 40 beds and if you walk to the other units, they're a lot smaller" (*CF50PLNNUF).

5.3.4.2 Sub-theme 2: Paperless Attitude there is a general positive view of the system from staff.

- Digital trend

> "*Whether or not we have a choice at all to stick to our guns and continue business as usual, it is nearly impossible"* (RD35NCSM).
>
> "*It's got a huge potential. It's an inevitable way to go for all industries for the benefits that I've spoken about: convenience, time, speed"* (RD35NCSM).

- Positive EHR attitude

> *"So if we could go electronic and be on par, it would actually elevate the status of the health sector and then people would start looking at us as equals rather than looking down on us*" (UMSHFG).
>
> "*What we want as the South African public is a national health information exchange that has my data, no matter where I go I have my data, I have my lab data, I have got my x-rays, I have my hospital stays, key elements of my hospital stay. I have got that information. I as Joe Public have that, and it doesn't matter if I switch from MedScheme to Discovery or I go into the Public System"* (ED54NCSF).
>
> "*So, for me an acquisition is almost a Greenfields – it's the best place to roll out a full, comprehensive electronic systems, because they currently have not been aligned and absorbed into your mixed bag of manual and electronic processes"* (RD35NCSM).
>
> *"Because that comes back to efficiencies, currently how we are managing our theatres is each doctor has a slate time, a theatre slate time, and some of the doctors have a full day and some have a half day, it just depends on how their practise is working. But now you have got a Doctor who has a full day slate, who is working from seven in the morning until seven in the evening, and the doctor does one case of an hour. So the theatre is standing empty for eleven hours, we have to staff it for eleven hours, we have to keep the air cons running for eleven hours. Whereas another Doctor that could have done a procedure*

could have booked that theatre, but because it is allocated to this doctor, he uses the theatre. So, I think there is a lot of things that can change. If you have this whole system that walks the whole pathway of the patient" (HM45SHMM).

- System reinvention

"*We ended up choosing this system called Bluebird for two reasons. One they agreed to adapt it for us, and two because they had the beginnings of a stewardship model which the other systems didn't have"* (ED54NCSF).

"*We started this process, we started with testing it in four different hospitals and we were on the route, a little bit like the phone companies, prototyping in the real world, not develop, develop, develop, develop and then implement. Which has its own challenges as you go along, but it also has benefit, you really getting how people are using it, and we chose two big hospitals and two smaller hospitals, because again in our world you don't know whether implementing something at Milpark is the same as implementing it at Linksfield*" (ED54NCSF).

- Positive systems view

"*I would say that Bluebird was a life saver, we were very happy and now I can manage to do other things I can manage to have my time for teaching and continually update people on infection control"* (ICS43PLFF).

"*Bluebird, things that we used to do manually are now being done electronically"* (UM60PLWICUF).

"*I think everything will be on the computer"* (UM42PLW1F).

"*No not really, it is stuff we have been doing all along anyway but now just on a computer system"* (UM53PLW7F).

"*Netcare has done exceptionally well to make a footprint into a technology-driven company"* (NM32SHMM).

"*Generally, I think it is a good system because the person that is on call also has access to the system if my PA or I are not at the hospital. When I am on call I can check from all the units to pick up problems" (*UM50PLW6F).

"*I think there is still value in electronic prescribing we just have to figure out how to do it well"* (ED54NCSF).

- Positive Paperless

"*So we don't want to simply replace one piece of paper thing with now capturing on a computer. Which as you know, the time it takes to capture is a major factor in electronic health records*" (ED54NCSF).

"*I think electronic everything in hospitals has got a huge benefit if they are simplified, user friendly and totally replace our analogue or paper-driven processes. They are very useful if properly implemented and if they totally replace the existing processes, so that there is no duplication and overlaps"* (RD35NCSM).

"*We need to go onto things like when you are ordering medications. Why can't we, just as we have Mobi for stock, why can't we have that for the pharmacists? That could be added to Bluebird"* (CF50PLNNUF).

CHAPTER 6: DISCUSSION OF FINDINGS

The chapter aims to link the findings of themes developed from chapter 5 with the research objectives and literature to answer the research questions. The purpose of this qualitative study was to discover and expose factors inherent in the adoption and use of EHR by leveraging the accounts of two strategic, three operational and sixteen frontline staff in the private urban hospital setting. Chapter 6 includes (a) an overview of the research problem and questions, (b) discussion of the results and their relationship to the research questions, (c) discussion of the results according to within the diffusion of innovation theoretical framework, (d) implication of the findings (e) recommendations for future research.

6.1 OVERVIEW OF RESEARCH PROBLEM AND QUESTIONS

The Institute of Medicine (IOM) gave direction and exercised leadership in their report "The Computer-Based Patient Record: An Essential Technology for Health Care" wherein they emphasised the need to embrace the adoption of EHR to improve quality and safety of the health care delivery (Ozair et al., 2015). HITECH financial incentive policy was introduced to neutralise the financial burden that is so often cited as a barrier to the adoption of EHR (Pipersburgh, 2012). However, despite the massive investment injection, availability of technology and reported benefits of Electronic Health Records, the adoption and use of health information technology have been slow. One of the interviewees stated the problem succinctly:

> *"My early experience with electronic health records recognised that despite the fact that a lot of people talk about electronic health records, not very many people have electronic patient records*" (ED54NCSF).

Although EHR research is active, the understanding of how to better leverage it to improve health and health care is scarce and therefore adoption is slow. This study, therefore, sought to contribute to this gap in the literature with this qualitative phenomenological study of EHR stakeholders in the hospital setting. The interview questions were designed to encapsulate existing literature and address the research questions given:

Primary research question: What do the experiences of strategic, operational and frontline hospital staff regards their exposure to and use of EHR in the course of implementation and use of EHR in the private urban setting?

- Sub-question 1: According to respondents, what health information systems were implemented?
- Sub-question 1(a): What are the EHR functionalities and capabilities that their experiences are referring to?
- Sub-question 2: What in the interpretation of respondents are the factors that encourage the adoption and use of an EHR?
- Sub-question 3: What in the interpretation of respondents are the factors that hinder the adoption and use of an EHR?

The study cohort was comprised of staff from the three predetermined layers, an executive director and regional director making up the strategic layer. There were three managers including two hospital managers and a unit manager. Lastly, there were sixteen frontline staff members consisting of an infection control sister, a clinical facilitator and nine unit (ward) managers. On completing the analysis of the shared experiences of the participants, three core themes, and ten sub-themes were generated as depicted in the table below.

Table 6.1: Predominant themes

Theme 1: Benefits of Electronic health records (+Relative Advantage)
○ 1.1 Operational process efficiency
○ 1.2 Data analytics benefits
○ 1.3 Quality of care delivery
Theme 2: Electronic health record Benefit erosion (- Relative advantage)
○ 2.1 Acquisition resource investment (Cost)
○ 2.1.1 Human Resource investment
○ 2.1.2 Technology, Equipment & Facilities Investment
○ 2.2 System related factors (Usability & Functionality)
○ 2.3 Networks & Communication channels
○ 2.4 Increased workload, duplication & redistribution (Work flow)
○ 2.5 Organisational culture & process alignment
○ 2.6 Data management
Theme 3: Promoters of EHR

6.2 OBSERVATIONAL STUDY OF SETTING

It is important to paint an observational canvas as a context for the data (Mack, Woodsong, MacQueen, Guest & Namey, 2005). This process provides the background to use as a lens to accurately interpret and understand the true nature of the themes. The observations were collected as field notes taken in the course of an interview or after the interview and later expanded. There is significance to the order of the observations. In hospitals, time is a precious commodity. The arrangement of interviews was left to the investigator to approach the individual participants. The researcher mostly phoned to request an interview and then emailed a brief including consent form, a summary of the proposal and all the necessary approvals. The details of how long the interview was expected to run were in brief. However, without fail, the frontline staff would always enquire as to the length of the interview. Besides, even though the appointment was prearranged, there was a sense of being taken by surprise. Expectedly the ward is a very busy place. Given that the interviews were conducted in the ward office, there were constant interruptions, ringing phones and people interrupting the interview. It became a normal part of the interviews; the interview would pause and then continue. It was fascinating that ward sisters were very reluctant to talk about the system and would keep referring the researcher to discuss it with the ward PA. Time taken away from work was problematic. At the second hospital, the nursing manager admitted that because of the amount of work in the wards, one-on-one interviews would not be feasible.

The culture of paper is deep-seated in the hospitals. In almost all the interviews except the two that were not at the hospital, evidence of paper was everywhere. The offices of the unit managers had filing cabinets filled with folders. On the desks, there were computers to access the hospital system otherwise the rest of the desk was covered in papers and files. In older clinics, there was an AppleMac laptop connected to a big Mac screen in one corner of the desk and patient files and papers on the other. In addition, the attitude towards technology was evident in the participants' behaviour. With the interview interruptions, the respondents would answer their cell phones. Of interest during this time is the fact that they were using smartphones, which speaks to their digital inclination.

The interviews were conducted mostly on hospital property except for the executive interviews that were at the headquarter offices. The one striking image that is visible all over the hospital is that of hand sanitizers. The sanitizers are in the lobby, next to the lifts, by the waiting areas, outside the ward doors, in the bathrooms and even office doors. They are everywhere. This became very interested given one of the EHR was implemented for the control of infection and appropriate antibiotic use. The infection control fight was being tackled from every front.

Figure 6.1: A hand sanitizer mounted outside the hospital office door.

6.3 ANSWERING THE RESEARCH QUESTIONS

The structure and focus of the study was designed to answer the four research questions. It is evident even in the current study that EHRs hold great promise for improving health care quality and efficiency. However, cost implications in the context of human resource, technology and organisational processes involved in acquisition, implementation, support, maintenance and continuous upgrade are still highly relevant in the discussion around health information system. The findings have gone a long way to shed light on the conundrum of poor EHR uptake. The research confirms Rogers' (2003) understanding that adoption of innovation is highly complex and goes beyond the innovation's relative advantage.

6.3.1 Answering the main research question

The main research question was: What are the experiences of executive, managerial and frontline hospital staff regarding their exposure to and use of EHR in the course of implementation and use of EHR in the private urban hospital setting?

6.3.1.1 Strategic perspective

Overall the participants expressed a positive view of electronic health records while acknowledging the existing challenges. Hospital staff are pleased with the EHR-facilitated improvements in health care quality, and operational efficiency. The regional director acknowledged the technology revolution trend and the necessity to adapt. EHRs are perceived to offer clinical, operational and social benefits that result in financial, quality and efficiency outcomes (Menachemi & Collum, 2011). The future of health care is digital. The nursing manager was confident of the organisational gravitation to a paperless environment. At the same time, there was a realisation that a move to electronic records does not mean transferring paper into digital format but rather identifying the areas in the organisation that would best benefit from the use of electronic records. The feeling was that simply entering all paper-based data and generating electronic files would not deliver value but would instead result in data that could not be used to deliver any form of value for either the hospital or the patient. Value-based health care scholars agree with this view, stating the need to capture relevant value-generating data that contributes to patient outcomes (Porter et al., 2013). Recognition was given to the current silos of information. Studies have shown that soloed IT systems impede performance measurement greatly and it then becomes impossible to implement improvements (Porter et al., 2013). Even though this limitation exists, there was a sense of accomplishment expressed regarding the sophistication of the billing and administrative capability of existing systems. There was an underlying tone of caution when it comes to electronic health systems, to avoid the oversimplified view of EHR and rather be aware of its complexity. Literature does show that EHR systems are complex and have thus contributed to non-adoption (Boonstra & Broekhuis 2010). Emphasis was given to the inhibitory cost of EHR acquisition relative to the fast-changing technology cycles, thereby casting doubt on the cost benefit analysis of such an investment. This view is not isolated; EHR return on investment uncertainty is a barrier to the adoption of computerised records (Peterson, Ford, Eberhardt, Huerta & Menachemi, 2011). The discussion brought understanding to the decision process and desired approach of incremental EHR implementation.

6.3.1.2 Frontline perspective

It is clear from the participants that an overwhelming majority of staff were able to identify the relative advantage of systems and the results were observable and

communicated in the staff meetings. Even though respondents agreed that the systems had challenges to work out, they did acknowledge the benefits of systems. However, there was a pervasive view that technology was not integral to quality of care. They could identify with the benefits as a result of the technology but expressed a compartmentalised sentiment of technology in that there do not associate the positive outcomes they get from using technology with the outcomes that they get from traditional nursing modalities. This could be as a result their implementation phase. Both hospitals were in early post-implementation phase, being into their first year of Bluebird and therefore technology was not yet routine.

