

**Gordon Institute  
of Business Science**  
University of Pretoria

# An analysis of the adoption of electronic health records in primary healthcare

**A research report submitted by**

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## ABSTRACT

**Background:** The challenges faced by the public healthcare system in developing countries such as South Africa (SA) have promulgated the use of Electronic Health Records (EHR) in primary healthcare facilities. This is due to the operational as well as administrative efficiencies offered by EHR.

**Objective:** This study seeks to understand if the efficiencies of EHR are being realised, under what circumstances, to what extent and assess the perceived barriers to adoption of EHR.

**Literature gap:** The implementation of EHR is still in the pilot phase and literature sources are available for adoption and implementation in other countries however, the resource challenges that plague SA may require different/ alternative solutions to guide implementation. Currently there is no published literature available regarding the adoption of EHRs in the public primary healthcare sector. Moreover, there is a need to scale up EHR in primary healthcare clinics, learning from evidence-based mechanisms to increase the positive impact created by technology in improving healthcare systems.

**Methodology:** The research investigated the end-user experiences of adopting EHRs and the perspectives of subject matter experts (SMEs) on the best practices for implementation of EHR. A qualitative exploratory study was undertaken; 16 interviews were conducted, which were broken up as follows: eight interviews with end-users of EHR in three primary healthcare facilities and eight SMEs from five companies were conducted to obtain insights in and validate the alignment of SME and end-user perspectives.

**Results and Conclusion** The importance of the interview results is that it led to the re-arrangement of change management models to streamline the adoption of electronic health record implementation in primary healthcare facilities. Key areas of improvement for implementers and SMEs were identified. There is potential to transform primary healthcare administration if the key drivers of adoption in primary healthcare are identified and improvements in that regard could lead to quicker adoption and assimilation of technologies like EHR.

## **KEYWORDS**

Electronic Health Records (EHR)

Health Information Systems (HIS)

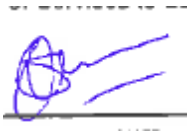
Primary Healthcare

Adoption

Collaboration

## 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.



Susan Mariya Thomas

13 January 2016

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## CHAPTER 1: INTRODUCTION TO THE RESEARCH PROBLEM

### 1.1 Description of the Problem and Background

*“Improving the health of a nation’s citizens can directly result in economic growth, because there will be more people able to conduct effective activities in the workforce.”*

-Francis S. Collins, Director National Institute of Health, USA

#### 1.1.1 The context of healthcare

Healthcare is one of the fundamental pillars of economic development and sustainable livelihood of countries around the world. As Frenk, (2014) stated: “Good health reduces poverty, protects family assets, improves educational performance, increases labour productivity, enhances the investment climate and, through all of these things, stimulates economic growth.” This statement is further validated by the data of the WorldBank, (2001) which reports that 10 percent improvement in life expectancy at birth is associated with an annual increase in economic growth of 0.3 to 0.4 percent. The converse is also true- poor health leads to lost productivity at a household, firm and government level and productivity losses are substantial for an economy (WHO, 2000). Despite the importance of healthcare, disparities exist and arise because of social inequalities within and among nations (Holtz, 2013). Holtz, (2013) furthermore states that these inequalities are attributable to inequitable access to quality healthcare for rural and urban populations, the unaffordability of healthcare and lack of sustainability in terms of political and financial support.

This ‘lack of equitability’ is reflected in healthcare. South Africa has one of the highest income disparities measured by the GINI coefficient at 0.65 (World Bank, 2015). The SA healthcare system is a two-tiered system, namely a private and public healthcare system. The public health system is under-resourced and over-stretched (40% of health expenditure) and caters for 80% of the population whereas the private sector accounts for 60% of health expenditure and serves only 20% of the population (South Africa.info, 2015). Furthermore, McIntyre, Doherty & Ataguba, (2012) reported that the gap in expenditure between the private and public sector have widened over time. This shows that the public healthcare has to play ‘catch-up’ regarding quality of care to the private sector. Public healthcare is the focus of this research.

This problem is further compounded in that, there has been a persistent incline in Healthcare financing see figure 1 below. The World Bank (2015) reported that SA’s

expenditure on health as a percentage of GDP is 8.9% versus Chile (a comparable economy) at 7.7%, yet the mortality (death) rate is 7 per 1000 live births in Chile and 34 per 1000 live births in SA. From this, it is evident that a greater efforts to improve healthcare quality is warranted.

Figure 1: Healthcare expenditure as a percentage of GDP from 2011 to 2013

Source: tradingeconomics.com



As Holtz (2013) suggested that sustainable financial support in healthcare is required- methods to decrease costs and concurrently improve the quality of healthcare in SA should be pertinent. This goal can be made more feasible if access to timely and accurate information of the requirements of the public health sector is available (Yang et al., 2015). Adera, Waema, & May, (2014) state that a lack of information can perpetuate disadvantage and inequality. Better information in turn leads to better healthcare planning, resourcing and systems and ultimately leads to healthy citizens who are able to work longer, pay taxes while reducing the outlay for actual healthcare (Freyman & Fontenot, 2014).

The problem regarding the disparities is further compounded in that the Centre for Disease and Enterprise (CDE) argues that the quality of care is expected to be poor at public institutions compared to private institutions, which leads to the assumption that the structural issues are intertwined with the quality of care and that this leads to the disparity reflected in the GINI coefficient (CDE, 2011). To this extent, Information and Communication Technologies (ICT) have the potential to reduce inequalities in SA by addressing the developmental gaps (Department of Communications: RSA, 2014). Thus, there is potential for ICT to transform the healthcare industry by becoming an enabling instrument.

ICT can enable people in remote and underserved areas to have access to services and expertise otherwise unavailable to them (WHO, 2008). The WHO, (2008) further reports that this is more pertinent in countries with uneven distribution or chronic shortages of physicians, nurses and health technicians or where access to facilities and expert advice requires travel over long distances. In such contexts, the goal of improved access to health care has stimulated the adoption of technology for remote diagnosis, monitoring and consultation (WHO, 2008).

### 1.1.2 The importance of ICT

The preceding arguments suggest that technology could provide a means to increase access to timely and accurate information and improve the quality of care. Reimann, Ehr Gott, Kaufmann and Carter (2012) corroborated this by stating that ICT improves connectivity and can transform the social and economic relationships across stakeholders, particularly in developing countries. ICT can bring about improvements through continuing education for healthcare workers, improved delivery and supply of health and disaster management to remote locations and it leads to transparency and efficiency of governance at institutions (Chandrasekhar & Ghosh, 2001).

An example of advancement in ICT is the Electronic Health Record (EHR); an initiative that brings about health action (Frieden, 2010). Health action is any activity that maintains or improves health (Frieden, 2010). Groves, Kayyali, Knott and Van Kuiken, (2013) report the mechanism by which EHRs cause health action is through data analysis, which leads to actionable information for an organisation. This actionable information leads to quality improvements and cost containment (Kibbe & Kuraitis, 2012), thereby leading to improved health outcomes.

The propensity to improve health outcomes was stated in the Global Information Technology Report (2014) which reported that IT in healthcare creates accessibility of information through data availability. Moreover, data has the ability to generate economic and social value, as reliable and accurate public health information is essential for the ongoing monitoring of healthcare and for evaluating and improving the delivery of healthcare services and programmes. However, this is dependent on the capacity of both public and private organisations to have necessary ICT infrastructure to acquire, interpret and treat these data (Global Information Technology Report, 2014).

This begs the question if SA has the necessary ICT infrastructure to be able to conduct such data analyses. South Africa is ranked moderately well in terms of ICT infrastructure (Gilbert, 1 October 2015). However, is SA gaining the full spectrum of benefits from ICT? The Department of Communications RSA, 2014 report reveals that South Africa is not yet leveraging the potential benefits associated with the ICT sector, which – in part – may be attributed to the lack of skills, the high cost of accessing ICT and the insufficiently developed infrastructure, which is evident in the healthcare industry. This constitutes the basis of this research to investigate why the potential benefits are not being realised.

One of the reasons why the potential benefits are not being realised can be attributable to a lack of a holistic approach to healthcare. In SA, health is deemed to be about treatment and care delivered by a healthcare system (Global Competitiveness Report, 2013). However, Weeks (2013) suggests that healthcare be thought of rather like systems thinking, a health system that includes policies, products and services aimed at disease prevention and well-being. To this extent, healthcare brings together a number of facets within the healthcare management framework. Systems that do not assume pertinence in this arena include community-based social systems, healthcare information systems (HIS), eHealth and mobile technologies (Weeks, 2013). This study seeks to understand the potential role that HIS can bring to primary healthcare within the healthcare management framework.

## 1.2 Research Problem

From the above the researcher defended the context of healthcare and discussed the benefits which IT can bring. However, the literature reviewed also raised potential drawbacks of the use of ICT such as security and privacy breaches which arise as a result of data storage and transfer capabilities, Furthermore, ICT necessitates high capital outlays with less than expected returns and it requires significant resources (Sao, Gupta, & Gantz, 2013). Other less researched issues are the costs of training individuals on the use of HIT systems and lack of adoption by users (Ramtohul, 2015). An understanding into the resource constraints faced by primary healthcare in SA and an understanding of adoption of IT systems in primary healthcare in SA thus constitutes the basis of the research problem.

### **Business Relevance**

If healthcare were to be thought of like systems-thinking as Weeks, (2013) stated it would require concerted efforts and a public private partnership (PPP) model of healthcare. This requires the state, private companies and non-governmental organisations to examine means of improving healthcare delivery where there are constrained resources. Electronic Health Records (EHR) can theoretically utilise technology to reduce the human workload needed to deliver healthcare as it can reduce time-consuming tasks so far handled by overburdened healthcare workers; however, these benefits are not being realised as yet (Ajami and Bagheri-Tadi, 2013). Thus, this study seeks to understand if benefits are being realised, under what circumstances, to what extent and assess the perceived barriers to adoption of EHR.