There were some differences in the satisfaction or frustration levels of frontline staff of the two hospitals. The two hospitals had about the same number of beds but one focused on obstetrics, gynaecology, neonatology and paediatrics with no emergency room and one intensive care unit. The other hospital had about the same number of beds but more clinical specialties, a trauma unit with an emergency room and more than one intensive care unit. The two hospitals therefore had two different levels of task complexities with different demands placed on them. The complexity of cases at the two hospitals would have an impact on how respondents experience and perceive the system. In the hospital with simpler tasks there were expressions of dissatisfaction but they were more pronounced at the hospital with more complex tasks as judged by ICU and emergency rooms. Given that one cohort consisted of one-on-one interviewees and the other a focus group, it is not valid to compare the two groups, and only general overarching views are worth mentioning.

Despite elements of frustration, the attitude of participants towards systems was positive to the point where they could envision themselves as part of the digital transformation. Interviewees were open to being more involved and consulted with in the design and implementation of systems. One of the unit managers expressed how she viewed EHR as an empowerment tool to navigate the hierarchy-driven structures of the clinical setting and allow them to do their work. She said the use of computerised systems would give them a platform to voice their opinions and contribute to improving existing systems. Furthermore, health information systems would serve as a status symbol not just within the hospitals or sector but also in the industry.

6.3.1.3 Lost in translation

Communication in the organisation takes place through various networks linked with

one another, loosely or tightly, depending on the network structure of the social group. The networks and opinions of those who are members heavily influence adoption decisions. Studies show that people depend on subjective evaluation coming from other people like themselves who have already adopted the innovation (Kruse et al., 2014). Adoption of innovations is highly influenced by the structure and quality of their social networks. In the current study, participants from the three tiers understood the reality of circumstances differently. In discussions with the strategic and managerial group of respondents, it was apparent that the implementation and use of computerised systems was very structured, streamlined and almost clinical. It was in discussions with the frontline staff that intricacies were uncovered. The frontline staff had more of a practical exposure (what is) as compared to the highly theoretical managerial view (what it ought to be).

It is against this backdrop that one may call this phenomenon “lost in translation” as the two groups had divergent views on matters informed by their exposure. There is again the need to have the channels of communication open in the form of staff involvement that harks back to the organisational decision process, in order to facilitate a point of common understanding. This common understanding is imperative if a coherent message is to be communicated through the social hospital network to influence the attitudes of fellow colleagues for or against innovation. This reality is consistent with current literature indicating that interpersonal peer-peer networks are powerful sources of influence for adoption (Zheng et al., 2010).

6.3.2 Research sub-question 1: system maturity

Some attention needs to be given to the organisational context within which technology is implemented (Lipsky et al., 2012). The hospitals in the study, like many hospitals, have various systems implemented to facilitate a multiplicity of activities like scheduling, billing and CDSS; therefore, their adoption may be related and influence one another. Hospitals may thus end up adopting a cluster of technologies. The factors motivating or inhibiting the adoption the different types of HIT are related (Weber-Jahnke, Peyton & Topaloglou, 2012). Therefore, a study of electronic health records would be more context-appropriate if undertaken in conjunction with other existing adopted technologies (Sun et al., 2015). It is important to understand the functions and capabilities of EHR.

According to the research participants’ accounts there are about twenty hospital systems with capabilities ranging from SAP administrative systems, Kronos attendance

management, Vision X leave processing systems, Mobil ward billing system, Mobit theatre billing system, SAP electronic patient demographics, pharmacy medication system, pathology and radiology results management and the Bluebird antibiotic stewardship clinical decision support system with clinical guidelines and reminders. When measured against the Institute of Medicine EHR maturity, this system is basic with elements of decision support that fall under comprehensive category.

Using the Institute of Medicine guidelines, it was found that one hospital with at least a basic EHR system reported implementation of the following ten computerised functions in at least one clinical unit of the hospital as follows: patient demographics (YES), physician notes (NO), nursing assessments (NO), patient problem lists (NO), patient medication lists (YES), discharge summaries (NO), laboratory reports (YES), radiologic reports (YES), diagnostic test results (YES), and order entry for medications (NO), list of medication (YES). For a comprehensive EHR system, all basic functions, along with fourteen additional functions, would need to be fully implemented in all major clinical units (CDSS – Antibiotic stewardship initiative). So even though the hospitals in the current study have decision support systems, they have not completely met the basic EHR level requirements, meaning that they are still basic.

6.3.3 Research Sub-Question 2: factors hindering the adoption and use of an EHR

What in the view of respondents are the factors that hinder the adoption and use of an EHR?

6.3.3.1 Systems relative advantage

There is general understanding that electronic health systems have relative advantage over traditional paper systems as evidenced by the generated themes arising from participants' perceptions of their interactions with health information technologies. Rogers (2003) states that relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. Diffusion of Innovation (DOI) is relevant for the current study. DOI explains how "an *innovation*, is *communicated* through *channels over time* among members of a *social system*" (Kruse et al., 2014) and can explain 49-97% variance observed in innovation adoption.

6.3.3.2 Quality of care

Participants believed that computerised records improved quality of care owing to timely access to information for making clinical decision. Participants positively identified EHR as an improvement in the management of patients. Respondents shared that computerised health systems save time. They detailed accounts of not having to wait for the pathology lab to deliver laboratory reports resulting in faster turnaround time for results. Other studies have cited perception of system usefulness as the most common facilitating factor for adoption of digital records (Gagnon, et al., 2012). The unit managers reported that a major benefit of the Bluebird CDSS has been the ability to rapidly diagnose and identify infections in the wards particularly those with resistant organisms. If identified, nurses can institute isolation procedures and avert the spread of resistant organisms and spare the lives of patients and improve patient safety (Menachemi et al., 2011). The system is able to give unit managers timely alerts concerning patient specimen results. The notification is actionable, meaning that staff must actually respond to the alert and implement some intervention that they record and thereby close the alert. It is this actionable system feature that contributes to the quality of care rendered to patients. In addition, the system ensures that there is no loss of patient data through misplaced physical copies. Beyond the ward, the system data can be compiled into a management report that monitors the effectiveness of the system in the particular hospital. Patients' demographics, pharmacy prescriptions, admissions and discharge history are readily available. The Bluebird-CDSS can also positively influence the treatment of patients through identifying the organism and also giving susceptibility test results, to inform clinicians about the appropriate antibiotics to prescribe. This promotes the correct use of antibiotics and in turn limits the development of antibiotic resistance. This antibiotic stewardship programme was evaluated and found improvements in the appropriate use of antibiotics and clinical outcomes (Brink, Messina, Feldman, Richards, Becker, Goff & Alliance, 2016) ensuring that the hospital was practising evidence-based medicine.

The participants report that EHR contributes to faster, more effective communication between health care professions in the different departments of the hospital. In addition, all members of the interdisciplinary team responsible for the patient receive information: pharmacy, doctor, and infection control sister and unit manager in the ward.

However, it is clear that it is not just about the benefits but there is a need for observability of results to serve as teaching tools. Observability is the extent to which the results of an innovation are visible to others as observations or communicated as accounts of the user experiences in the social system networks (Rogers, 2003). DOI also points out that the extent to which the results of an innovation are visible to others is positively associated with adoption. Other studies agree with the need for demonstrable benefits (Gagnon et al., 2012). One of the hospital managers discussed the use of system results to share with other staff members (HM52PLMM). The information about positive results diffuses through hospital peer-to-peer networks to positively influence their outlook.

6.3.3.3 Data use and analytics

Researchers have found that computerised systems have led to improvements in the access and availability of information. If a patient is loaded onto SAP, their data is accessible from any of the group hospitals. Respondents also pointed out that because of the availability and access of data, considerable time is saved. When a person presents to the hospital there is no need to recapture their information. The systems increase mobility such that information is accessible from any of the other internal department or sister hospitals. In addition, availability of real-time data confers monitoring capacity with up-to-date information on patients, staff and processes within the hospital. There is access to past and current infection control information via Bluebird of patients across the many group hospitals. Electronic data also allows for the ability to easily and quickly transition between new and old data sets, which is particularly beneficial when investigating infection control cases. Having patient data stored electronically increases the availability of data, which can be quantitatively analysed to identify evidence-based best practices more easily.

6.3.3.4 Operational process improvements

The interviewees noted that the use of electronic systems allowed research subjects to improve on certain operational activities and perform them faster and more conveniently. The need to accurately track what materials patients use for billing purposes is fundamental to the financial viability of a hospital. The barcode scanning Mobil and Mobit systems helped the wards to manage and properly bill clients. The electronic billing system saved time and eliminated the need to write on paper thereby ensuring accurate billing. The systems allow billing of services delivered while minimising administrative and documentation costs. With the use of SAP, admissions

and orders automatically trigger charges, thereby ensuring reimbursement for all services rendered while also reducing administrative time that would have been spent with manual billing. The hospital interviewees believed that electronic records saved them time by eliminating the duplication of data capturing from between hospitals as a result of system integration. With a combination of SAP and Mobil, many billing errors are eliminated, which will potentially mean the hospital is able to recover revenue. Correct timely billing translates to timely reimbursement.

Participants narrated the convenience saved time of using the Mobit system that simplified pre-packaged billing of theatre supplies.

6.4 EROSION OF RELATIVE ADVANTAGE

However, as Rogers (2003) stated, relative advantage alone is not sufficient to sustain diffusion. Health informatics literature presents the relative advantage of EHRs over paper in the form of reduced costs, enhanced patient safety, better quality of care, and improved clinical and administrative efficiency (Menachemi et al., 2011). This following section outlines the factors raised by respondents that undermine the relative advantage of health information systems. These factors have been grouped as cost, technology, networks, workflow, organisational and data management.

6.4.1 Cost

According to respondents, cost is still a major contributor to the erosion of relative advantage of computerised records. This view is shared with other researchers (Boonstra et al., 2010). Cost is perceived to exert influence at three levels: (a) acquisition of computerised system hardware and software, (b) financial investment in people for training, support and IT literacy and (3) financial resources for supportive IT equipment, facilities and IT infrastructure. It is important to include all three as they have a financial implication and must be accounted for particularly when performing return on investment calculations (Peterson, Ford, Eberhardt, Huerta & Menachemi, 2011).

6.4.2 Technology acquisition

These are costs that go towards the purchasing and installation of system hardware and software components. It is important to take into account that these have to be maintained, replaced and upgraded within affordable limits of scarce company

resources. EHR have been perceived to have a prohibitive initial investment given that there are delayed returns. There is also a need to take into account the size of the organisation. In the present study, it was found that the CDSS was rolled out to fifty-seven hospitals. The reality of a start-up amount to initially roll out into all facilities is sizable. Cost is central to the decision process; as the strategic respondent mentioned, there is a need to weigh the cost of innovation against the benefits due to the organisation.

6.4.3 Training, Support and IT literacy

In assessing the financial requirements of implementing a new system the resources for training and support are factored in. It is through training that system users will gain an understanding of what system features exist and how they function in clinical practice. Training is a logical progression of the acquisition process. Researchers agree with the need for and importance of training (Bredfeldt et al., 2013). Furthermore, as some studies show, the benefits of a system are premised on correct intended use of the system that can be realised through training and support. Training is a requirement for optimal system use. However, both its financial implications and human resource considerations are crucial. The quality, quantity and frequency of training have cost implications. Failure to properly cater for training and support leads to implementation failure.

6.4.4 IT & Computer Literacy

The inability of staff to effectively use computer systems will negatively affect the potential to realise their benefits. In planning implementation, an IT and computer literacy audit would be warranted so as to provisionally allocate appropriate funding to IT education. Generally, all respondents acknowledged the gap that exists with nursing computer literacy. Inability to use a computer would mean an additional level of training to cover both the system training and computer skills training, without which end-users cannot meaningfully use the systems and ultimately cannot deliver on the promise of electronic health information systems.

6.4.5 IT Equipment, Facilities and IT Infrastructure

Health information technology implementation has to factor in all the required IT equipment, IT infrastructure and necessary facilities. Inadequacies of these supportive components hinder the ability to realise the relative advantage of the acquisition. Not

only is there erosion of the potential benefits due to a functionality deficit, but also there is subsequent development of negative attitudes about the technology that presents as frustration on the part of end-users. Ultimately work productivity is negatively affected and can even result in a reversion to paper.

On-going support both onsite and offsite are important expressions of organisational commitment and support. However, with all that said implementation goes beyond financial resources and other factors need to be aligned. This has been evidenced by the continued adoption gap even after the HITECH financial incentive programme was implemented proving it takes more than financial resources for the success of implementation (DesRoches, et al., 2013).

6.4.6 System Usability and Functionality

Another equally powerful contributor to the erosion of the merits offered by electronic health records, according to respondents, is the intrinsic property of the technology. Included in this theme are user interface related issues, system functionality challenges and training and support. The complexity of an innovation as perceived by members of a social system is negatively related to its rate of adoption (Meigs et al., 2016; Kruse et al. 2014). Scholars agree that perceived ease of use of technology is one of the strongest predictors of IT acceptance among users (Gagnon et al, 2010).

6.4.7 User Interface

User interface is the ability to gain access into the system. Respondents raised dissatisfaction with the ability to interact with the system. This theme covers access, login process, passwords and selective access. Some participants encountered difficulties with the interface and were therefore unable to proceed further with using the system. This challenge has actually been observed in other studies showing that complicated interfaces require too much navigation (Kuhn et al., 2015). One of the interviewees recounted the inconvenience associated with having to remember individual passwords for twenty different systems. The price of privacy is at the cost of convenience. Similarly, the need to recall constantly changing system passwords was perceived in a negative light by the participants. These factors block system access thereby interfering with the ability to use the system. Beyond the access barrier is the perpetuated attitude that the system is not user-friendly. Diffusion of innovation theory states that the complexity of an innovation as perceived by members of a social system is negatively related to its rate of adoption (Kruse et al. 2014).

6.4.8 System functionality

This theme includes the need to synchronise, system design challenges, lack of system communication, the need for system improvements and selective access. System integration has been identified as a challenge to using EHR. Inadequately connected systems are not able to communicate leading to an inability to share data between systems and diminution of the optimal use of the system. Lack of sharing erodes the relative advantage of EHR over paper and limits coordination or collaboration or access or availability of information. Information resides in multiple systems instead of one central location. This impedes the usefulness and effectiveness of EHR. This recent study agrees that lack of interoperability among different systems and the resultant inability to share clinical data between medical entities remains a significant barrier to meaningful use of systems (Meigs et al., 2016).

One of the recurring problems with the Mobil system is the need to constantly reboot for optimal system function. This has introduced an inconvenience and additional step in the use of the technology. If not rebooted the system does not function. Participants voiced this as a shortcoming with the system. In addition, the scanning capacity has introduced a time-consuming activity of locating the barcode corresponding with the charged item. Research has shown that poor design and usability undermine the ability to perform work (Jones et al., 2012). Furthermore, scholars agree that perceived ease of use of a technology or the lack thereof is one of the strongest predictors of IT acceptance among users (Gagnon et al, 2010).

6.4.9 Training and support and IT literacy

The diffusion of innovation theory argues that innovation information is communicated through channels over time among members of a social system (Kruse et al., 2014). DOI maintains that training and support provide information that can be used to alleviate the uncertainty of the technology and give a sense of familiarity (Rogers, 2003). In line with the diffusion of innovation, the way the training is conducted, the appropriateness of channels used, frequency of sessions over time and the context of the social system are important. There is evidence that adopters learn through trial use of the innovation (Nambisan et al., 2013) that is possible through a well-planned training. The majority of participants singled out computer literacy as a challenge that can hinder adoption. People that are not comfortable with using a computer would not be able to perform any computer-related work. This finding was consistent with other

studies indicating that a lack of basic computer skills among nurses who had no background in information technology affected EHR implementation (Furst et al., 2013). In the current study, participants went even further to specifically mention the elderly being more challenged than the younger generation.

6.4.10 Organisational culture

Paper persistence was one of the organisationally based cultural phenomena. The introduction of EHR implies the intention to reduce the dependency on paper-based health care delivery processes. However, the research participants provided extensive accounts of existing paper persistence culture. Paper persistence is the continued use of paper or the use of both paper and computerized records. In the context of partial system adoption, some activities are digital while others are manual. There can also be system loopholes for paper use. In addition, the organisational processes themselves allow for the ability to go back and forth between the two modalities. The dual nature of activities results in redundancies and increased workload resulting from the residual paper inefficiencies. Furthermore, respondents disclosed that paper serves as a form of backup in cases of system malfunction.

In the study, there is evidence of the interchangability of the two systems. This dual environment retards the urgency for digital compliance. In the current study, a culture of paper persistence was found. Paper persistence detracts from EHR benefits in that the system is not used to its full capacity because of continued reliance on paper systems. This results in suboptimal use of the system that negatively impacts on users' perception of the system and, in turn, poor adoption.

6.4.11 Centralized decision process

In any organisation, the innovation decision is comprised of the individual staff decision process and that of the organisation (Kim, 2015). Frontline participants expressed sentiments of not being involved in decision-making but rather informed and instructed to implement computerized applications, following an authoritative approach. The diffusion of innovation framework outlines three decision types: the individual decision process is optional, the top down approach is authoritative and collaboration with staff is collective (Rogers, 2003). Literature has shown that different decision-makers, namely strategic, managerial or frontline, influence adoption at different technology stages: investment, implementation and institutionalisation (Avgar et al., 2012). Additional research concurs that strategic decisions are the pre-implementation stage

while the later stages are reliant on operational and frontline staff (Liebe et al, 2016). Frontline staff expressed lack of engagement as a result of their perception of an authoritative process at the implementation stage; this in turn negatively influences staff attitude regarding the implemented technology. Research has shown that successful implementation is a result of collective decision-making (Peckham et al., 2014). In addition, in the South African regulatory context, doctors are independent of the hospital meaning the utilisation of an authoritative approach would not be appropriate. There is extensive literature on this matter (Nambisan et al., 2013). Therefore, staff engagement is imperative.

6.4.12 Data Management

Ensuring data quality, quantity, value Porter et al., 2013) and security (Boonstra et al., 2010) is still a challenge and barrier to the adoption of EHR. Some participants viewed the systems as compliance tools to meet payers' requirements and questioned the clinical relevance of the data. There was a sentiment expressed that data has to be collected not just for being data but also for the data to contribute value for the hospital and patients. Hence the additional concern with electronic data is the amount that is generated and the capacity to extract value from it. Some unit managers have pointed out situations where there are were too many alerts coming in multiple times on the same patient meaning the design of the system is problematic.

The systems are also perceived to being designed by experts with no clinical insight thereby limiting the system's contribution to clinical relevance. This issue is intricately interlinked with the decision-making process and subsequent staff engagement. If a collaborative model of decision-making prevails then relevant stakeholders in the form of staff will be involved from the design to implementation and use of systems. What this guarantees is that there is a clinical fit-compatibility with the work to be done and the data generated has clinical value.

Law regulates the safety and security of data to protect the confidentiality of patients and hospitals must comply. However, as evidenced by the research subjects' interpretation, security trade-offs exist that undermines the other benefits like simplicity, time saved, access, availability and sharing of patient information. The need for security means the introduction of access limitations that can be both time-consuming and complex.

6.5 PROMOTERS OF EHR

This section addresses Research Sub-Question 4: What in the interpretation of respondents are the factors that encourage the adoption and use of an EHR?

6.5.1 Communication channels and networks

In this section, the focus is on the ability of institutions to leverage human resources for optimal use of systems to attain desired outcomes and in turn have a positive impact on adoption. Communication among EHR users, through network channels, is instrumental in contributing to positive user attitude (Zheng et al., 2010). The use of EHR helps support, promote and form the basis for peer-to-peer network channels that transcend professional boundaries between the various clinical and operational disciplines in a hospital setting. Hence participants attested to the use of EHR having improved communication with fellow colleagues from the different departments. Castillo, Martinez-Garcia, and Pulido (2010) found that communication among users of the EHR is integral to positive user outlook. These networks can be leveraged to communicate positive EHR information amongst users and share experiences. This practice would be in line with literature wherein networks were used as teaching tools with more experienced users supporting their less competent colleagues (Castillo et al. 2010). Studies have shown that networks can be used to convince non-adopters of the merits of EHR (Angst, et al., 2010).

6.5.2 System utility and knowledge resource

Training and support, as previously mentioned, is a facilitator of successful implementation. However, from the interviews, continuous training and using the system enhances acceptance of computerised record keeping. Participants indicated that their system competence could be attributed to continuous experiential learning. One of the unit mangers mentioned that she would go from ward to ward to learn how others were using the system and this was done over time. Participants comment that with continuous use, the system became easier to work with and master. The official training was scheduled for a particular time, but participants voiced the need for a frequency of follow-up training sessions in order for people to sharpen their skills. Continuous use breeds familiarity allowing for the dissolution of system complexity, which in turn encourages greater use of the system and increases the opportunity to correctly use the system and realise the benefits of use (Gagnon et al., 2012). Participants subjected themselves to continuous learning that led to an accumulation of

system knowledge in the form of experience. There is a need to keep encouraging staff to keep using the system and encourage a learning environment. These observations are aligned with literature where it has been demonstrated that on-going training and use may increase the use of systems (Bredfeldt et al., 2013).

6.5.3 Staff engagement and empowerment

Participants indicated that they were not consulted before implementation of technology applications. They expressed a sense of despondency and acknowledged the top-down decision process of the company. Respondents voiced their desire to be more involved even to the point of design. Their argument was that they were the ones using the systems and they were the experts on what is needed on the ground. Hence, they believed that if they were more involved in the process the technology would be more context-appropriate and compatible with their work needs and providing them as frontline staffs with a tool to better deliver quality health care services. This view is supported by literature (Nambisan et al., 2013).

Participants viewed the Bluebird system to be more than just a quality improvement system. There was a held perception that systems like Bluebird serve as empowerment tools in the hierarchy ordered world of medicine. Unit managers view Bluebird as more than a clinical tool, but rather as an empowerment tool to give nurses a platform to have a voice. Bluebird allows the nurses to be on par with the doctors with the availability of infection control information. Christensen (2009) states that disruptive innovations results in decentralisation of knowledge and skills making it possible for previously complex activities to be performed by less-skilled individuals with the help of the innovation. In a similar manner, CDSS can decentralise clinical decision-making to empower nursing staff with evidence-based medicine. Furthermore, staffs foresee the use of technology transcending health care sector boundaries and empowering health care professionals bestowing a form of status.

6.5.4 Paperless Outlook

The study has established that participants acknowledged the digitisation trend in health care, that there was a general positive view of a paperless hospital and the overall positive view of the electronic systems that were in use in the hospital. Staff showed interest in the systems and most agreed with the idea of a paperless environment with a few reservations of how it would be implemented and how it would

work. Therefore organisations can leverage this positive paperless view to engage and involve staff in decision-making.

6.6 CONCLUSION

The discussion section has answered the research question using the study findings from chapter 5. The findings have resulted in a maturity audit of the study hospitals and found them to meet the Institute of Medicine basic EHR category. The findings were grouped into three overarching sectional themes including: (1) the relative advantage of electronic health records, (2) erosion of electronic health records benefits (3) promoters of electronic health records. Each sectional theme was further divided into subthemes. It is important to note the interconnected nature of the themes. For the purposes of results, presentation the themes were reported as distinct. The themes were outlined as discrete items but in fact there are many dependencies in and among the themes. They exert influence and impact each other in countless ways. Therefore, they do not exist in a linear relationship but one that is highly interrelated and complex. In summary, there is an overall positive attitude towards EHR systems and a paperless environment. Participants were able to identify the relative advantages of EHR. However, relative advantage alone is not enough to sustain the diffusion of EHR to deliver health outcomes. In practice, one has to contend with factors that undermine the potential benefits of electronic health records. Therefore, the challenge in practice is how to leverage factors that promote the use of EHR in order to optimise its use and in turn its diffusion.

CHAPTER 7: CONCLUSION

7.1 INTRODUCTION

This study succeeded to adequately explore and deduce meaning from the expressed perceptions of electronic health record users and decision makers of the three organizational tiers being strategic, operational and frontline staff with the aid of a phenomelogical qualitative method design. In the process, the investigator gained a deeper understanding of the interrelated nature of factor influences inherent in the adoption and use of EHR to contribute to healthcare practice and academia.

7.2 RESEARCH BACKGROUND & OBJECTIVES

(i) Audit the current EHR functional maturity of the private hospitals from information that participants share about the electronic records functionality in use. The maturity argument states that as you move along the maturity curve, factors of relevance change (Sun et al., 2015). Therefore, it is important to know the maturity level, as the level will inform the relevance of factors for that stage.

(ii) Conduct interviews with the purpose of identifying factors that influence EHR adoption and how they apply and manifest within and between the organizational levels including strategic, management and frontline.

(iii) Examine and describe the setting of the phenomenon hospital diffusion network structure and seek to identify staff networks and how these could impact on EHR adoption.

7.3 MAIN FINDINGS

Participants in this study all had an overall positive outlook towards the paperless hospital environment. Participants agreed that EHR have relative advantage over paper in the form of operational efficiencies and delivery of care improvements. They did acknowledge existing challenges of using electronic information systems including (a) financial investment, (b) system usability and functionality, (c) deficient communication (d) organizational processes and culture, (e) increased workload and (f) data management. Similarly, participants identified the ability to leverage human

resources and the paperless outlook as promoters of electronic information system use. These findings will contribute to the knowledge base of health information systems management, and assist management on how to better realise the gains of computerised systems and minimize the erosion of electronic health record benefits.

7.4 IMPLICATIONS FOR MANAGEMENT & HOSPITAL

7.4.1 Results Observability

Literature is awash with benefits of EHR yet end-users and decision makers still struggle to incorporate these systems into daily clinical work. This study has discovered that participants' ability to observe and communicate positive system outcomes greatly influences end-user outlook. Therefore, there is a need to institute processes that would ensure the diffusion of EHR use observable results. Communication of observable outcomes requires peer-to-peer networks. Diffusion of innovation framework agrees that observability is one of the innovation attributes that positively influence adoption (Rogers, 2003 page).