Peng, Dey and Lahiri (2014), reported that EHR and HIS are important drivers of an organisation's process transformation by facilitating productivity and enhancing collaboration and transactions across organisational boundaries. This will benefit both public and private institutions alike. Quick adoption and assimilation of these technologies are important steps for an organisation to gain competitive advantage and achieve success (Peng et al., 2014). It is probable that South Africa, considering its discrete public and private healthcare sectors, has differing degrees of adoption and technological readiness.

### **Academic Relevance**

Within the context of the healthcare service delivery framework, the study aims to focus on the technology support systems, namely the change management framework, to facilitate the adoption of EHR in primary healthcare. However, the success of such technology support systems will depend on a culture of learning as it is reliant on developed skills. Scholarly literature is available on EHR in primary healthcare in other countries-(Ajami & Bagheri-Tadi, 2013), (Barton, 2014), (Farias & Unb, 2012), (Khalifa, 2013) and (Ramtohl, 2015)- however, there are no literature reports focusing on South Africa. Furthermore, the resource constraints and challenges faced by the institutions in these literature sources may be different to SA. Therefore, the creation of solutions and responses to their challenges may warrant different methods (De Rosis & Seghier, 2015). De Rosis and Segheiri, (2015) report that the level of social and economic development, the characteristics of healthcare systems and managerial capability can create the argument for technological readiness of a country. This study intends to find out if the public sector particularly primary healthcare is ready for EHR. Furthermore, it will add to the existing body of literature in the wider Electronic Health

Record space, and specifically in the South African EHR space. The findings thereof could prompt further research into this topic.

### 1.3 Research Scope

The scope of this research is limited to EHR within the South African primary healthcare system. The research is bound by the following definitions.

Primary healthcare: "essential healthcare that is based on scientifically sound and socially acceptable methods and technology, which make universal healthcare universally accessible to individuals and families in a community. It is through their full participation and at a cost that the community and the country can afford, to maintain at every stage of their development in the spirit of self-reliance and self-determination" (WHO, 2008). Primary healthcare is usually provided at a clinic, which is defined by (Cullinan, 2006):p7) as "a facility at and from which a range of primary healthcare services are provided."

Health information technology/health IT/HIT defined by SearchHealthIT, (2016): "the area of IT involving the design, development, creation, use and maintenance of information systems for the healthcare industry."

Electronic Health Record (EHR): an information repository of the health status of a subject of care in electronic format, stored and transmitted securely and accessible by multiple authorised users, and whose primary purpose is the support of continuing, efficient and quality integrated healthcare. It contains information that is retrospective, concurrent and prospective (ISO, 2005).

Health information system (HIS) defined by the WHO, (2014): "a system that integrates data collection, processing, reporting and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services."

eHealth defined by WHO, (2015): "the use of ICT for health, for example, to treat patients, pursue research, educate students, track diseases, and monitor public health."

### 1.4 Research Motivation

The resource challenges, which affect SA, are different to other countries and this is made apparent in The National Department of Health (Annual report, 2012/13). The



report indicates that the healthcare sector in South Africa faces major challenges, with shortage of healthcare professionals and financial resources cited as some of those major challenges. Professionals in this sector are mostly overworked. Furthermore, there is a lack of healthcare infrastructure in rural South Africa (Versteeg, Du Toit & Couper, 2013).

From the arguments and challenges around the context of healthcare and ICT, it becomes evident that efforts to simplify processes, reduce costs and improve quality of public healthcare should be given wide support and priority ranking. There have been positive effects with the use of ICT in other industries as Hosseini, Chileshe, Zou, & Baroudi, (2013) showed, with regard to healthcare, The WHO (2008) reported that improvements in ICT enable people in remote and underserved areas to gain access to services and expertise otherwise unavailable to them. This is more pertinent in countries with uneven distribution or chronic shortages of physicians, nurses and health technicians or where access to facilities and expert advice requires travel over long distances. In such contexts, the goal of improved access to healthcare has stimulated the adoption of technology for remote diagnosis, monitoring and consultation (WHO, 2008). Therefore, the need for EHR has been made more apparent.

The benefits of EHR can be actualised only once the implementation has been done correctly. Some preliminary success of EHR had been observed in resource-poor countries such as Brazil and also in Spain (Farias & Unb, 2012). However, the problem lies in creating well-designed, effective, low-cost systems by sharing resources, learning from each other's experiences and self-evaluation of work conducted in SA (Fraser et al., 2005). This constitutes the premise of this study.

In light of the necessary development and implementation of eHealth services as an approach to cost reduction and quality improvements within the public sector (Ramtohul, 2015); currently a fundamental research gap exists.

### **1.5 Research Objectives**

The main aim of the study is to obtain an understanding of the end-user perspective of EHR as well as the subject matter experts' perspective regarding implementation of EHR in order to suggest best practices for adoption and implementation of EHR in the primary healthcare system of South Africa.

The specific objectives of this research are to investigate:

- (i) The end-users' and subject matter experts' opinions on the perceived benefits of EHR in primary healthcare;
- (ii) The end-users' and subject matter experts' opinions on the perceived barriers to adoption of EHR in primary healthcare;
- (iii) If the use of an integrated Health Information Technology (HIT) network would be beneficial to primary healthcare in SA;
- (iv) If there is any alignment between SME and end-user perspectives of EHR in primary healthcare.

To investigate if factors such as cost, time, perceived usefulness and perceived ease of use contribute to the adoption of EHR in primary healthcare, the Actor Network Theory and Technology Acceptance Model by Davies (1986) were used after analysing the literature presented in the literature review. Due to the pertinent roles of subject matter experts (SME) and end-users in the EHR 'ecosystem', they were deemed to be ideal informants for this research. During the process of conducting the qualitative interviews, the model was utilised as a data-gathering tool and discussion point.

This allowed for new insights regarding the literature review and has contributed to a better knowledge regarding best practises for implementation. In addition, this process afforded the researcher the opportunity to form a clearer understanding of the challenges and barriers to adoption faced by healthcare workers.

The literature review in Chapter 2 focuses on the pertinent issues and themes regarding the benefits of EHR, but the themes will emphasise the need for integration of EHR and the factors, which impede adoption of EHR based on practices in other countries as well as in different sectors beyond primary healthcare.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Introduction

The research title describes the relationship between two constructs, which are electronic health records, and primary healthcare. Primary or basic-level healthcare is important because it is related to economic growth by virtue of increased employment. However, the SA public health industry is plagued by a number of challenges like a shortage of health workers and inadequate infrastructure which comprises the quality healthcare services. Efforts to reduce the workload of healthcare workers and to decrease costs in public healthcare is needed. Electronic Health Records is one such initiative. Freymann Fontenot (2014) argued that the benefits of an EHR and HIS are savings for patients, physicians, the community and the wider population as well as savings per disease. The system makes the data collection and reporting flawless and the quality of data impeccable (Qureshi et al., 2014). The transition to EHR (the paperless healthcare system) facilitates the transformation of the patient into a citizen with lower healthcare costs and eventually also a healthier citizen.

With the inherent inequalities and resource constraints of healthcare facing the public health sector in SA organisations need to think of new methods of healthcare delivery in these settings. Thus, the resource-based view of institutions was the theoretical base of the study. It is noteworthy that the existing literature studied in this review had been conducted in countries such as Germany, UK, US, Brazil, Saudi Arabia and Spain. The best practices for implementation and analysis into adoption can be studied from the evidence-based literature positioned here.

This chapter highlights some salient points concerning EHR and also draws some attention to the fundamental issues with the current understanding of EHR. The first section focuses on the importance of healthcare, challenges in healthcare and the choice of primary healthcare is defended. The second section focuses on the role of technology and EHR to curb some of the challenges facing healthcare. Lastly, the third section discussed the technology adoption factors and change management models for EHR.

Using these sub-sections, this research attempts to understand and add new insights into EHR in primary healthcare. A study into the adoption of EHR in public primary healthcare in South Africa had not been conducted yet as EHR implementation was still in the pilot phase. The findings of the study are aimed to add to the growing body of

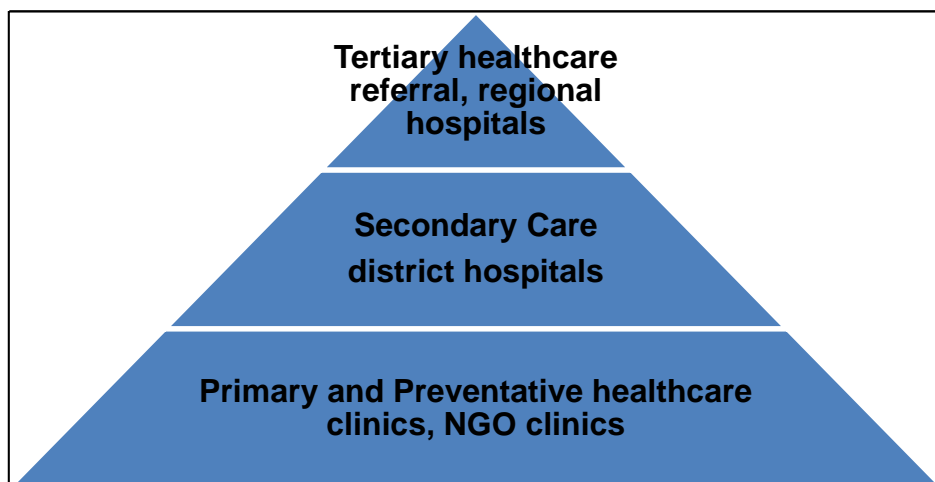
knowledge around EHR. The study further seeks to validate the findings by Ramtohul, (2015) which utilised the actor network based view to understand the role of EHR in public healthcare.

## 2.2 The South African Healthcare Sector

The South African healthcare system is a two-tiered (dual) system, the state-owned or public healthcare system (funded by government) and the private healthcare system. This current system is inequitable and disproportionate regarding access to health services (NHI Policy Paper, 2011). Ataguba and Alaba, (2012) reported that an imbalance in healthcare financing in SA existed where the majority of funding was located in the private sector serving a minority of the population. The public sector has significantly less resources yet has to manage significantly higher patient numbers (NHI Policy Paper, 2011). This implies that greater efforts on addressing the needs and challenges of the public healthcare sector should be the focus. The studies focus is thus public primary healthcare.