7.4.2 Cost implication

Cost is still a prohibitive factor for the adoption of electronic health records. There are complex interactions of cost as it applies to EHR. The cost of implementation includes the hardware and software, human resources investment and the supportive equipment and facilities. These factors in turn have further cost implications on the operations of the organization. For example training has cost implications of not just for the training exercise but also the effects on workflow and loss of workdays. Therefore organizations need to map out the full extend of cost because any shortfalls will surface as barriers to use and erode the benefits of the system.

7.4.3 Usability and Functionality

Diffusion of innovation states that compatibility of innovation with users way of doing thing fosters familiarity and promotes adoption (Rogers, 2003). Compatibility is the product of the technology, the human user and how well each fits the other. It is the value derived from how humans and technology interact that counts in innovation, and not the quality of the elements in isolation (Coiera, 2015). Management has to appropriately plan for computerized health information systems and ensure that there

is work compatibility between the technology and end-users. Failure to do so results in usability and functionality challenges as participants in the study pointed out.

7.4.4 Communication networks and channels

This study found peer-to-peer networks highly effective in diffusing information about EHR. Participants used the network for support with the system, for training and learning from the more competent colleagues in using the system and for communicating positive outcomes. Management to engage and involve staff in implementation planning and system roll out can leverage these networks more. Participants also indicated the value of champions in serving as a knowledge hub, educator, trainer, supporter and a link with management. Research agrees that champions can bridge the information systems knowledge gap (Cresswell et al., 2013).

7.4.5 Training

All frontline participants reported on the importance of training and support. Training alleviates the knowledge uncertainty and complexity perceptions associated with new technology. A well-structured training program to fit end-user workflow and deliver the highest value is imperative. Training content needs to align with work context. Training sessions have to be well coordinated starting with the initial training up to follow up sessions. In addition, online and onsite support needs to be well accessible and available. Studies support the importance of training in the process of implementation (Goldsack & Robinson, 2014; Bredfeldt et al., 2013). Given the magnitude of the computer illiteracy challenge, management has to consider incorporating IT literacy sessions as consistent part of staff training.

7.4.6 Staff Empowerment

The importance of staff engagement has already been mentioned above. In the current study, it became clear that staff had a positive outlook of technology. However, they decried lack of involvement in decision-making. They believed they could contribute in the design and implementation of context relevant technology. Organizations have to use this outlook to promote computerized information system leveraging the positive paperless perspective of staff. This sentiment was echoes when one of the participants said:

"*I believe that innovation comes from the hospital's side. Because we are the ones that are working on these systems on a day-in-day-out perspective. So, we generally give feedback to that, but coming back to that systems and working and sharing together, they are a lot of systems and there could be better integration. Absolutely" (*NM32SHMM*)*.

7.5 LIMITATIONS OF STUDY

The current study has several limitations. The first limitation is the potential for participants to provide dishonest responses. There was an assumption made that the participants would be free and open to voice their true opinions and experiences. Participant received the study brief via email a day before the interview. This allowed ample time to familiarize them with the subject matter. At the beginning of each interview time was spend again giving a summary of the study and consent and confidentiality to ensure they are comfortable enough to proceed with the interview. Emphasis was made of the academic nature of the research to avoid any confusion among participants assuming the study connection to the EHR vendor company.

The second limitation was the sample challenge. The third hospital pulled out of the interview pool of participants citing unfamiliarity with the subject matter. This resulted in only two hospitals participating. In addition, in the second hospital due to time constraints the interview model had to be adapted to a focus group instead of one on one interviews. This meant that the sample size in total stayed the same but the ability to compare between hospitals was limited. The sample variety was decreased. The study was not successful in recruiting physicians to participate in the study and given the tight study timelines the investigator proceeded with available participants who were mostly nurses. This means the study results cannot be generalized.

7.6 FUTURE STUDY RECOMMENDATIONS

It is the researcher's opinion that a bigger sample, covering all three-hospital groups covering a wider geographic base would improve the generalizability of study findings. In addition ideally this kind of study would benefit from a longitudinal design where sequence from pre implementation, implementation and optimal use is followed.

Patients are under the care of doctors in hospitals, therefore, doctors' buy in and attitude is crucial for the diffusion of electronic health records in hospitals. Given that physicians were not included in this study, future study design can include doctors.

Participants maintained a perspective of technology not being an integral part of the treatment modalities, it would be beneficial to look more into this external view of technology. This would assist implementers of EHR deal with attitude towards EHR and view it as one of the treatment modalities. Participants really felt that information systems was not part of their job description, their job is to get the patient better. There is a need to convince clinical end-users that information systems are actually part of the intervention tools.

Lastly, there was a point raised around power redistribution and decentralization to investigate further. There was a view expressed that CDSS can serve as a tool for nursing staff to manoeuvre the hierarchical clinical structure to make clinical decisions. This view would be in line with the disruptive innovation theory that innovations lead to a decentralisation of processes. Further investigation of this phenomenon would be vital as positive results could be used as a tool to promote EHR among the nursing staff and have overall positive impact on the organization.

7.7 CONCLUSION

Computer based information systems will not totally replace paper based record system rather there is progress to a point of equilibrium where the two can coexist and maximum value is derived form the balance (Kimble, 2014). EHR have the potential to change certain aspects of healthcare delivery, but cannot be viewed as the only solution to improving healthcare (Porter et al., 2013).

REFERENCES

Abramson, E. L., Patel, V., Malhotra, S., Pfoh, E. R., Osorio, S. N., Cheriff, A., ... & Kaushal, R. (2012). Physician experiences transitioning between an older versus newer electronic health record for electronic prescribing. *International journal of medical informatics*, *81*(8), 539-548.

Adler-Milstein, J., DesRoches, C. M., Furukawa, M. F., Worzala, C., Charles, D., Kralovec, P., ... & Jha, A. K. (2014). More than half of US hospitals have at least a basic EHR, but stage 2 criteria remain challenging for most. *Health Affairs*, 10-1377.

AAFP. (2017). *Understanding features & functions of an EHR*. Retrieved from: http://www.aafp.org/practice-management/health-it/product/features-functions.html

Agarwal, R., Gao, G., DesRoches, C., & Jha, A. K. (2010). Research commentary-The digital transformation of health care: current status and the road ahead. Information Systems Research,21(4), 796-809.

Ajami, S., & Bagheri-Tadi, T. (2013). Barriers for adopting electronic health records (EHRs) by physicians. *Acta Informatica Medica*, *21*(2), 129..

Angst, C., Agarwal, R., Sambamurthy, V., & Kelley, K. (2010). Social Contagion and Information Technology Diffusion: The Adoption of Electronic Medical Records in U.S. Hospitals. *Management Science*, *56*(8), 1219-1241.

Atherton, J. (2011). Development of the Electronic Health Record. *Virtual Mentor*, *13*(3), 186-189.

Audet, A. M., Squires, D., & Doty, M. M. (2014). Where are we on the diffusion curve? Trends and drivers of primary care physicians' use of health information technology. *Health Services Research*, *49*(1pt2), 347-360.

Bernard, H. R., & Bernard, H. R. (2012). *Social research methods: Qualitative and quantitative approaches*. Sage.

Bahensky, J. A., Jaana, M., & Ward, M. M. (2008). Health care information technology in rural America: electronic medical record adoption status in meeting the national agenda. *The Journal of Rural Health*, *24*(2), 101-105.

Benatar, S. (2013). The challenges of health disparities in South Africa. *SAMJ: South African Medical Journal*, *103*(3), 154-155.

Blumenthal, D., & Tavenner, M. (2010). The "meaningful use" regulation for electronic health records. *New England Journal of Medicine*, *363*(6), 501-504.

Boonstra, A., Versluis, A., & Vos, J. F. (2014). Implementing electronic health records in hospitals: a systematic literature review. *BMC Health Services Research*, *14*(1), 1.

Bowles, K. H., Potashnik, S., Ratcliffe, S. J., Rosenberg, M. M., Shih, M. N. W., Topaz, M. M., ... & Naylor, M. D. (2013). Conducting research using the electronic health record across multi-hospital systems: semantic harmonisation implications for administrators. *The Journal of Nursing Administration*, *43*(6), 355.

Buntin, M. B., Burke, M. F., Hoaglin, M. C., & Blumenthal, D. (2011). The benefits of health information technology: a review of the recent literature shows predominantly positive results. *Health Affairs*, *30*(3), 464-471.

Bredfeldt, C. E., Awad, E. B., Joseph, K., & Snyder, M. H. (2013). Training providers: beyond the basics of electronic health records. *BMC health services research*, *13*(1), 1.

Brink, A. J., Messina, A. P., Feldman, C., Richards, G. A., Becker, P. J., Goff, D. A., ... & Alliance, N. A. S. S. (2016). Antimicrobial stewardship across 47 South African hospitals: an implementation study. *The Lancet Infectious Diseases*, *16*(9), 1017-1025

Burke, H. B., Becher, D. A., Hoang, A., & Gimbel, R. W. (2016). The adoption of an electronic health record did not improve A1c values in Type 2 diabetes. *Journal of Innovation in Health Informatics*, *23*(1), 433-438.

Byyny, R. L. (2015). The tragedy of the electronic health record. *Pharos Alpha Omega Alpha Honor Med Soc*, 2-5.

Caine, K., & Tierney, W. M. (2015). Point and counterpoint: Patient control of access to data in their electronic health records. *Journal of General Internal Medicine*, *30*(1), 38-41.

Castillo, V. H., Martínez-García, A. I., & Pulido, J. R. G. (2010). A knowledge-based taxonomy of critical factors for adopting electronic health record systems by physicians: a systematic literature review. *BMC medical informatics and decision making*, *10*(1), 1.

Chao, W. C., Hu, H., Ung, C. O. L., & Cai, Y. (2013). Benefits and challenges of electronic health record system on stakeholders: a qualitative study of outpatient physicians. *Journal of Medical Systems*, *37*(4), 1-6.

Christensen, C. M., Dillon, K., Hall, T., & Duncan, D. S. (2016). Competing against luck: the story of innovation and customer choice. New York City, NY: Harper Collins.

Coiera, E. (2015). Technology, cognition and error. *BMJ Quality & Safety*, *24*(7), 417-422.

Cranfield, S., Hendy, J., Reeves, B., Hutchings, A., Collin, S., & Fulop, N. (2015). Investigating health care IT innovations: a "conceptual blending" approach. *Journal of health Organisation and Management*, *29*(7), 1131-1148.

Creswell, K., & Sheikh, A. (2013). Organisational issues in the implementation and adoption of health information technology innovations: an interpretative review. *International Journal of Medical Informatics*, *82*(5), e73-e86.

Cucciniello, M., Lapsley, I., Nasi, G., & Pagliari, C. (2015). Understanding key factors affecting electronic medical record implementation: a sociotechnical approach. *BMC health services research*, *15*(1), 1.

Department of Health. (2015). *Towards national health insurance for South Africa*. https://www.health-e.org.za/wp-content/uploads/2015/12/National-Health-Insurance-for-South-Africa-White-Paper.pdf.

DesRoches, C. M., Charles, D., Furukawa, M. F., Joshi, M. S., Kralovec, P., Mostashari, F., ... & Jha, A. K. (2013). Adoption of electronic health records grows rapidly, but fewer than half of US hospitals had at least a basic system in 2012. *Health Affairs*, 10-1377.

DesRoches, C. M., Worzala, C., Joshi, M. S., Kralovec, P. D., & Jha, A. K. (2012). Small, nonteaching, and rural hospitals continue to be slow in adopting electronic health record systems. *Health Affairs*, *31*(5), 1092-1099.

Dick, R. S., Steen, E. B., & Detmer, D. E. (Eds.). (1997). *The computer-based patient record: an essential technology for health care*. National Academies Press.

Erasmus, L., & Sikhondze, N. C. (2016). Electronic Medical Records: A Developing and Developed Country Analysis. *International Association for Management of Technology IAMOT 2016 Conference Proceedings.*

Fichman, R. G., Kohli, R., & Krishnan, R. (Eds.). (2011). Editorial overview-the role of information systems in health care: Current research and future trends. *Information Systems Research*, *22*(3), 419-428.

Friedberg, M. W., Chen, P. G., Aunon, F. M., Van Busum, K. R., Pham, C., Caloyeras, J. P., ... & Brook, R. H. (2013). *Factors affecting physician professional satisfaction and their implications for patient care, health systems, and health policy*. Rand Corporation.

Gagnon, M. P., Desmartis, M., Labrecque, M., Car, J., Pagliari, C., Pluye, P., ... & Légaré, F. (2012). Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. *Journal of medical systems*, *36*(1), 241-277.

Geibert, R. C. (2006). Using diffusion of innovation concepts to enhance implementation of an electronic health record to support evidence-based practice. *Nursing administration quarterly*, *30*(3), 203-210.