The SA public health sector follows a hierarchical referral system. A patient gets referred from a primary health facility or community health centre to a district hospital. The district hospital provides generalist services to patients referred from the primary care facility. Should the patient require specialist services, the patient is then referred to a tertiary or regional hospital (Cullinan, 2006). Figure 2.1 below illustrates the three levels of healthcare as described in the public sector in SA.

**Figure 2 Public Healthcare Structure in South Africa**



Such a decentralised structure was introduced for a purpose. Jiménez-Rubio (2014) reported that decentralisation of health systems can have effects such as efficiency improvements in the provision of public services, equity and economic growth. However, the SA healthcare industry has not realised these 'efficiency improvements' and as a whole faces many challenges, including escalating costs and insufficient regulatory control despite a decentralised health system (Malherbe, 2013). The reason behind this could be attributed to a lack of accountability and transparency in the provision of public healthcare services. This is affirmed in the World Bank, (2011) report that states that there is no reporting by service providers and local governments to citizens regarding quality of services and use of resources. A properly designed EHR provides officials with an audit trail, which can deal with the lack of accountability and transparency issues.

Malherbe (2013) argued that advances in medical treatment, which had been aided by technology, had assisted in the increase of an individual's life span, but had come at a considerable cost. This trend indicated that healthcare expenditure was increasing. This was corroborated in the gazetted RSA report (Government Gazette- Republic of South Africa, 2013). Despite the fact that studies showed that healthcare expenditure was increasing, a study on the return on investment offered by technology systems had not been conducted in the healthcare industry. However Ren & Dewan, (2015) point to the success of technology in other industries like finance and believe that IT systems are moving from being a source of competitive advantage to a necessity for survival. Thus if there is demonstrated success with the use of IT systems in other industries, it stands to reason that the same can be applicable to healthcare.

### **2.2.1 The relevance of primary healthcare**

Primary healthcare is considered the backbone of a country's health system. As per the definition of primary healthcare, it is essential that healthcare be made accessible. It is evident that the approach should go beyond the traditional healthcare system toward a person-centred healthcare system (WHO, 2008). This has an impact on the Primary Care Assessment Tool (PCAT), which measured a primary care facility on four dimensions: access, continuity, coordination and comprehensiveness (Bresick et al., 2015). Starfield, Shi and Macinko, (2005) stated that public primary healthcare in developing countries, which aimed at improving the general health of populations, was successful in narrowing the gaps between socially disadvantaged and advantaged populations. This argument highlighted the relevance of efficient primary healthcare –

particularly in SA where there are considerable income disparities that perpetuated inequality in the country.

A growing concern was the difficulty experienced by a vast number of patients when it came to accessibility of health facilities in relation to the people that used them. If the distance was great, then people experienced greater difficulty due to increased travel times, often coupled with poor transportation infrastructure (Delamater, Messina, Shortridge & Grady, 2012). With the advent of mobile healthcare infrastructure, this had re-defined the boundaries of EHR, as healthcare could now be taken to the people via healthcare workers who could update the point-of-care procedures via a tablet or mobile phone onto the longitudinal health record (EHR) of the patient, which allowed for continuity of care (Labrique, Vasudevan, Kochi, Fabricant & Mehl, 2013). The above argument illustrates how the use of technology could be used to battle certain resource constraints.

### **2.3 The Impact of Healthcare on the Economy**

Poor health has consequences at a household, firm and government level. The impact of ill health on a household was studied by Khan, Bedi and Sparrow (2015) and they found that the financial burden of disease resulted in reduced savings and assets. Furthermore, heightened mortality in a household led to income loss by reducing labour supply. At a firm level, a business needs a successful and healthy community to create demand for the firms' products, provide critical assets and a sustainable environment.

A community needs successful businesses for employment, which leads to income and opportunities for its citizens (Porter & Kramer, 2011). Ill health leads to lost productivity, and productivity losses are substantial for an economy (WHO, 2000). This was corroborated by Fine (2013) who reported that unemployment was associated with increased morbidity and mortality. At government level, illness can result in increased costs of having to provide or finance healthcare services, increased social security payments including disability or unemployment benefits and reduced tax receipts (WHO, 2009). Thus, efforts to make healthcare more efficient and reduce costs at the same time should become a priority.

The argument for good health was that an "investment in health saves lives and money" (Hôpital Albert Schweitzer Haiti, 2015). According to the World Health Organisation (WHO, 2009), health contributes to individual utility or social welfare in three ways. Firstly, people preferred to be healthy as good health directly affects utility.

Secondly, the enjoyment in consumption of other goods and services was partly influenced by an individual's level of health. Thirdly, without good health other economic objectives like employment (which generates income and allows people to consume goods and services) were compromised. This was agreed by (Bloom E David, Canning David, 2008) and (Tulchinsky and Varavikova, 2014), who stated that high or positive levels of population health were directly proportional to high levels of national income. However, Cutler, Deaton and Lleras-Muney (2006) argued that the major force behind health improvements in the past years were not attributable to higher income levels, but through health technologies and public health policies. Both arguments augmented the importance of population health in the contribution to the economic prospects of a country.

The question now is whether technology initiatives such as EHRs can aid the process of establishing healthy communities. Lleras-Muney (2006) argued the benefits of health-related technologies, leading to improved health. Calman, Hauser, Lurio, Wu and Pichardo (2012) also presented a strong case for the adoption of EHR in that EHRs can help achieve the goal of maintaining healthy communities as they act as a catalyst to allow for communication between primary care providers and public health departments.

## 2.4 The Role of Technology

According to the World Health Organization (2007), an effective healthcare system has six building blocks:

- (i) Leadership/governance;
- (ii) Healthcare financing;
- (iii) Health workforce;
- (iv) Medical products and technologies;
- (v) Information and research;
- (vi) Service delivery.

The need for medical products and technologies and information and research are two areas where EHR can make a meaningful contribution. South Africa is in the process of implementing the National Health Insurance system. Sarbadhikari (2013) reported that effective information systems were considered the backbone of universal health coverage. This was corroborated by Hussein (2015), who reported that the role of eHealth was contributors toward Health Information Systems, which required participation from all key stakeholders in both private and public healthcare sectors.

EHR plays a strategic role in fulfilling the requirements of NHI through:

- i) Improving access and quality of care;
- ii) Expanding coverage;
- iii) Increasing the financial efficiency;
- iv) Enabling connectivity in health systems;
- v) Building the healthcare capacity (UN Economic and Social Council, 2013).

Regardless of whether the NHI system is implemented or not, the above argument clearly illustrates the need and importance of technology in a healthcare system to improve the healthcare situation in SA.

Technology plays a key role in socio-economic and organisational development (Farias & Unb, 2012). Information Technologies in Health (HIT) by itself can improve health value (defined as utility costs). Thus, HIT can be used as a solution to our problem of rising costs and national deficit. HIT as implemented in US gave rise to five advantages. Firstly, it optimised work processes, which eliminated the need to search in charts and multiple entries of information. Secondly, it facilitated optimal choices using checklists predefined dose ranges and education with linkages to information resources. Thirdly, it served as reminder to perform preventative health services like vaccines. Fourthly, it reduced errors using clinical decision support. Lastly, it facilitated the integration and summarisation of data from multiple sources and reduced redundancies of test costings (Payne et al., 2013). This highlighted the strategic importance of technology, which cannot be overlooked.

It is necessary for investment, skills and technology to be integrated and mobilised within the healthcare sector (SA ePublication, 2010). The role of technology in this regard cannot be overstated. For example, Pennathur et al., (2011) indicated that EHR and other types of health information systems (HIS) could provide distributed access to data, reduced the need for duplicate information entries, thereby enabling caregivers with a more complete assessment of patients' medical history.

The following section outlines the benefits of EHR, which had been organised as follows: benefits for government; benefits for the facility; benefits for end-users; and benefits for the patient.



## 2.5 The Benefits of EHR for Government

An important role of EHR was that it informed decision-making, not only at facility level, but at government level as well. This premise was based on the assumption that the EHR is the cloud-based model of EHR, which can provide access to anonymised data beyond the clinic level to inform decision-making (Haskew et al., 2015). This point draws attention to the role of data that will be discussed in 2.5.1 below.

Thus, an important function of HIS is in the administration of healthcare services. As mentioned earlier, HIS provides the invaluable data that leads to actionable outcomes. Haskew et al. (2015) reported that the use of data for gathering healthcare trends was important in obtaining population data indices. HIS becomes important to obtain, manage and use this information. The efficiencies in communication and administrative functions were also attributed to HIT (Payne et al., 2013). This argument proposed the return on investment that is obtainable from EHR to improve the health system administratively, which can be deemed useful from the perspective of government.

Despite these benefits to government, EHR and health technologies can demand a significantly high initial cost (CAPEX), especially in resource-constrained settings where a server and a network are not found (Haskew et al., 2015). However, in his book Gupta (2014) argued that public expenditure plays a decisive role in development. Thus, the researcher argued that cost could not be the deciding factor as to whether a technology initiative should be implemented; rather the criteria should be if there is potential for significant economic development or improvement within the healthcare sector with technologies.

Calman, Hauser, Lurio, Wu and Pichardo (2012) stated that EHR acts as a catalyst to allow for communication between primary healthcare providers and public health departments. However, to date investments into eHealth made by the Department of Health had not created the desired 'network effect' due to lack of compatibility and interoperability between various IT systems (Kotze, 2014). This was compounded further by the fact that the SA eHealth system had widely differing levels of eHealth maturity between and within provinces; furthermore there were silos of information within government (NDoH) leading to disparities in reporting (Department of Health & CSIR, 2012).

Information exchange through an EHR is critical in a national healthcare system. An effective EHR has advanced storage information sharing accessibility to enable health

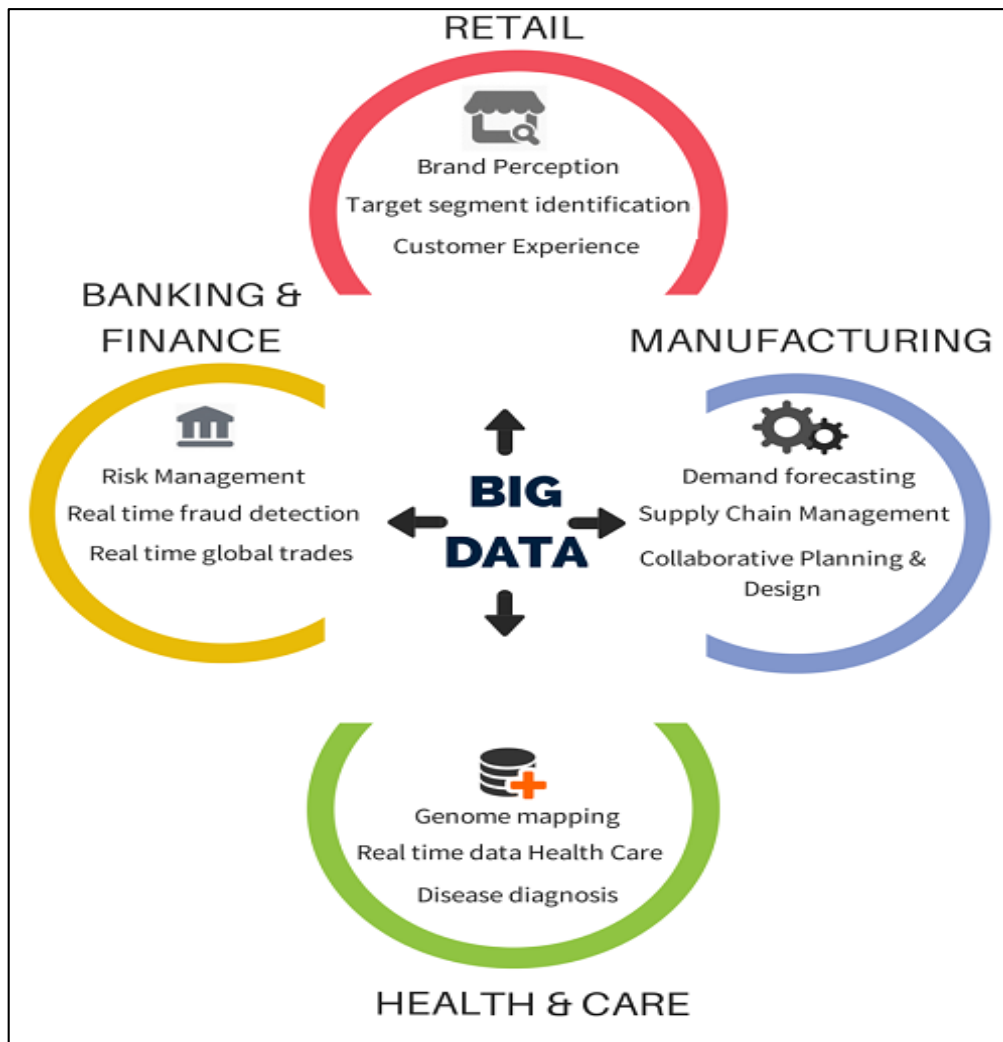
workers to collaborate on decisions, thereby reducing the probability of medical errors (Schiff & Bates, 2010). It is plausible that lack of interoperability and compatibility was one of the reasons why the full spectrum of benefits of EHRs were not being realised. Thus, the role of government would be to set the minimum required standards or policy governing eHealth of which interoperability and IT compatibility should be one. The premise by which the government will attain benefits through an EHR was based on data analytics.

### 2.5.1 The role of data analytics

From a technical perspective, it was incumbent upon an effective EHR system to process, store and share a variety of different information and resources, and at the same time maintaining data security and privacy (Andriopoulou, Birkos & Lymberopoulos, 2015). Hussein (2015) reported that the role of eHealth was as a contributor toward Health Information Systems through which the organisation and government can monitor health trends. To this extent, data analytics became important.

Data analytical applications are the keys to unlocking silos of disparate data into actionable insight. To understand true costs and outcomes, critical pieces of internal and external data is required namely: patient demographics, clinical data, financial information, clinical outcomes, and claims or health information exchange (Pettin, 2013). Through data analytics, which informs EHR, clinical outcomes can be improved. A good example of how data analytics improves outcomes was the case of Discovery, an insurance company with their core competence being data analytics to understand consumer behaviour. Through data analytics, insight was generated, which was reflected in the healthcare outcomes they achieved. The government has the potential to utilise the data generated by HIS to inform timely interventions with positive outcomes in public healthcare. Figure 3 below illustrates the top industries utilising big data for improved outcomes. Thus, if other industries were realising the potential benefits of 'big data' the same could be applied to the public healthcare sector.

**Figure 3: The top industries using Big Data adapted from Dezyre, (2014).**



Two real-time clinical management activities employed in data analytics were registries and predictive modelling. According to Reinke (2012), registries were software applications that provided a concise view of the patient by integrating pharmacy, lab, electronic health records and claims data. They may also include clinical guidelines and patient assessment.

Predictive modelling, on the other hand, was another data analytics technique focused on forecasting future medical costs (Wills, 2014). Reinke (2012) stated that predictive modelling was used as a risk adjustment tool in the budget setting process, thereby identifying patients with high cost conditions and who are likely to drive up total healthcare expenditure. This becomes important for all individuals involved in

healthcare to identify, as it will lead to decreased public healthcare costs and improve the 'health inequality' situation as it stands.

A third suggestion the literature employed was real-time analytics, which allowed for decision-making at the patient's bedside. Real-time analytic systems generated updated information concerning a patient's history and current status and offered solutions for diagnosis and treatment (Wills, 2014). This shows the potential to improve on quality of care for patients.

Through the discussion of the three methods of data analytics (registries, predictive modelling and real-time analytics), it was noticeable that the applicable information that was mined from raw data improved the quality of care and cost efficiency. The role of data analytics in HIT becomes critical in the healthcare management framework, hence the name 'integrated' HIT.

In the section to follow, the study will delve further into the mechanism of cost-containment that can occur through collaboration. The underlying theoretical base for the benefits that collaboration can achieve in healthcare is the Network Theory.

### **2.5.2 The Network Theory**

According to Jang, Lee and An (2012), a social network was defined as a social structure, which was comprised of a set of actors (such as individuals or organisations) or networks of people related to one another (such as relationships, connections or interactions) by particular characteristics. Social networks were viewed as graphs, and actors' relationships between each other were expressed with nodes (the actors) and links (the relationship between the actors). The best study of innovation in a services sector may be the relationship between humans and non-human artefacts regarding the view of the actor Network Theory on socio-technical networks. To this extent, the EHR was a case in point (Farias & Unb, 2012). The EHR would be the non-human super-actor around which the effects of other actors surrounding it came together and derived value/utility from it (Cucciniello, Lapsley, Nasi & Pagliari, 2015). Furthermore, intra-organisational and inter-organisational communication ties became important in the case of EHR in primary healthcare.

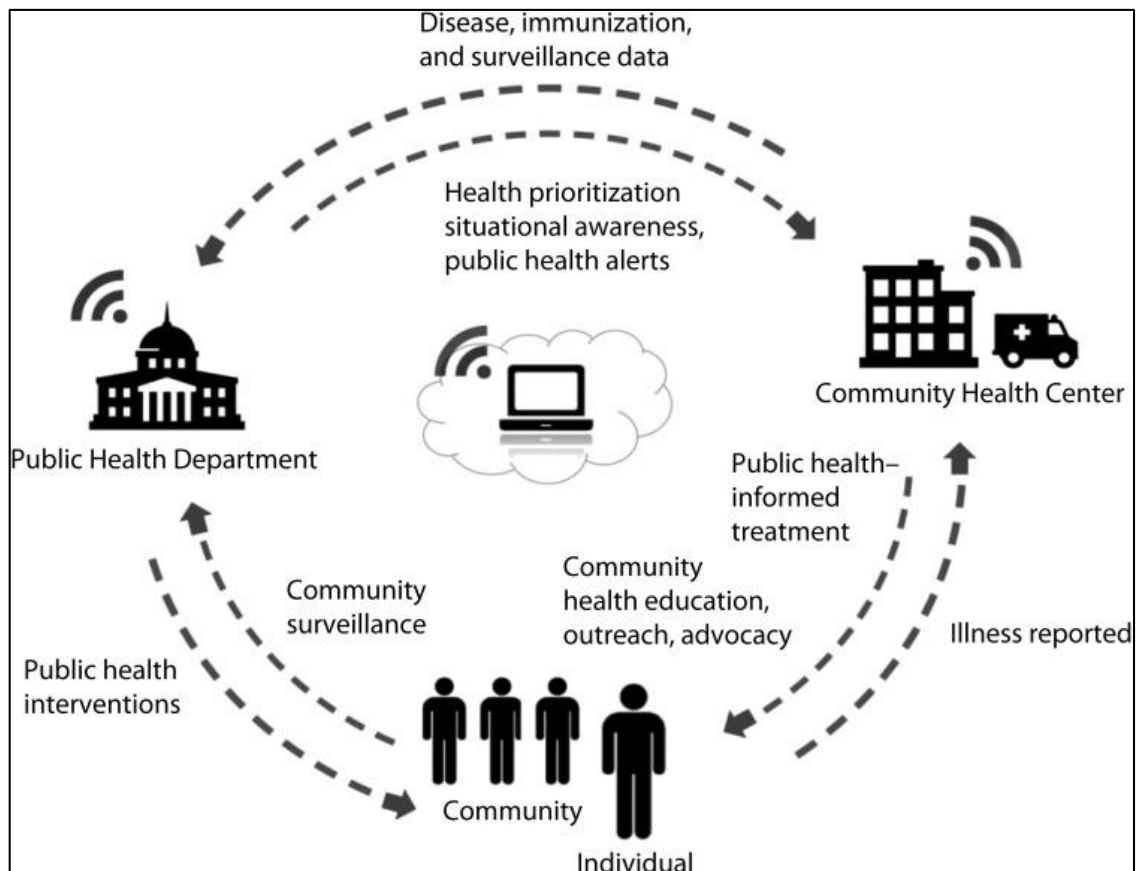
There are several characteristics of a network that influence the way the network works. This includes the degree of centrality: a highly centralised network has direct

ties to most other network members. The centralised network brings various actors, for example government, medical practitioners, auxiliary staff and patients in the public and private sector, together in a value-creation process (Rivera-Santos & Rufin, 2010). Another structural characteristic is degree and density. Degree refers to the number of connections a node has in a network, and individuals with many connections can mobilise a large amount of resources and play a central role in the flow of information. Density refers to the ratio of the number of actual connections to all possible connections (Jang, Lee & An, 2012). However, the assumptions of the network view was that should any actor be added or removed from the system, (as in the case if EHR is introduced into an organisation), then the whole network will be affected (Cresswell, Worth & Sheikh, 2010). The argument highlighted how an EHR can bring several disparate actors along the value chain together with the benefit of cost-containment and improved quality of care.