Gibson, C. J., Dixon, B. E., & Abrams, K. (2014). Convergent evolution of health information management and health informatics: a perspective on the future of information professionals in health care. *Applied clinical informatics*, *6*(1), 163-184

Goetz, G. D., Kuzel, A. J., Feng, L. B., DeShazo, J. P., & Love, L. E. (2012). EHRs in primary care practices: benefits, challenges, and successful strategies. *The American Journal of Managed Care*, *18*(2), e48-54.

Goldsack, J. C., & Robinson, E. J. (2014). The impact of health information technology on staffing. *Journal of Nursing Administration*, *44*(2), 117-120.

Greenhalgh, T., Potts, H. W., Wong, G., Bark, P., & Swinglehurst, D. (2009). Tensions and paradoxes in electronic patient record research: A systematic literature review using the meta-narrative method. *Milbank Quarterly*, *87*(4), 729-788.

Greenhalgh, T., Robert, G., Bate, P., Macfarlane, F., & Kyriakidou, O. (2008). *Diffusion of innovations in health service organisations: a systematic literature review*. John Wiley & Sons.

Gregory, D., & Buckner, M. (2014). Point-of-care technology: Integration for improved delivery of care. *Critical Care Nursing Quarterly*, *37*(3), 268-272.

Hatton, J. D., Schmidt, T. M., & Jelen, J. (2012). Adoption of electronic health care records: Physician heuristics and hesitancy. *Procedia Technology*, *5*, 706-715.

Hesse, B. W., Ahern, D. K., & Woods, S. S. (2011). Nudging best practice: the HITECH act and behavioral medicine. *Translational Behavioral Medicine*, *1*(1), 175-181.

HIMSS Analytic. (2014). *EMR adoption model*. Chicago, IL: HIMSS Analytics.

Ho, Y. X., Gadd, C. S., Kohorst, K. L., & Rosenbloom, S. T. (2014). A qualitative analysis evaluating the purposes and practices of clinical documentation. *Applied Clinical Informatics*, *5*(1), 153-168.

Hsiao, C. J., & Hing, E. (2012). *Use and characteristics of electronic health record systems among office-based physician practices, United States, 2001-2012* (pp. 1-8). US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

Ingebrigtsen, T., Georgiou, A., Clay-Williams, R., Magrabi, F., Hordern, A., Prgomet, M., ... & Braithwaite, J. (2014). The impact of clinical leadership on health information technology adoption: systematic review. *International journal of medical informatics*, *83*(6), 393-405.

Institute of Medicine (US), Committee on Quality of Health Care in America. (2000). *To err is human: Building a safer health system*. Kohn, L. T., Corrigan, J., & Donaldson, M. S. (Eds.). Washington DC, WA: National Academies Press.

Jackson, M. O., Rogers, B. W., & Zenou, Y. (2016). The economic consequences of social network structure. *Available at SSRN 2467812*.

Jacobs, L. (2009). Interview with Lawrence Weed, MD—the father of the problem-oriented medical record looks ahead. *Perm J*, *13*(3), 84-89.

Jamoom, E. W., Patel, V., Furukawa, M. F., & King, J. (2014, March). EHR adopters vs. non-adopters: impacts of, barriers to, and federal initiatives for EHR adoption. *Health care*, *2*(1), 33-39

Jha, A. K., DesRoches, C. M., Campbell, E. G., Donelan, K., Rao, S. R., Ferris, T. G., ... & Blumenthal, D. (2009). Use of electronic health records in US hospitals. *New England Journal of Medicine*, *360*(16), 1628-1638.

Jha, A. K., DesRoches, C. M., Kralovec, P. D., & Joshi, M. S. (2010). A progress report on electronic health records in US hospitals. *Health affairs*, *29*(10), 1951-1957.

Jones, E. B., & Furukawa, M. F. (2014). Adoption and use of electronic health records among federally qualified health centers grew substantially during 2010–12. *Health Affairs*, *33*(7), 1254-1261.

Karsh, B. T., Weinger, M. B., Abbott, P. A., & Wears, R. L. (2010). Health information technology: fallacies and sober realities. *Journal of the American Medical Informatics Association*, *17*(6), 617-623.

Kazmi, Z. (2014). Effects of exam room EHR use on doctor-patient communication: a systematic literature review. *Journal of Innovation in Health Informatics*, *21*(1), 30-39.

Kenneally, J., Curley, M., Wilson, B., Buddrus, U., Porter, M., Murnane, S., ... & Hoyt, J. (2014, January). Accelerating electronic medical record adoption & innovation with targeted IT capabilities. In *ISPIM Conference Proceedings*. The International Society for Professional Innovation Management (ISPIM).

Kim, T. (2015). Diffusion of changes in organisations. *Journal of Organisational Change Management, 28*(1), 134-152.

King, J., Patel, V., Jamoom, E. W., & Furukawa, M. F. (2014). Clinical benefits of electronic health record use: national findings. *Health services research*, *49*(1pt2), 392-404.

Kimble, C. (2014). Electronic health records: Cure-all or chronic condition? *Global Business and Organisational Excellence*, *33*(4), 63-74.

Kirkwood, A., & Price, L. (2013). Examining some assumptions and limitations of research on the effects of emerging technologies for teaching and learning in higher education. *British Journal of Educational Technology*, *44*(4), 536-543.

Kreindler, G. E., & Young, H. P. (2014). Rapid innovation diffusion in social networks. *Proceedings of the National Academy of Sciences*, *111*(Supplement 3), 10881-10888.

Krist, A. H., Beasley, J. W., Crosson, J. C., Kibbe, D. C., Klinkman, M. S., Lehmann, C. U., ... & Peterson, K. A. (2014). Electronic health record functionality needed to better support primary care. *Journal of the American Medical Informatics Association*, *21*(5), 764-771.

Krist, A. H., Beasley, J. W., Crosson, J. C., Kibbe, D. C., Klinkman, M. S., Lehmann, C. U., ... & Peterson, K. A. (2014). Electronic health record functionality needed to

better support primary care. *Journal of the American Medical Informatics Association*, *21*(5), 764-771.

Kruse, C. S., DeShazo, J., Kim, F., & Fulton, L. (2014). Factors associated with adoption of health information technology: a conceptual model based on a systematic review. *JMIR Medical Informatics*, *2*(1), e9.

Kuhn, T., Basch, P., Barr, M., & Yackel, T. (2015). Clinical documentation in the 21st century: executive summary of a policy position paper from the American College of Physicians. *Annals of Internal Medicine*, *162*(4), 301-303.

Lanham, H. J., Sittig, D. F., Leykum, L. K., Parchman, M. L., Pugh, J. A., & McDaniel, R. R. (2014). Understanding differences in electronic health record (EHR) use: linking individual physicians' perceptions of uncertainty and EHR use patterns in ambulatory care. *Journal of the American Medical Informatics Association*, *21*(1), 73-81.

Lee, H. W., Ramayah, T., & Zakaria, N. (2012). External factors in hospital information system (HIS) adoption model: a case on Malaysia. *Journal of Medical Systems*, *36*(4), 2129-2140.

Lee, J., Kuo, Y. F., & Goodwin, J. S. (2013). The effect of electronic medical record adoption on outcomes in US hospitals. *BMC health services research*, *13*(1), 1.

Liebe, J. D., Egbert, N., Frey, A., & Hübner, U. (2010). Characteristics of German hospitals adopting health IT systems-results from an empirical study. *Studies in health technology and informatics*, *169*, 335-338.

Lipsitz, L. A. (2012). Understanding health care as a complex system: the foundation for unintended consequences. *JAMA*, *308*(3), 243-244.

Lown, B. A., & Rodriguez, D. (2012). Commentary: Lost in translation? How electronic health records structure communication, relationships, and meaning. *Academic Medicine*, *87*(4), 392-394.

Mack, N., Woodsong, C., MacQueen, K. M., Guest, G., & Namey, E. (2005). Qualitative research methods: a data collectors field guide.

Mandl, K. D., & Kohane, I. S. (2012). Escaping the EHR trap—the future of health IT. *New England Journal of Medicine*, *366*(24), 2240-2242.

Martin, K., & Parmar, B. (2012). Assumptions in decision making scholarship: Implications for business ethics research. *Journal of Business Ethics*, 105, 289-306. doi:10.1007/s10551-011-0965-z.

Mascia, D., Di Vincenzo, F., Lacopino, V., Fantini, M. P., & Cicchetti, A. (2015). Unfolding similarity in interphysician networks: the impact of institutional and professional homophily. *BMC Health Services Research*, *15*(1), 1.

McDonald, C. J., Overhage, J. M., Tierney, W. M., Dexter, P. R., Martin, D. K., Suico, J. G., ... & Meeks-Johnson, J. (1999). The Regenstrief medical record system: a quarter century experience. *International Journal of Medical Informatics*, *54*(3), 225-253.

Menachemi, N., & Collum, T. H. (2011). Benefits and drawbacks of electronic health record systems. *Risk Manag Healthc Policy*, *4*, 47-55.

Meeks, D. W., Smith, M. W., Taylor, L., Sittig, D. F., Scott, J. M., & Singh, H. (2014). An analysis of electronic health record-related patient safety concerns. *Journal of the American Medical Informatics Association*, *21*(6), 1053-1059.

Meeks, D. W., Takian, A., Sittig, D. F., Singh, H., & Barber, N. (2014). Exploring the sociotechnical intersection of patient safety and electronic health record implementation. *Journal of the American Medical Informatics Association*, *21*(e1), e28-e34.

Meigs, S. L., & Solomon, M. (2016). Electronic health record use a bitter pill for many physicians. *Perspectives in Health Information Management*, *13*(Winter).

Musen, M. A., & van Bemmel, J. H. (1997). *Handbook of medical informatics*. Houten: Bohn Stafleu Van Loghum.

Najaftorkaman, M., Ghapanchi, A. H., Talaei-Khoei, A., & Ray, P. (2013). Recent research areas and grand challenges in electronic medical record: A literature survey approach. *The International Technology Management Review*, *3*(1), 12-21.

Najaftorkaman, M., Ghapanchi, A. H., Talaei-Khoei, A., & Ray, P. (2015). A taxonomy of antecedents to user adoption of health information systems: A synthesis of thirty years of research. *Journal of the Association for Information Science and Technology*, *66*(3), 576-598.

Nambisan, P., Kreps, G. L., & Polit, S. (2013). Understanding electronic medical record adoption in the United States: communication and sociocultural perspectives. *Interactive Journal of Medical Research*, *2*(1), e5.

O'Connor, P. J., Sperl-Hillen, J. M., Rush, W. A., Johnson, P. E., Amundson, G. H., Asche, S. E., ... & Gilmer, T. P. (2011). Impact of electronic health record clinical decision support on diabetes care: a randomized trial. *The Annals of Family Medicine*, *9*(1), 12-21.

Ober, K. P., & Applegate, W. B. (2015). The electronic health record. *www.alphaomegaalpha.org*, *78*(1), 9.

Oliveira, T., & Martins, M. F. (2010, September). Information technology adoption models at firm level: review of literature. In *European Conference on Information Management and Evaluation* (p. 312). Academic Conferences International Limited.

Ozair, F. F., Jamshed, N., Sharma, A., & Aggarwal, P. (2015). Ethical issues in electronic health records: A general overview. *Perspectives in clinical research*, *6*(2), 73.

Payne, T. H., Corley, S., Cullen, T. A., Gandhi, T. K., Harrington, L., Kuperman, G. J., ... & Tierney, W. M. (2015). Report of the AMIA EHR 2020 task force on the status and future direction of EHRs. *Journal of the American Medical Informatics Association*, ocv066.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, *42*(5), 533-544.

Palojoki, S., Pajunen, T., Saranto, K., & Lehtonen, L. (2016). Electronic Health Record-Related Safety Concerns: A Cross-Sectional Survey of Electronic Health Record Users. *JMIR medical informatics*, *4*(2), e13.

Peterson, L. T., Ford, E. W., Eberhardt, J., Huerta, T. R., & Menachemi, N. (2011). Assessing differences between physicians' realized and anticipated gains from electronic health record adoption. *Journal of medical systems*, *35*(2), 151-161.

Pietkiewicz, I., & Smith, J. A. (2014). A practical guide to using Interpretative Phenomenological Analysis in qualitative research psychology. *Psychological Journal*, *20*(1), 7-14.

Pipersburgh, J. (2011). The push to increase the use of EHR technology by hospitals and physicians in the United States through the HITECH Act and the Medicare incentive program. *Journal of Health Care Finance*, *38*(2), 54.

Porter, M. E., & Lee, T. H. (2013). The Strategy That Wilt Fix Health Care. *Harvard business review*, *91*(10), 50-+.

Porter, M. (2013). *Adoption of electronic health records in the United States*. Oakland, CA: Kaiser Permanente International.

Pourbohloul, B., & Kieny, M. P. (2011). Complex systems analysis: towards holistic approaches to health systems planning and policy. *Bulletin of the World Health Organisation*, *89*(4), 242-242.

Price, M., Lau, F., & Lai, J. (2011). Measuring EMR adoption: a framework and case. *ElectronicHealth care*, *10*(1).

Price, M., Singer, A., & Kim, J. (2013). Adopting electronic medical records Are they just electronic paper records? *Canadian Family Physician*, *59*(7), e322-e329.

Rahimi, N., & Jetter, A. (2015, August). Explaining health technology adoption: past, present, future. In *2015 Portland International Conference on Management of Engineering and Technology (PICMET)* (pp. 2465-2495). IEEE.

Rahman, R., & Reddy, C. K. (2015). Electronic health records: a survey. *Health care Data Analytics*, *36*, 21.

Rameshwara, G. N., Kumar, N., & Raghavendra, B. (2015). Effects of Computerized Patient Records on Patients. *Bonfring International Journal of Man Machine Interface*, *3*(3), 25.

Rocha, Á. (2013). Evolution of information systems and technologies maturity in health care. *Health care Information Technology Innovation and Sustainability: Frontiers and Adoption: Frontiers and Adoption*, 238.

Rogers, E. M. (1983). *Diffusion of innovations*. New York City, NY: Free Press.

Rogers, E. M. (2003). Elements of diffusion. *Diffusion of innovations*, *5*, 1-38.

Saleem, J. J., Russ, A. L., Neddo, A., Blades, P. T., Doebbeling, B. N., & Foresman, B. H. (2011). Paper persistence, workarounds, and communication breakdowns in computerized consultation management. *International Journal of Medical Informatics*, *80*(7), 466-479.

Sanjari, M., Bahramnezhad, F., Fomani, F. K., Shoghi, M., & Cheraghi, M. A. (2014). Ethical challenges of researchers in qualitative studies: the necessity to develop a specific guideline. *Journal of medical ethics and history of medicine*, *7*.

Schwab, K. (2016). *The fourth industrial revolution*. Geneva, Switzerland: World Economic Forum.

Scott, J., Tallia, A., Crosson, J. C., Orzano, A. J., Stroebel, C., DiCicco-Bloom, B., ... & Crabtree, B. (2005). Social network analysis as an analytic tool for interaction patterns in primary care practices. *The Annals of Family Medicine*, *3*(5), 443-448.

Siegler, E. L. (2010). The evolving medical record. *Annals of Internal Medicine*, *153*(10), 671-677.

Sharp, R., Grech, C., Fielder, A., Mikocka-Walus, A., Cummings, M., & Esterman, A. (2014). The patient experience of a Peripherally Inserted Central Catheter (PICC): a qualitative descriptive study. *Contemporary nurse*, *48*(1), 26-35.

Sun, J. & Qu, Z. (2015). Understanding health information technology adoption: A synthesis of literature from an activity perspective. *Information Systems Frontiers*, *17*(5), 1177-1190. http://dx.doi.org/10.1007/s10796-014-9497-2

Tierney, W. M., Kanter, A. S., Fraser, H. S., & Bailey, C. (2010). A toolkit for e-health partnerships in low-income nations. *Health Affairs*, *29*(2), 268-273.

Turpin, J., Ankem, K., & Uppala, V. (2016). Physician adoption of electronic health records: a visualisation of the role of provider and state characteristics in incentive program participation. *Information Research*, *2*(21).

van Poelgeest, R., Heida, J. P., Pettit, L., de Leeuw, R. J., & Schrijvers, G. (2015). The association between eHealth capabilities and the quality and safety of health care in the Netherlands: Comparison of HIMSS Analytics EMRAM data with Elsevier's 'The Best Hospitals' data. *Journal of Medical Systems*, *39*(9), 1-6.

Verdon, D. R. (2014). EHRs: the real story. Why a national outcry from physicians will shake the health information technology sector. *Medical Economics*, *91*(3), 18-20.

Weber-Jahnke, J., Peyton, L., & Topaloglou, T. (2012). eHealth system interoperability. *Information Systems Frontiers*, *14*(1), 1-3.

White, A., & Danis, M. (2013). Enhancing patient-centered communication and collaboration by using the electronic health record in the examination room. *Jama*, *309*(22), 2327-2328.

Zheng, K., Padman, R., Krackhardt, D., Johnson, M. P., & Diamond, H. S. (2010). Social networks and physician adoption of electronic health records: insights from an empirical study. *Journal of the American Medical Informatics Association*, *17*(3), 328-336.

APPENDICES

PLAGIARISM DECLARATION

APPENDIX 1: PARTICIPANT INFORMED CONSENT

Study Title: Factors related to the adoption of electronic health records

Principal Investigator: Svieta Ngcaba

Institution: Gordon Institute of Business Sciences – University of Pretoria

Contact number: 0822103650
Email: 16390394@mygibs.co.za

Date: 2016

Dear Mr./Mrs./Ms/Dr.....date

1) INTRODUCTION

You are invited to volunteer for a research study. This information leaflet is to help you to decide if you would like to participate. Before you agree to take part in this study you should fully understand what is involved. If you have any questions, which are not fully explained in this leaflet, do not hesitate to ask the investigator. You should not agree to take part unless you are completely happy about all the procedures involved.

2) THE NATURE AND PURPOSE OF THIS STUDY

You are invited to take part in a research study. The aim of this study is to evaluate your experience with the use of electronic health records. By doing so we wish to learn more about the factors related to the adoption and use of electronic health records. A proposal of the study is available should one be required.

3) EXPLANATION OF PROCEDURES

This study involves answering some questions with regard to your experience with the use of electronic records in the hospital.

4) RISK AND DISCOMFORT INVOLVED.

If at any point in the course of the interview you are uncomfortable with answering a question you are free to stop the interview and choose to skip the question or stop the interview all together.

5) POSSIBLE BENEFITS OF THIS STUDY.

This study will help with the identification of factors that would better improve the adoption of electronic records and also improve the design of electronic records for use in the hospital setting.

6) ETHICAL APPROVAL. This Protocol was submitted to the Faculty of Health Sciences Research Ethics Committee, University of Pretoria, telephone numbers 012 3563085 / 012 3563084and written approval has been granted by that committee. A letter of approval is available if a copy is needed.

7) INFORMATION

Questions concerning the study can be referred to:

Researcher - Svieta Ngcaba

Cell: 0822103650

8) CONFIDENTIALITY

All information obtained whilst in this study will be regarded as confidential. Results will be published or presented in such a fashion that participants remain unidentifiable.

11) CONSENT TO PARTICIPATE IN THIS STUDY. I have read or had read to me in a language that I understand the above information before signing this consent form. The content and meaning of this information have been explained to me. I have been given opportunity to ask questions and am satisfied that they have been answered satisfactorily. I understand that if I do not participate it will of no consequence to my livelihood. I hereby volunteer to take part in this study.

I have received a signed copy of this informed consent agreement….....

Participant's name .....

Signature & Date .....

Investigator's name .....

Investigator's signature & Date .....

Witness Name and signature & Date ……

APPENDIX 2: INTERVIEW PROTOCOL

(Start with Informed consent prior to interview)

Part 1

Background Questions

Age

Gender

Professional Qualification

Position at Work, role & department

Level strategic, operational, administrative, managerial & strategic

Experience with computers = number of years & competence

Experience with the organisation = tenure

Managerial role = tenure

Part Two

Interview Questions

Do know about EHRs? How? Have you used EHR at work? What do have at the hospital as EHR? If no, please explain. If yes, in what functionality?

What has your experience with EHRs been with your work in the hospital?

(i) In relation to quality of care (ii) Patient safety

(iii) Unexpected outcomes

(iv) Other issues.

How easy or difficult is it to work with the EHR system from input to retrieval?

Have EHRs met your expectations? Has this opinion changed over time?

What effect has the EHR system had on your work? Are you finding the EHR to be helpful? If yes, can you give examples? If no, can you give examples?

Do EHRs impact on care of patients or documentation?

In your view, what EHR features or functionalities do you find to be particularly helpful for your work?

What impact has the EHR had on your organisation?

How have EHRs affected the way you work with others staff, clinicians and management? Has your communication and relationship with the CEO/other Physicians/Nurse staff/ management and staff
remained consistent and constant? If not, why not and if yes, how has it changed?

Can you mention any number of people who have been helpful on this journey of EHRs? On a scale of 1-5 can you say how helpful they were?

Why do you use EHR system?

Who makes the decisions and suggestions on EHRs in your organisation? At what level are these discussions taking place?

How do you as view possible consequences of not adopting an EHR system?

What problems and challenges have you experienced with using the EHR system? What have been the key challenges to success? How did you address the challenges?

What do you think is required to make the EHR system better? What is the next functionality of EHR to better your work?

What advice can you offer about EHR systems? Are there any changes or recommendations you have in terms of the EHRs?

What more would you like to add that would be beneficial to this study?

APPENDIX 3: GIBS ETHICS COMMITTEE LETTER OF CONDITIONAL APPROVAL

Dear Svieta Ngcaba

Protocol Number: Temp2016-02133

Title: Factors related to the adoption of electronic health records

Please be advised that your application for Ethical Clearance has been approve subject to the following conditions.

Conditionally approved pending health ethics

Once you have made this minor amendment and submitted the changes to the Research Coordinator, you will be allowed to continue collecting your data.

We wish you everything of the best for the rest of the project.

Kind Regards,

Adele Bekker

APPENDIX 4: LETTER OF APPROVAL TO CONDUCT RESEARCH

05 October 2016 Dear Svieta Ngcaba

Netcare Milpark Hospital

Tel: +27 (0) 11 480 5600 Fax: +27 (0) 11 482 3317 9 Guild Road, Parktown West, Johannesburg, South Africa PO Box 91155, Auckland Park, 2006, South Africa www.netcare.co.za

RESEARCH TO BE CONDUCTED IN NETCARE FACILITY

The Management of Netcare Milpark Hospital has taken note of the application for ethical approval by the Ethical Committee for the following research study to be conducted: Factors Related To Adoption Of Electronic Health Records.

In principle the Netcare Hospital Management does not have any reservations for the abovementioned research to be conducted on its premises subject to unconditional ethics approval being granted.

We furthermore confirm that application will then be made to the Netcare Research Operations Committee and that the research may not commence prior to receipt of FINAL APPROVAL from the Netcare Research Operations Committee.

We wish you success in your research.

Yours faithfully

_____

Anton GillisHospital General Manager 05 October 2016

Netcare Hospitals (Pty) Ltd T/A Netcare Milpark HospitalDirectors: S Chetty, J du Plessis, R H Friedland, K N Gibson, C Grindell, N Phillipson Company Secretary: L Bagwandeen

Reg. No. 1996/006591/07

APPENDIX 5: ETHICS APPROVAL

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.
- FWA 00002567, Approved dd 22 May 2002 and Expires 28 August 2018.
- IRB 0000 2235 IORG0001762 Approved dd 22/04/2014 and Expires 22/04/2017.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Committee

1/11/2016

Endorsement Notice

Ethics Reference No.: Temp2016-02207

Title: Factors related to the adoption of Electronic Health Records

Dear Svieta Ngcaba

The **New Application** as supported by documents specified in your cover letter dd 30/9/2016 for your research received on the 30/9/2016, was approved by the Faculty of Health Sciences Research Ethics Committee on the 1/11/2016.

Please note the following about your ethics approval:
- Please remember to use your protocol number **(Temp2016-02207)** on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, or monitor the conduct of your research.

Ethics approval is subject to the following:
- The ethics approval is conditional on the receipt of **6 monthly written Progress Reports**, and
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

*** Kindly collect your original signed approval certificate from our offices, Faculty of Health Sciences, Research Ethics Committee, Tswelopele Building, Level 4-60*

Dr R Sommers; MBChB; MMed (Int); MPharMed, PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health).

☎ 012 356 3084 deepeka.behari@up.ac.za http://www.up.ac.za/healthethics
✉ Private Bag X323, Arcadia, 0007 - Tswelopele Building, Level 4, Room 60, Gezina, Pretoria

APPENDIX 6: RESEARCH COMMITTEE APPROVAL

Netcare Hospitals (Pty) Ltd

Tel: + 27 (0)11 301 0000
Fax: Corporate +27 (0)11 301 0499
76 Maude Street, Corner West Street, Sandton, South Africa
Private Bag X34, Benmore, 2010, South Africa
www.netcare.co.za

RESEARCH OPERATIONS COMMITTEE FINAL APPROVAL OF RESEARCH

Approval number: UNIV-2016-0067

Ms Svieta Ngcaba

E mail: svietangcaba@gmail.com; saras.subramoney@dimensiondata.com

Dear Ms Ngcaba

RE: FACTORS RELATED TO THE ADOPTION OF ELECTRONIC HEALTH RECORDS

The above-mentioned research was reviewed by the Netcare Research Operations Committee's delegated members and it is with pleasure that we inform you that your application to conduct this research at Netcare Sunninghill, Milpark & Parklane Hospitals, has been approved, subject to the following:

i) Research may now commence with this FINAL APPROVAL from the Netcare Research Operations Committee.

ii) All information regarding Netcare will be treated as legally privileged and confidential.

iii) Netcare's name will not be mentioned without written consent from the Netcare Research Operations Committee.

iv) All legal requirements with regards to participants' rights and confidentiality will be complied with.

v) Netcare must be furnished with a STATUS REPORT on the progress of the study at least annually on 30th September irrespective of the date of approval from the Netcare Research Operations Committee as well as a FINAL REPORT with reference to intention to publish and probable journals for publication, on completion of the study.

vi) A copy of the research report will be provided to the Netcare Research Operations Committee once it is finally approved by the relevant primary party or tertiary institution, or once complete or if discontinued for any reason whatsoever prior to the expected completion date.

vii) Netcare has the right to implement any recommendations from the research.