The diagram below (Figure 1) shows a network using an integrated HIT being used to create an ecosystem of multiple stakeholders. Through the use of technology, various healthcare providers and users can be connected to optimise effective healthcare delivery. Quality of the healthcare service delivery depends on the cooperation among multiple stakeholders that constitute a large-scale distributed system (Andriopoulou et al., 2015). Efficient information flow and collaboration among the community health centre and the Department of Health leads to improved surveillance or tracking of the health centre, which leads to timely public health interventions and ultimately healthier populations.

**Figure 4 Integrated EHR/HIT model**

*Adapted from Calman, Hauser, Lurio, Wu & Pichardo, (2012)*



Integrated HIT can empower patients and end-users by surrounding them with a supporting social and technical collaborative network. The emerging information technologies facilitate health-related information collection, sharing and flowing among a community, including patients, healthcare providers, medical data analysts and medical regulators (Calman, Hauser, Lurio, Wu & Pichardo, 2012).

To this extent, it is highly valuable to merge the diverse IT technologies and then multiple healthcare activities to foster sustainable healthcare ecosystems for collaborative healthcare delivery (Yang et al., 2015). In the 2012 CSIR survey, it was found that there were 42 different stand-alone HISs operating in various public sector institutions with minimal levels of interoperability. Thus, the DoH commissioned the CSIR to establish a set of standards of interoperability of eHealth systems, which would allow for 'knowledge/information sharing' across different systems in different facilities (Chetty, 2015). Thus, government have realised the benefits, which can be attained through use of an integrated EHR and are appropriately regulating the use of eHealth systems.

## 2.6 The Benefits of EHR for End-Users

EHRs were defined according to the Health Information and Management Systems (HIMSS) as: “a longitudinal electronic record of patient health information generated by one or more encounters in any delivery of care setting. Included in this information were patient demographics, progress notes, problems, medications, vital signs, past medical history, immunisations, laboratory data and radiology reports” (HIMSS, 2015). Some of the basic benefits associated with EHR included being able to easily access computerised records and the elimination of illegible notes, which emphasised the potential benefits to end-users (Menachemi & Collum, 2011). Other benefits were improved clinical decision-making (Farias & Unb, 2012) through health information exchange. Peng et al. (2014) reported that EHR systems resulted in savings for the patient and the patient’s insurance company, but lowered revenues for the provider. This shows the benefit to the healthcare provider and end-user.

An Electronic Health Record should have a Clinical Decision Support (CDS) system built into it. Some functionalities of a Clinical Decision Support system include providing the latest information about a drug, cross-referencing a patient allergy to a medication, and alerts for drug interactions and other potential patient issues that were flagged by the computer (Menachemi & Collum, 2011). With the continuous growth of medical knowledge, this allowed the practitioner to be alerted to latest treatment modalities. The aim was not to replace the practitioner as the diagnostic specialist, but rather to supplement his/her knowledge. Care would then be delivered in a much safer and more efficient manner. As more and more CDS systems are used, one can expect certain medical errors to be averted and that, overall, the patient will receive more efficient and safe care (IOM, 2001). This has the potential to reduce medical errors and reduce the mortality rate in SA of 34 per 1000 live births, which was described in Chapter 1.

## 2.7 The Benefits of EHR for Healthcare Facilities

Digital healthcare records were introduced due to the benefits of cost containment and time saved on healthcare delivery, as it also decreased waiting times for patients (Ojo & Popoola, 2015). Other benefits were improved clinical decision-making, hospital processes that were optimised with an appropriate information system, and overall knowledge management improvements (Farias & Unb, 2012), as well as quality improvements that may reduce length of stay in hospital/clinics and allow for a reduction in administrative errors (Lee, Mccullough & Town, 2013).

The above literature provides valuable arguments regarding improved quality of care and reduced cost. One school of thought was that due to the direct correlation of EHR with benefits such as timely access to patients' information, health-tracking and reduction of medical errors, inadvertently quality of care was improved (Zhou et al., 2009). The other school of thought indicated that there was no direct correlation between EHR use and quality improvements, which can only occur if decision support is in place (Dexheimer, Talbot, Sanders, Rosenbloom & Aronsky, 2008). The argument between the two schools of thought was thus whether or not a direct or indirect correlation existed between EHR and quality of care, which inadvertently seemed to state that a relationship does exist, as long as the decision support was also in place.

Mithas, Ramasubbu, & Sambamurthy, (2011) stated that whilst IT infrastructure provided the base foundation, the management of information was of greater importance in influencing an institution's performance. This was further corroborated by Barton, (2014) and Walston (2014), who stated that EHR can maximise efficiencies and lead to organisational success through utilisation of information/data. Mithas, Ramasubbu and Sambamurthy (2011) defined information management according to three criteria:

- (i) The ability to provide data and information to users with timeliness, accuracy, security, reliability and confidentiality;
- (ii) Provide universal connectivity and access with adequate reach and range;
- (iii) Adaptability to tailor the infrastructure to emerging business needs and direction.

The results of their study posited that information management capability was significantly affected by customer management, process management and performance management. Furthermore, information management affected financial performance by itself or with other mediating organisational capabilities.

Upon an analysis of literature on cost-containment and IT resource exploitation, resource combination emerged as a finding. Resource exploitation was the value-creating mechanism where knowledge technology or institutions were leveraged to increase value for the user either through a reduction in cost or better accessibility for the user. Resource combination, on the other hand, was the mechanism of value creation where two to three interactional resources were combined to create the desired value for the user (Srivastava, Shirish, 2015; Lichtenthaler & Ernst, 2012).



### 2.7.1 Resource exploration/exploitation

In light of the pertinent gains in quality and cost reduction through EHR as indicated by Ojo and Popoola (2015), as well as the improvement in public health and programme management (Blaya, Fraser & Holt, 2010; Salmon et al., 2013), the authors argued that EHR and such technology initiatives should be introduced in an economically sustainable way that would not consume clinic resources, which would otherwise go toward patient care. This became pertinent for this study into primary healthcare as resources in this sector are already constrained.

According to Petruzzelli (2012), a combination of resource exploration and exploitation generated new innovation. New technologies created new knowledge, which must be integrated in a firm's technological resource base and constitutes the basis of resource exploitation. For example, Narayana Hrudalaya is a hospital in Bangalore that leverages economies of scale and resource exploitation to generate profits (Srivastava, 2015). The author highlighted the role of technology in reducing the cost of healthcare, where the size and quality of the resource base determined the exploitive potential. Furthermore, Srivastava (2015) stated that value creation was dependent on the interactional use of resources between provider and user in service systems and ICT was the key interactional resource. This spoke to Network Theory, which was discussed earlier in section 2.5.1.

According to (Piao, 2014), there was a positive correlation between resource exploitation and organisational longevity. The author stated that firms needed to engage actively in both exploitation and exploration to prolong their firms' lifespan, despite the negative dynamics associated between exploitation and exploration. This had implications for HIT in that if hospitals wanted to maintain competitiveness, they would have to maximise their resources through economies of scale and resource exploitation to generate profits, as stated in the example of Narayana Hrudalaya. However, the researcher argues that the example of Narayana Hrudalaya may not be applicable to SA as the equivalent economies of scale do not exist.

The resource-based view had two underlying assumptions: firstly, that there was resource heterogeneity between two firms or institutions; and secondly, that this resource heterogeneity was long lasting (resource immobility) (Mata, Fuerst & Barney, 1995).

The second assumption, one of resource immobility, became especially relevant in the context of EHR in primary healthcare. The assumption was based on the premise that even if a firm had a resource, but if there were inadequate capabilities to utilise the resource, this placed a firm at a cost disadvantage and thus the aim to achieve sustainable competitive advantage was lost. Teece (2007) reported that sustainable advantage of an institution required more than ownership of unique assets; it also required dynamic capabilities that can keep the asset base of an institution up to date and relevant. This pointed to the administrative (managerial functions) that were important for the implementation of these 'asset bases'.

The question arose, whether the resource-based view was applicable to NGOs or public institutions, which are the premise of this study. NGOs raise funds through two means: charging of fees for a delivery of a service; and through donor funding and grants. Thus, the importance of strategic cost management is important in these entities (De Aguiar & Martins, 2006). Williams (1999) pointed to the flaws of the NGO management method in that there were limitations in the administrative area and in their training of staff. Frumkin and Kim (2001) agreed that the means to increase organisational effectiveness and contain costs did not happen through management. The authors suggested that the management lag between NGOs and private institutions could be overcome with managerial knowledge and technology. This is where EHR becomes relevant to the public sector and NGOs, as such system could become a means of containing costs.

A further functionality of HIT was in the administration of healthcare services. As mentioned earlier, HIT provided the invaluable data that leads to actionable outcomes. Haskew et al. (2015) reported that the use of data for gathering healthcare trends was important in obtaining population data indices. HIT becomes important to obtain, manage and use this information. Thus, the efficiencies in communication and administrative functions were also attributed to HIT (Payne et al., 2013). Despite the high cost to acquire, maintain and operate HIT, the return on investment warrants the use of HIT to improve the health system functionality both operationally and administratively, particularly in the public health sector.

## 2.8 Technology Adoption

Critical to the success of EHR was its adoption. Khalifa (2013) argued that EHR technology adoption and implementation consumed hospital resources in return for

fewer than expected benefits. Urhuogo (2013), who stated that inadequate adoption of the technology was a factor that led to high costs, strengthened this argument. Therefore, inadequate adoption could be attributed to many factors, among them lack of compatibility of systems, lack of skills, high costs of installation and implementation and ultimately also contribute to the rising costs of healthcare in SA, despite implementation of HIT.

Research conducted by Cline and Luiz (2013), indicated that there was a positive influence of automation on cost and strategic value in public sector hospitals in relation to patients' experience, hospital staff workflow improvements and overall morale in the workplace. However, in South Africa, the value of healthcare automation was poorly understood and the opportunity cost of improvements in IT was side-lined for other costs like building infrastructure and equipment (Cline & Luiz, 2013). This indicated that the strategic value and benefit of technology was not understood fully by end-users of the technology or by decision-makers in the institutions or at government level, which led to poor adoption and technology would thus not be 'exploited', which increased ultimate costs.

Technology adoption is critical for the successful implementation of EHR, thus the following factors are deemed necessary for implementation.

### **Leadership**

#### **a) Within the organisation**

Leading improvement efforts efficiently is challenging and faced with sensitive issues, requiring a combination of technical skills, facilitation skills and personal qualities. It needs to happen at multiple levels and needs to ensure alignment with staff priorities, and active work among staff to foster collaboration and engagement with improvement aims. Respected individuals can play a vital role in encouraging colleagues across different professions. The key to success may be 'quieter' leadership, less about bombastic declarations and more about working to facilitate collaboration (Dixon-Woods, McNicol & Martin, 2012).

#### **b) From government**

The government plays a significant role in the widespread adoption and diffusion of HIT, thus playing a role in the acceptance of the use of such systems (Lee et al., 2013). Furthermore, the benefits to government are more timely access to information for records and statistical analysis, which aids

research and allows for improved decision-making. The guidelines, according to the National Health Regulatory Framework, stipulated the focus on strengthening the enabling environment for eHealth, creating legal certainty, establishing the policy context for delivery of eHealth and identifying the standards to be adopted to ensure that building larger silo systems is avoided (Kotze, 2014). Thus, the role of leadership cannot be overstated.

Mostert-Phipps, Pottas & Korpela, (2013) summarised the major findings on factors that affect adoption of HIT by end-users as follows:

- (i) **Lack of capacity and necessary structures to implement, execute support and monitor existing policies and regulations in terms of technology implementation.** Boundaries between professional, disciplinary and managerial groups presented important obstacles to change, and consensus within one profession was not always shared by others. Middle managers and frontline staff could be especially difficult to engage in improvement, because they already faced numerous, complex, competing clinical and organisational demands, often with inadequate staffing, limited resources and equipment shortages (Dixon-Woods et al., 2012);
- (ii) **Insufficient training.** In the work of (Ramtohul, 2015), technology readiness of individuals was cited as a major obstacle to adoption of EHR;
- (iii) **Lack of ownership and accountability.** This was corroborated by Dixon-Woods et al. (2012), who stated that engaging staff and overcoming a perceived lack of ownership were among the biggest challenges in improvement efforts;
- (iv) **Insufficient quality control mechanisms;**
- (v) **Shortage of staff;**
- (vi) **The absence of adequate connectivity and communication infrastructure.** This could be linked to the geographical location of the healthcare facility as stated by King, Furukwa and Buntin (2013);
- (vii) **Ease of use.** This could be perceived as a positive or negative influencer for adoption. The perceived ease of use referred to how easily the system could be learnt and intuitively used. EHR must be clear and structured for the user if it is to affect positively their willingness to adopt the system (Davis, 1989: p319). (Ramtohul, 2015) reported that the EHR was deemed useful through ease of use, clarity, comprehensibility, timeliness, data security, the possibility to establish contacts as well as to compare notes with other persons concerned, individuality and the quality of information;

- (viii) Lack of government-backed drive to implement health information technologies;**
- (ix) Lack of incentivisation for healthcare staff to adopt technologies;**
- (x) Lack of knowledge of the benefits that healthcare technology can offer in terms of improved quality of healthcare delivery and impact on lowering costs.**

Additional factors such as education level, age and gender can influence technology adoption (Vance, Tomblin, Studeny & Coustasse, 2014). Literature highlighted the disparities in adoption of EHR based on geographic location, resource constraints, organisational complexity, overall citing a less favourable business case for adoption and lack of expertise necessary to integrate EHR into practice workflow (King, Furukawa & Buntin, 2013). It was noteworthy that all of the above-mentioned research had been conducted in a mature developed market, where the resource constraints experienced are different to those experienced in an emerging market like SA.

Peng et al. (2014) stated that related to the process of HIT diffusion was the contagion effect, which suggested that one's ability to adopt technology was primarily influenced by the number of others who had adopted the technology. The underlying base in the contagion effect was the assumption that, at any given time, all individuals in the network who were yet to adopt the technology were uniformly exposed to the same amount of influence from current adopters. In addition, absorptive and disseminative capacities were built upon the theory of knowledge transfer, whereby certain actors were more likely to adopt technologies, because they had accumulated sufficient related knowledge or because their peers possessed the capacity to impart related knowledge. However, the context of the application of the contagion effect was different in the study by Peng et al., (2014) and this research seeks to understand if the same can be true in primary healthcare in South Africa.

A study regarding the acceptance of EHR in SA had not been conducted yet and is the basis of this study. The Technology Acceptance Model, originally developed by Davis (1986) identified certain key constructs, which will be useful for a study regarding adoption. It was a theory of individual behaviour, which explained acceptance from a rational perspective (Wirtz, Mory & Ullrich, 2012).

Based on the model, two constructs – namely Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) – determined the attitude of the end-user towards adoption of her, which in turn informed the behavioural intention and ultimate acceptance/usage of EHR. PU was defined as the users' subjective probability that using EHR will improve their future performance within the scope of the organisational context (Davies et al. 1989: p985). (Venkatesh, Morris, Davis & Davis, 2003) defined social influence as 'the degree to which an individual perceived that important others believed that he/she should use a new system. With regard to the efficiency of EHR, data security plays a role. Generally, end-users such as physicians have to perceive that using the EHR will help them attain gains in job performance that is job relevant. A study on EHR in Germany revealed that the expected benefits and expected costs of using EHR became relevant (Wirtz et al., 2012). This was corroborated by Boonstra et al. (2004) and Pizzi et al. (2005).

## 2.9 Change Management

The use of EHR created a high degree of change within the organisation (in this case the primary healthcare facility) during adoption and post-adoption. The speed and depth of impact of the EHR may be enhanced by the way in which this EHR is implemented (Boonstra & Broekhuis, 2010). EHR (technology) alone was insufficient for ensuring that the benefits were realised; the incumbent was the manager of the institution who needed to understand the human and organisational processes involved in change management and adoption (Cucciniello et al., 2015). This idea addressed the notion that effective implementation required people, processes and technology.

When deploying EHR, a key understanding of the dynamics at play at each primary health clinic/organisation was needed, which included internal politics and an in-depth analysis of the various personalities of health workers at play; that is, those health workers who may present potential challenges as well as early adopters. Focus groups needed to be created, where attention could be given to so-called 'problem children'. Rumours related to the efficiency and adequacy of EHR should be dealt with timeously. Generally, the most powerful resisters who diligently work against the implementation and adoption of EHR may become the best allies once they see the full spectrum of benefits that EHR may bring (Wu, Jackson, & Hunt, 2010). Once the transition toward

EHR is undertaken, plenty of support should be given to end-users as and this may be aided by an in-clinic IT specialist or dedicated support from the software company.

As stated previously, EHR adoption was contingent not only on removing barriers, but addressing the change processes involved (McAlearney, Hefner, Sieck & Huerta, 2015). Literature by Szydlowski & Smith, (2009) promoted the use of standard change management structures such as Kotter's eight steps with the implementation of EHR in primary healthcare (see figure 3).

- **Step one** was to get things moving. It involved dialogue around EHR;
- **Step two** was important to convince people that change was necessary and strong leadership was influential in this phase;
- **Step three** was to give people a better understanding of why things had to change and the influence that EHR can have on their lives;
- **Step four** spoke to the leader or management who will lead and talk by example in the adoption of EHR and integrate it into daily routines;
- **Step five** was about empowering early adopters and removal of obstacles;
- **Step six** referred to short-term wins, be they extrinsic or intrinsic motivational factors;
- **Step seven** referred to a change in the structures and systems that do not fit the overall new scheme;
- **Step eight** referred to how the change should be anchored within the organisational/clinic structure (Ramakrishnan, 2014).