APPENDIX 7 LETTER OF PERMISSION TO CONDUCT RESEARCH (1)

Netcare Sunninghill Hospital

Tel: +27 (0) 11 806 1500
Fax: +27 (0) 11 806 1636
Cnr Witkoppen & Nanyuki Roads, Sunninghill, South Africa
PO Box 4867, Rivonia, 2128, South Africa
www.netcare.co.za

28th September 2016

LETTER CONFIRMING KNOWLEDGE OF FACTORS RELATED TO ADOPTION OF ELECTRONIC HEALTH RECORDS RESEARCH

To whom it may concern

Re: ***Factors Related To Adoption Of Electronic Health Records.***

We hereby confirm knowledge of the above named research application to be made to the Netcare Research Operations Committee and in principle agree to the research application for Netcare Sunninghill Hospital/site/division, subject to the following:

1. That the data collection may not commence prior to receipt of FINAL APPROVAL from the Netcare Research Operations Committee.
2. A copy of the research report will be provided to the Netcare Research Operations Committee once it is finally approved by the tertiary institution, or once complete.
3. Netcare has the right to implement any recommendations from the research.
4. That the Hospital/Site/Division Management reserves the right to withdraw the approval for research at any time during the process, should the research prove to be detrimental to the subjects / Netcare or should the researcher not comply with the conditions of approval.

We wish you success in your research.

Yours faithfully

Pieter Louw
Hospital General Manager

Netcare Hospitals (Pty) Ltd T/A Netcare Sunninghill Hospital
Directors: S Chetty, J du Plessis, R H Friedland, K N Gibson, C Grindell, N Phillipson
Company Secretary: L Bagwandeen
Reg. No. 1996/006591/07

APPENDIX 8: LETTER OF PERMISSION TO CONDUCT RESEARCH (2)

Netcare Park Lane Hospital

Tel: +27 (0) 11 480 4000
Fax: +27 (0) 11 643 2141
Cnr Junction Avenue and Park Lane, Parktown, South Africa
Private Bag X40500, Houghton, 2041, South Africa
www.netcare.co.za

Date:30/Sept/2016

To: University of Pretoria: Ethics Committee

RESEARCH TO BE CONDUCTED IN NETCARE FACILITY

The Management of **Netcare Park Lane Hospital** has taken note of the application for ethical approval by GIBS Ethical Committee for the following research study to be conducted

Factors Related To the Adoption Of Electronic Health Records

In principle the Netcare Hospital Management does not have any reservations for the abovementioned research to be conducted on its premises subject to unconditional ethics approval being granted.

We furthermore confirm that application will then be made to the Netcare Research Operations Committee and that the research may not commence prior to receipt of FINAL APPROVAL from the Netcare Research Operations Committee.

Yours faithfully

G.H.J Venter 30 SEP 2016 Hospital General Manager

Signed by Hospital Management **Date** 30/Sept 2016

Hospital General Manager

Netcare Hospitals (Pty) Ltd T/A Netcare Park Lane Hospital
Directors: S Chetty, J du Plessis, R H Friedland, K N Gibson, C Grindell, N Phillipson
Company Secretary: L Bagwandeen
Reg. No. 1996/006591/07

APPENDIX 9: INSTITUTE OF MEDICINE ELECTRONIC HEALTH RECORD FUNCTIONS

1. Health information and data: The electronic documentation, storage and retrieval of patient data, which is needed to make decisions about their care, such as medical history, tests results, allergies and medications.
2. Results management: Managing the results of all types of treatments or assessments, such as electronic reports of laboratory results and radiology procedures with automated displays of previous results.
3. Order entry and order management: A computerized order entry system that can provide information to support decision-making. This sort of system can delete lost orders and illegible handwriting, generate related orders, monitor duplicate or contradictory orders and reduce the time taken on paper work. (CPOE)
4. Decision support: A way to enhance clinical performance by providing reminders, warnings and other tools to help providers and staff make appropriate clinical decisions and improve patient care. (CDSS)
5. Electronic communication and connectivity: Supporting electronic communication among health care team members, external care partners (such as pharmacists) and the patient. This also relates to connectivity to data sources that are external to the EHR for the purpose of sharing data.
6. Patient support: Tools that can be used to support patient self-care and the management of chronic diseases. It includes educational materials and patient web portals. 134
7. Administrative processes: Including scheduling, billing and claims.
8. Reporting and population health management: The tools and clinical logic/business rules necessary to view and analyse data from the EHR and to manage populations of patients (IOM, 2003b).

APPENDIX 10: COPY OF LETTER REQUESTING INTERVIEWS

Dear Dr/Ms/Mr.,

I am an MBA student at GIBS as part of the University of Pretoria. My background is in health - General practice with interest in Health Information Technology. I looked up your name in the Netcare Hospital Listing. Hospital management and the Netcare Research Committee granted permission to proceed with research interviews at the facility.

This particular study seeks to explore factors contributing to the adoption of Electronic Health Records in the South African context. Literature is awash with the centrality of clinician involvement in the adoption, implementation, and meaningful use of EHR. Your contribution in the form of expectations, experiences, and views of Electronic health records will be invaluable to this research.

I would be most grateful if you would agree to an interview in person at your convenience. I have about ten questions to ask, and I'll probably take 45-60 minutes of your time. I appreciate your consideration of my request.

I have attached a copy of the research protocol, consent form, Netcare approval letter and University Ethics approval letter for your perusal.

Thank you so much for your time, and I am looking forward to meeting with you.

Sincerely,

APPENDIX 11: EMAIL CORRESPONDENCE

On Mon, Dec 12, 2016 at 9:48 AM,

Good day Svieta

Thank you for you research request.

We would like to inform you that xxxxxxxx does not have electronic health records. In addition to this, our current Acting Hospital General Manager, xxxxxxx has no experience with electronic health records. As he is our Financial Manager and acting in the mentioned role, he feels that you will not benefit from interviewing him.

Regards

Thank you so much. With your time constraints,
the best option might be a focus group.

See you Tuesday.

On 14 Dec 2016, at 3:07 PM,

Dear Svieta Ngcaba,

Apologies - the hospital has been really busy.

*NB - cannot afford you an hour with each UM you have to use your time sparingly.

This will be Tuesday next week.

xxxx please schedule 5 UM's

Regards,

ATLAS.ti Report

EHR ADOPTION FACTORS

Document groups

Report created by Svieta Ngcaba on 18 Jan 2017

DOCUMENT GROUP

FRONTLINE

Members:

1 Transcription -#1RecordingUM38PLSAPF 2 Transcription - #3Recording UM42PLW1F 3 Transcription - #5Recording UM53PLW7F 4 Transcription - #6Recording UM50PLW6F 9 Transcription - #15Recording 23 UM60PLWICUF 10 Transcription - #16Recording 29 ICS43PLFF 11 Transcription - #17Recording 21 & 22 UM37PLWANCF 12 Transcription - #18Recording 33 & 34 UM48PLLWF 13 Transcription -#19Recording 26 CF50PLNNUF 14 Transcription - #9Recording 24 DR67MPFF 16 Transcription - #20Recording UMSHFG

MANAGEMENT

Members:

7 Transcription - #13Recording 31 NM32SHMM 8 Transcription - #14Recording 32 HM45SHMM 15 Transcription - #7Recording 28 HM52PLMM

PARKLANE UM

Members:

1 Transcription -#1RecordingUM38PLSAPF 2 Transcription - #3Recording UM42PLW1F 3 Transcription - #5Recording UM53PLW7F 4 Transcription - #6Recording UM50PLW6F 9 Transcription - #15Recording 23 UM60PLWICUF 10 Transcription - #16Recording 29 ICS43PLFF 11 Transcription - #17Recording 21 & 22 UM37PLWANCF 12 Transcription - #18Recording 33 & 34 UM48PLLWF 13 Transcription -#19Recording 26 CF50PLNNUF 14 Transcription - #9Recording 24 DR67MPFF

STRATEGIC

Members:

5 Transcription - #10Recording 25 ED54NCSF 6 Transcription - #12Recording 27 RD35NCSM

SUNNINGHILL UM

Members:

16 Transcription - #20Recording UMSHFG

Themes (Data, Staff, Hospital parameter and Hospital systems are not themes rather modifiers**)**

ATLAS.ti Report

EHR ADOPTION FACTORS

Code groups

Report created by Svieta Ngcaba on 18 Jan 2017

CHALLENGES

Members:

● Alert system ● bluebird challenges ● complex ● costly ● delay in results ● Delayed returns ○ EHR disadvantage ● Ghost Patients ● interface ● Kronos system challenges ○ lack of accountability ● Mobit challenges ● Passwords ● Reboot ○ system challenges ● Time consuming

DATA

Members:

● Data ● Hospital days ● Hospital size ○ Hospital status system ● Patient data ○ Patient demographics ○ Staff qualifier ○ track data

DATA QUALITY & VALUE

Members:

● -Data overload ● content of digital records ● Context relevant system ● Data accuracy ● Data relevance and overload ● data value ○ lack of accountability ○ Limited realtime data ● meaningful system ○ Narrative ○ one size fits all ● Pain vs Gain ○ Practioners not a homogenous group ○ Realtime data ○ retrospective data ○ standardized records ○ UM no benefit ● validity of data

DATA SAFETY AND SECURITY

Members:

● Data risk ● Data safety & security

DOCTORS

Members:

● computer underutilization ● Doctor independence ● Doctor involvement ● doctor involvement with capture ● doctor platform ● Doctor power attitude ○ Doctors attitude to data ○ Doctors cost connscious ○ Doctors less receptive ○ Doctors' fees ● Financial motivation

EHR ADVANTAGE

Members:

● Actionable alerts ● Advantages of alerts ● Data management ○ EHR advantage ● paperless ● usability

FINANCIAL EFFICIENCY

Members:

● cost saving

FINANCIAL INVESTMENT

Members:

● Access Terminals ● Backup equipment ● costly ● Equipment shortage ● equipment upgrade ● IT infrastructure

HOSPITAL PARAMETER

Members:

● Big unit ● Cases ● Fewer ICU patients ○ Hospital X ● medium hospital ● minimum use ● No casualty ● Parklane hospital ○ Patients ○ small hospital ● Small Ward ● UM ALL ward ● Ward

INCREASED WORK LOAD

Members:

● Increased workload & additional responsibilities ● Limited time ● Time consuming

IT &COMPUTER LITERACY

Members:

• Aged not digital • Computer education • Computer incompetence • Youth are computer savvy

HOSPITAL SYSTEMS

Members:

• Administrative use • Antibiotic stewardship • Billing system • Bluebird system • case manager system • clinician diversity & independence • doctor platform • Hospital X systems ○ Lab systems ○ Maintenance system • Mobil introduction • Mobil system • Mobit system ○ Radilogy system • SAP system ○ Staffing system • systems ○ Theatre booking system

NETWORKS & CHANNELS

Members:

• +collaboration • +communication channel • +coordination of care • +External networks • +Field expert • +Interdisciplinary collaboration • +internal networks • +peer-peer accountability • +peer-peer learning • +peer-peer networks • +Peer-peer support

NON-ALIGNED COMMUNICATION

Members:

• -Communication inconsistency • -Lost in translation

OPERATIONAL EFFICIENCY

Members:

• Data management • Efficiency ○ Enhance patient experience • Enhanced mobility ○ Mobit • Observable results ○ Prepack convinience ○ systems efficiencies • time saving ○ work monitoring tool • workload decreased

ORGANIZATIONAL PROCESSES

Members:

• Adequate system trial time • Backup process • Comprehensive EHR ○ implementation time ○ Implemntation • Incremental model ○ incremental roll out ○ Job to be done • operational process • organizational process ○ pay per service ○ Pilot • Selective & Restricted Access ○ Staff level ○ system effectiveness ○ Tone of frustration ○ Tracking patients

PAPER PERSISTENCE

Members:

• Manual:Electronic dual system • Negative technology attitude • Paper persistence • Redundancy

PAPERLESS ATTITUDE

Members:

• Digital trend • EHR + attitude • General Positive system view • paperless

QUALITY CARE

Members:

• clinical case management • clinical efficiency • Facilitate early intervention • Facilitating best practice • Guidelines adherence • guiding treatment • Infection control • infection control principles • Legibility • Patient management • Quality care ○ Sharing best practice • speed up diagnosis ○ Tracking of devices

STAFF

Members:

• Age ○ CF50PLNNUF • clinical facilitator • computer experience ○ DR67MPFF ○ ED54NCSF ○ HM45SHMM ○ HM52PLMM • Hospital manager • Hospital manager role • Hospital X tenure ○ ICS Position ○ ICS43PLFF ○ Managerial ○ NM32SHMM ○ Nursing Manager ○ PA ○ PA role • PA work • Position • position tenure • Previous position • qualification ○ RD35NCSM ○ Regional Director ○ regional team ○ role of nonclinical staff ○ UM ALL • UM ALL age • UM ALL Netcare tenure • UM ALL position • UM ALL qualification • UM ALL tenure ○ UM37PLWANCF ○ UM38PLSAPF ○ UM42PLW1F ○ UM48PLLWF ○ UM50PLW6F ○ UM53PLW7F ○ UM60PLWICUF ○ UMSHFG

STAFF ENGAGEMENT

Members:

• behaviour change measures • clinical frontline consultation • decision making involvement • Decision making process • Doctor involvement • doctor involvement with capture • Doctor power attitude ○ employee IT input ○ Ignorance • Nursing empowerment ○ Patient App • system development • Unintended consequence

SYSTEM KNOWLEDGE

Members:

• +Field expert • Continuous learning • experiential learning • Wealth of experience

SYTEM DESIGN

Members:

• Access • complex • Designer lack clinical knowledge • Limited access • Log in process • Open acess to all UMs • Passwords • Reboot • Selective & Restricted Access • system communication • system development • system improvements • system integration • system reinvention • Unintended consequence • workaround • Workflow

TRAINING & SUPPORT

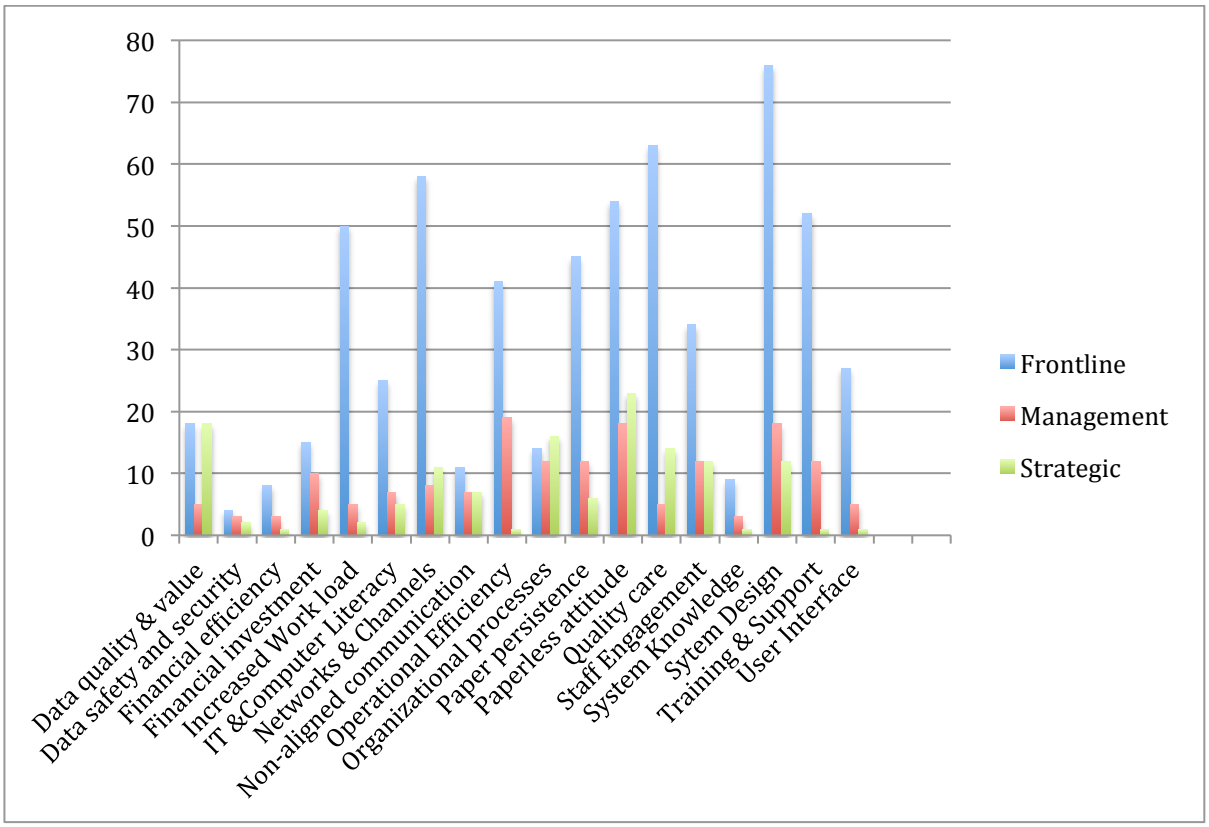
Members:

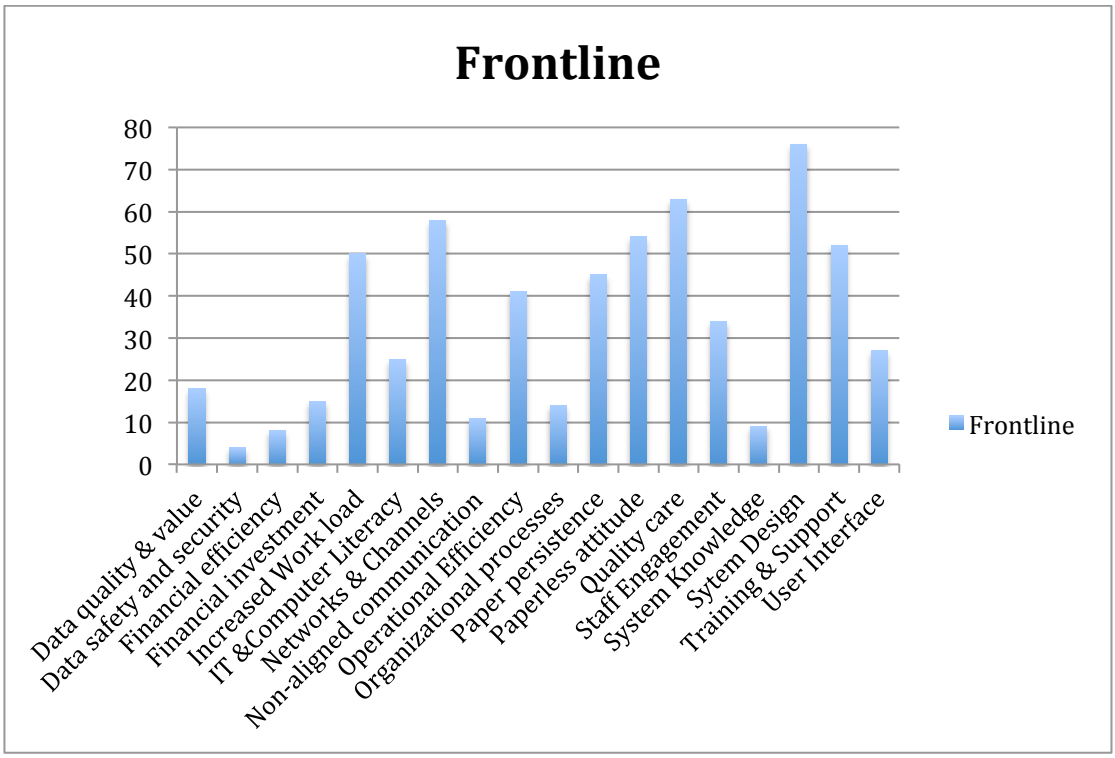
• champion leader • Hand holding • Hospital manager role • ill equipped onsite trainers • Inadequate IT support • No ongoing training • Off site training • ongoing training • oversight • System support • training • training dynamics

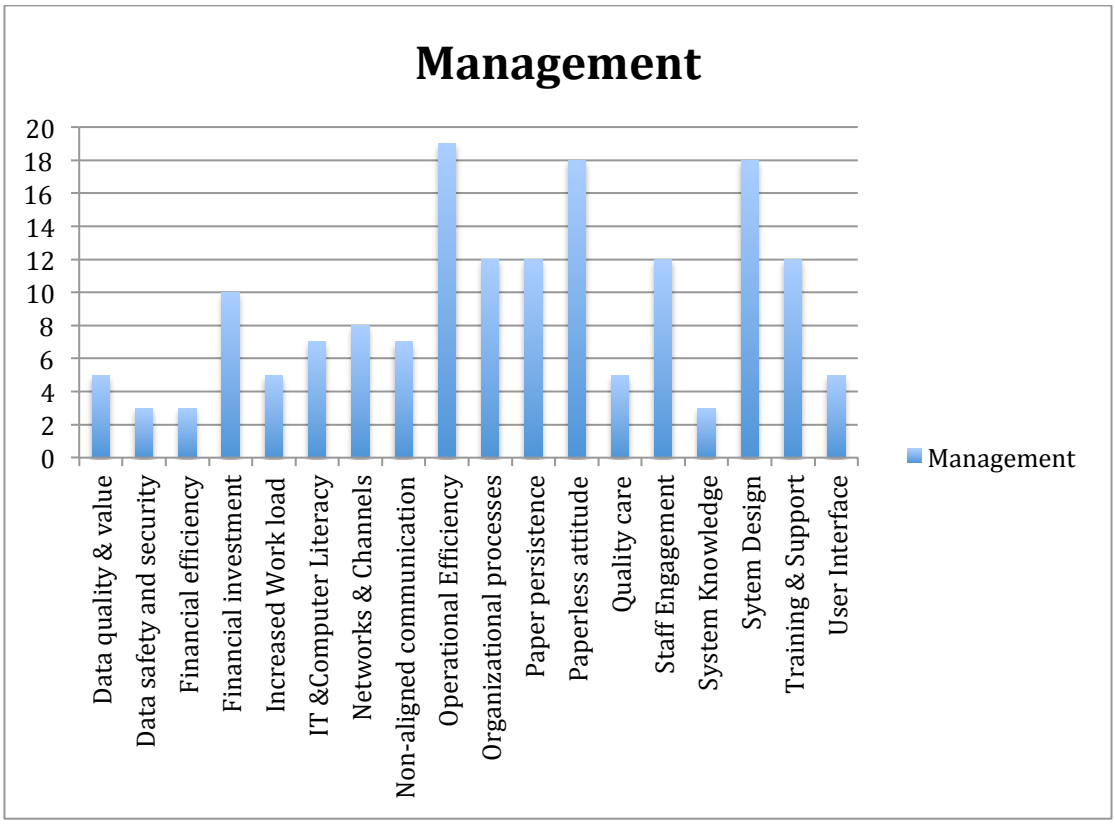
USER INTERFACE

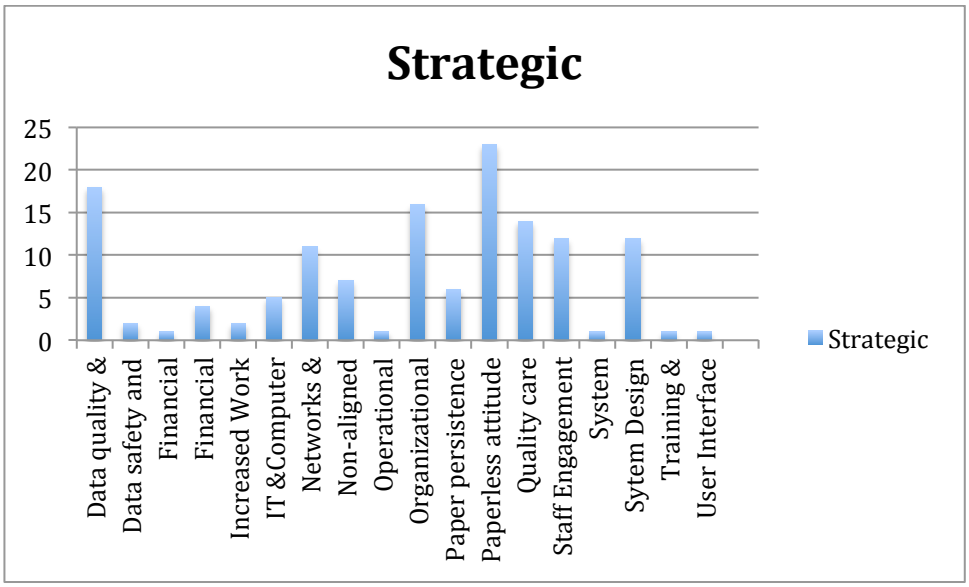
Members:

• Access • Access Terminals • Limited access • Log in process • Open acess to all UMs • Passwords • Reboot • Selective & Restricted Access









Access Network