Figure 5 Kotter's Eight Step Change Framework

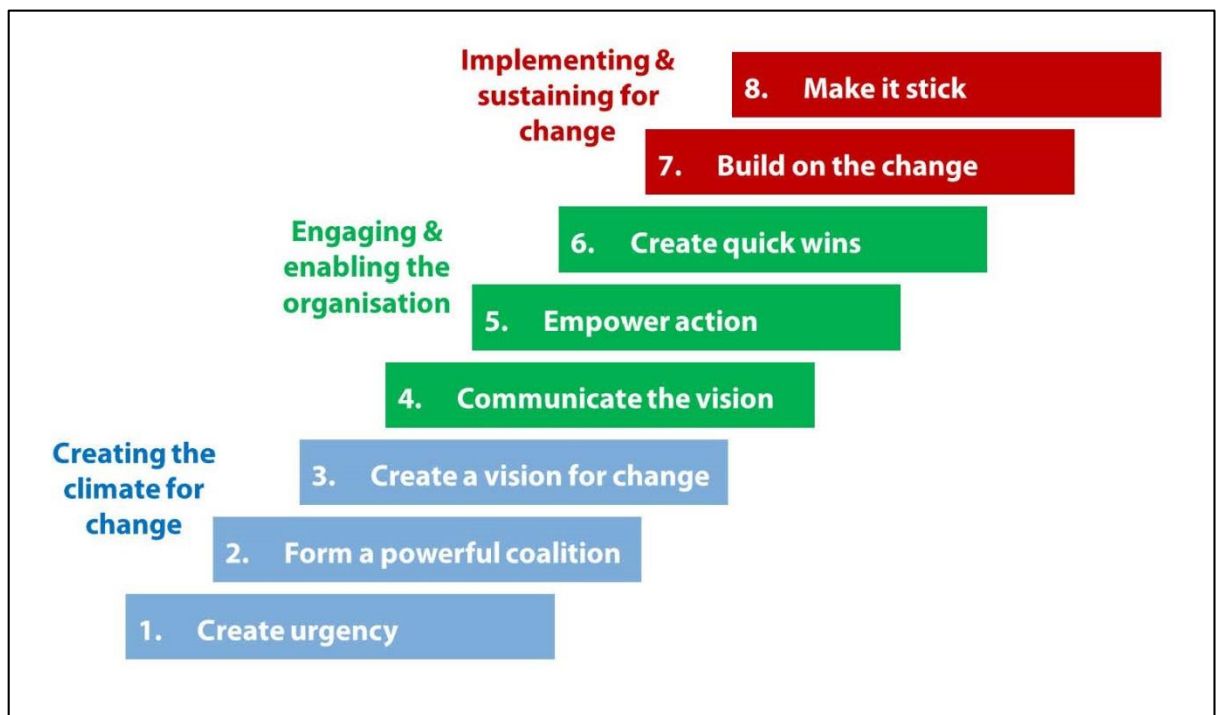


Diagram illustrating the Kotter eight steps to guide change management (Ramakrishnan, 2014).

## 2.10 Conclusion

The literature review delineated the benefits that can be attained through EHR, which were classified according to benefits for government, institutions, end-users and lastly patients. The public healthcare sector in SA faces numerous challenges, which include a shortage of healthcare workers plus financial and infrastructure resource constraints and an increasing work burden on public health workers.

The role of EHR becomes important for quality improvements, working process efficiencies, collaboration, communication and cost containment, and thus, EHR is integral to bridge the digital and economic divide. The role and benefits of EHR can only become truly realised if the system is implemented correctly, is compatible across other systems and greater efforts towards the adoption by end-users are needed. In the context of an NHI in SA, a fully integrated HIT becomes crucial to its success.

The literature review put a strong case forward on the cost containment that can be achievable through EHR. In addition, quality of care was a dominant theme and normally cost and quality are inversely related. However, both can be attained through EHR if the system is implemented correctly. The importance of change management



procedures becomes crucial here. Literature highlights the use of standard frameworks like Kotter's eight steps to effective change management.

The literature review further highlighted the factors that affect adoption of EHR. The major constructs were cost, perceived usefulness, ease of use, time saved, insufficient training, which tied to poor implementation, shortage of staff, ease of use, geographical location of the facility, age of the potential adopter, technological readiness of the individual, which in turn was tied to behavioural intent or attitude of the individual, lack of incentivisation structures for staff to utilise technology and lack of a government backed drive to implement EHR. These were based on peer-reviewed literature studies that were either identified as potential factors that could affect adoption in SA or literature regarding adoption of EHR in public sector facilities in countries such as Germany (Ramtohul, 2015). Thus, this study aims to extend the academic body of knowledge regarding adoption – after successful installation and implementation – of EHR, particularly in the public primary healthcare setting in SA.

There is a need to understand adoption of EHR from a South African perspective. This will guide best practices for implementation to ensure that when EHR is rolled out on a large scale, risks of failure are mitigated or avoided. EHR can create more 'interconnected' healthcare facilities, which will contribute towards health management and governance and ultimately contribute to a healthy population

## CHAPTER 3: RESEARCH PROBLEM, SCOPE AND QUESTIONS

### 3.1 Introduction

This research broadly studies the impact/benefits EHR will have on primary healthcare and factors that could lead to a lack of adoption of EHR in primary healthcare. The previous chapter discussed the literature on the potential benefits that can be realised from the transition to her, based on evidence-based literature from peer-reviewed journals in other countries. South Africa is in the pilot phase of EHR implementation and softer issues such as change management, which affect adoption of her, become pertinent.

Existing literature spoke of the role technology plays in the key socio-economic and organisational development (Farias & Unb, 2012) as well as the benefits that an EHR can provide, namely the benefits of cost containment and time saved on healthcare delivery as it decreased waiting times for patients (Ojo & Popoola, 2015). Other benefits are improved clinical decision-making, hospital processes are optimised with an appropriate information system, knowledge management improvement (Farias & Unb, 2012), quality improvements that may reduce the length of stay in hospital/clinics and a reduction in administrative errors (Lee et al., 2013). However, if the full-range of benefits are not being realised by end-users (perceived usefulness), this could hamper adoption of the system.

Thus, a study to juxtapose the technology acceptance model based on EHR is warranted to see if individual behaviour plays a role in adoption of EHR in addition to the factors cited by Mostert-Phipps, Pottas and Korpela (2013). A study on EHR in Germany revealed that the expected benefits and expected costs of using EHR became relevant (Wirtz et al., 2012). Boonstra et al. (2004) and Pizzi et al. (2005) corroborated this. Thus, the aim of this research is to build on the existing international knowledge of EHR adoption and expand it to South African implementation of EHR, particularly in primary healthcare.

Based on the literature review and the arguments provided thus far, deductive reasoning (that is, beginning from the general to the more specific) was employed to narrow down the theory presented to three research questions.

These three questions are as follows:

## 3.2 Research Questions

### 3.2.1 Question 1: What are the key enabling factors/benefits associated with EHR/HIT in primary healthcare?

Literature indicated the overall benefits of EHR, which were covered intensively in Chapter 2. Some of the basic benefits associated with EHR include being able to easily access computerised records and the elimination of illegible notes; this shows the potential benefits to end-users (Menachemi & Collum, 2011). Other benefits were stated as being improved clinical decision-making (Farias & Unb, 2012) through health information exchange. Peng et al. (2014) reported that EHR systems resulted in savings for the patient and the patients' insurance company, but lowered revenues for the provider (Peng et al., 2014). In addition, Haskew et al. (2015) reported that the use of data for gathering healthcare trends was important in obtaining population data indices. However, the purpose of this research question is to assess if end-users of EHR understand the benefits that can be attained.

### 3.2.2 Question 2: What are the barriers that impact on adoption of HIT?

The over-arching research question is an understanding of the factors that impact adoption of HIT in SA. The literature review indicated that factors affecting adoption included:

- A lack of capacity and necessary structures to implement, execute, support and monitor existing policies and regulations in terms of technology implementation;
- Insufficient training and lack of ownership and accountability;
- Insufficient quality control mechanisms and shortage of staff;
- The absence of adequate connectivity and communication infrastructure;
- Problems with ease of use and lack of government-backed drive to implement health information technologies;
- Lack of incentivisation for healthcare staff to adopt technologies;
- Lack of knowledge of the benefits that healthcare technology can offer in terms of improved quality of healthcare delivery and impact on lowering costs (Mostert-Phipps et al., 2013).

However, it is important to ascertain and distinguish a ranking of factors impacting adoption of EHR and HIT in public primary healthcare facilities in South Africa and thus, the behaviour intention was added as a factor.

### 3.2.3 Question 3: How can the use of an integrated HIT network be beneficial to primary healthcare in SA?

A lack of interoperability or compatibility between various IT systems was considered one of the major drawbacks of EHR systems (Kotze, 2014). Porter and Kramer (2011) stated that “the competitiveness of a company and the health of its communities are closely intertwined, and equal or greater opportunities arise from serving the disadvantaged communities.’ To this extent, there has been a shift in the way business is done toward shared value creation.

The SA eHealth system has widely differing levels of eHealth maturity between and within provinces, furthermore there are silos of information within government (NDoH), leading to disparities in reporting (Department of Health & CSIR, 2012). According to Cline and Luiz (2013), HIT has the ability to curb the many problems faced by the public healthcare sector in SA.

## CHAPTER 4: RESEARCH METHODOLOGY

### 4.1 Introduction

In order to gain an understanding, further knowledge and answer the research questions proposed in Chapter 3, the study by (Ramtohul, 2015) on adoption was used. The study (Ramtohul, 2015) was conducted with end-users of EHR in Germany and Switzerland, working in public sector institutions to identify factors that affect adoption of EHR. The master plan for this research used parts of Ramtohul's (2015) research design, but this research report takes cognisance of the factors that play a role in adoption as elicited in the Technology Acceptance Model.

The aim of this study was to determine if perceived benefits of EHR are being realised and if not, what some of the challenges experienced with use of these digital health records were. The study focused on eight end-users of EHR, who are employed in different job categories in health clinics in South Africa as well as eight subject matter experts (SMEs) in EHR. The main reason for the approach was to check if there was alignment between the goals of end-users and subject matter experts whilst implementing EHR.

Because EHR implementation is still in the pilot phase in South Africa, interviews were conducted with the end-users and SMEs. Given the nature of the research, interview bias was possible. However, the researcher tried to limit any possible bias as far as possible. This chapter will now explain the methodology that will be used to test the research questions outlined in Chapter 3.

### 4.2 Choice of Methodology

Qualitative research provides a platform to interpret and understand human experiences within a specific context using text as opposed to numbers (Petty et al., 2012). During the literature review it was seen that there is a myriad of sources talking about the benefits and adoption challenges of EHR in various healthcare settings for example (Dixon-Woods et al., 2012; Farias & Unb 2012; Freyman & Fontenot, 2014; Haskew et al., 2015; Khalifa, 2013; King, Furukawa & Buntin, 2013). These studies were conducted in other geographies. As posited by De Rosis and Segheiri, (2015) the level of social and economic development, the characteristics of healthcare systems and managerial capability affects the readiness of individuals to embrace technologies. Thus the study was undertaken to 'interpret and understand' challenges with EHRs.

Qualitative research is based on an interpretive research philosophy whereby the researcher intends to make sense of the subjective and socially constructed meanings expressed about the phenomena (EHR) under investigation. Moreover, the research approach was inductive because it sought to generate new theories or add on to existing theories by establishing and examining patterns (Saunders et al., 2012). Agee (2009) said that a qualitative study inspires a process of exploration and discovery.

Research into EHR in SA was limited, particularly in the context of primary healthcare. This problem was further compounded by the fact that research around adoption of EHR was ignored. There are several disparate systems in use in different clinic settings; thus, it was decided to conduct a qualitative empirical study through a holistic perspective to generate new theory regarding the best practice for implementation of EHR.

Given the problem background, the study was an exploratory cross-sectional study (Zikmund, Babin, Carr & Griffin, 2012) because it sought to investigate the existence and the effectiveness of EHR that is utilised by primary healthcare workers in SA; therefore, a qualitative approach was followed. This approach was more suitable since the researcher intended to gather in-depth insights of what perceptions were currently held and why they were held, in relation to the effectiveness of EHR; thus, an inductive approach was followed. After analysis, the researcher was able to discover patterns, categories and interrelationships through the exploration of open-ended questions, rather than a theoretically derived hypothesis (Blanche, Durrheim & Painter, 2006).

#### **4.3 Population**

According to Saunders et al., (2012) a full set of cases from which a sample is taken is called a population. The universe or population chosen for this study were key stakeholders for healthcare provision in both the public and private sector, which included subject matter experts (SMEs) who deal with EHR and physicians and auxiliary staff (nurses) who are end-users of EHR in primary healthcare facilities.

The SMEs consisted of executives and leaders who experienced the implementation of EHR and are based in large organisations in the Gauteng region. The end-user group consisted of healthcare workers in health clinics in the Gauteng region.

#### **4.4 Unit of Analysis**

The unit of analysis was the subject matter experts (SMEs) of EHR in primary healthcare as well as end-users of EHR. The WHO (1978: p2) defined primary

healthcare as: “essential healthcare made universally accessible to individuals and families in the community by means of being acceptable to them, through their full participation and at a cost that the community and country can afford”. To this extent, SMEs and end-users of EHR at primary healthcare facilities were an ideal unit of analysis as the researcher planned to establish if there was alignment between the goals of the implementer and end-user.

#### 4.5 Sampling Method and Size

The literature revealed that a sample is a selected subset from the larger population that allows the researcher to draw conclusions based on measurements taken from that specific subset of the population (Zikmund et al., 2012). According to Saunders et al. (2012), there were two appropriate sampling techniques, viz. probability and non-probability sampling. With probability sampling, every individual in a population had an equal chance of being selected, meaning that a representative sample was chosen. Probability sampling strategies included simple random sampling, stratified random sampling, systematic sampling and cluster sampling. On the other hand, with non-probability sampling (non-random sampling), the researcher selects the sample, using an element of subjective judgement. Non-probability sampling included purposive sampling (judgemental sampling), convenient sampling, quota sampling and snowball sampling.

For the current study, the researcher utilised two sampling techniques: the purposive sampling technique, whereby the researcher’s own judgement was used to select cases that would best enable the researcher to answer the research questions and meet the research objectives (Saunders et al., 2012). Secondly, snowball sampling was employed, where sample members referred subsequent sample members who have shared similar experiences (Saunders & Lewis, 2012). The inherent bias in purposive sampling contributes to its efficiency. The choice of purposive sampling was fundamental to the quality of data gathered, thus the competence and reliability of the respondent had to be ensured (Tongco, 2007).

For a study of this nature, which is dependent on readily available EHR systems, the study population was limited because EHR is not yet available in all primary healthcare clinics. Moreover, only a particular small section of the population (subject matter experts and end-users) would be suitable to participate in the study. Therefore, purposive sample was deemed necessary to select the study participants for a particular purpose to gain in-depth insights on subject-matter experts’ and end-users’

opinions on the benefits of EHR and barriers to its adoption. Semi-structured, in-depth interviews were conducted with eight subject matter experts and eight end-users of EHR within three health clinics in Johannesburg.

#### 4.6 Measurement Instrument

As stated previously, a qualitative research approach was followed. Therefore, the researcher developed semi-structured open-ended questions to gather in-depth information in line with the main research questions. The following key questions were administered to the respondents:

- a) **What are the key enabling factors/benefits associated with HIT in SA?**
- b) **What are the key factors associated with adoption of HIT in SA?**
- c) **How can the use of an integrated HIT network be beneficial in SA?**

These research questions formed the basis of the interview schedule. To probe the minds of the respondents further, the respondents were given some key definitions of terms like performance expectancy, effort expectancy, social influence, behavioural intention and facilitating conditions. The respondents would then have to decide and justify if they saw the constructs as either positive factors or negative factors affecting adoption or both.

#### 4.7 Data Collection

##### 4.7.1 Pre-test

A pre-test or pilot interview was conducted with two respondents, who formed part of the final sample to ascertain the flow and the ease with which the questions could be posed to the respondents. Subsequently, a few changes were made to the interview schedule to cut the long questions into shorter and clearer questions. The appropriate manner in which the questions would be posed was agreed upon. The information to be communicated prior to the interview schedule being commenced was also clarified during the pre-test. Interviewing techniques were practiced, and the recording device was working correctly.

##### 4.7.2 Interviews

Primary data collection was completed via personal face-to-face semi-structured interviews with 16 research participants who represented subject matter experts and end-users of EHR to explore their perception on the feasibility of EHR. This allowed the researcher to get close to the social actors. The date, time and location of the



interviews were at the discretion of the interviewee. The content of the interview schedule is appended in Appendix B. Semi-structured face-to-face interviews are most popularly used practices in business research (Myers, 2013). Advantages of face-to-face interviews in this study were the rich data that could be acquired from the interviews as reported in an article by McCoyd and Kerson (2006). Details of the primary healthcare facility was made accessible. In addition, the interviewer had the opportunity to observe end-users working with various EHR systems *in situ* as well as some of the challenges they experienced with certain systems. Another advantage of interviewing respondents in person was the completion of paperwork and informed consent forms by respondents, which was managed more easily.

Conducting interviews is disadvantageous in some instances as there is a chance of bias and respondents may not want to answer some more personal questions. Future studies could thus look at surveys to explore and validate the findings of this research in large samples. Data collected within a limited period could result in biased information that is dependent on management's perceptions at a single point in time. This limitation could be overcome if further research were to be conducted over a longer future period. As discussed earlier, the researcher employed purposive/judgemental sampling so that the sample was representative of SMEs and end-users of EHR.

Advantages of primary data are that it is original and relevant to the topic of research study, thus the degree of accuracy is high. Primary data is current and it can give a realistic view on the use of EHR in the work environment. The advantages to interviews are that information can be gathered from illiterate sources and there is no chance of non-response as the interviewer personally collects data.

The researcher first informed the participants and addressed all relevant ethical issues such as the purpose of the study, voluntary participation, the non-disclosure agreement, informed consent and rights to withdrawal. The researcher (interviewer) then employed transcription and translation to record the responses during the interview process, after seeking permission from respondents to record. Noteworthy was that the face-to-face approach enabled the researcher to add and probe further questions when required and also for the participants to seek clarity on some matters (Saunders et al., 2012).

The process of data management was a continuous one throughout the study. The author was aware that the efficacy hereof will largely determine the quality of results. Analysis of interviews took place through voice recordings and note taking, which required active listening. Audio recordings were conducted with 15 respondents after obtaining their consent, one respondent did not wish to be recorded and copious note taking was done. Each interview took an average of 45 minutes, with some lasting over an hour and the shortest one lasting 40 minutes. Each interview was then transcribed and the data was analysed.

Multiple types of observation, including object-/activity-/person-oriented observations were used to complement the interviews (Cresswell, Worth & Sheikh, 2012). This was done with the purpose of triangulation and to contribute to a deeper understanding of the sociotechnical processes involved in adopting the new technology like EHR.

#### **4.8 Data Reliability and Validity**

Data reliability and validity are terms mainly used in the quantitative research paradigm. However, in the qualitative research paradigm it is the duty of the researcher to convince the audience that the findings of a research inquiry are worth paying attention to (McCracken, 1988). Golafshani (2003) reported that while the credibility in quantitative research depends on instrument construction, in a qualitative study the researcher is the instrument. An inquiry audit might enhance the dependability or reliability of research. This can be verified through examination of raw data (voice recordings), transcripts and process notes (Golafshani, 2003).

The researcher ensured that data reliability was achieved by interviewing two samples with a standardised interview schedule across both samples, and the researcher made every effort to pay attention to the languages and perspectives of the respondents as opposed to self-interpretation. During the analysis, Leximancer software was used to elicit the most pertinent themes that emerged from the interviews. Thereafter, triangulation of data was employed. Triangulation was defined to be “a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study” (Creswell & Miller, 2000: p. 126)

#### **4.9. Analysis Approach**

In line with a qualitative research methodology employed, the study utilised thematic analysis of the data with axial coding, which facilitated the summarisation of the data into common themes (Gibbs, 2007). Leximancer software was used to aid the coding

process (Leximancer Pty Ltd, 2015). According to Strauss and Corbin (1990, 1998), the basic framework of generic relationships was understood as using a "coding paradigm" to include categories related to:

- The phenomenon under study, namely EHR;
- The conditions related to that phenomenon (context conditions, intervening structural conditions or causal conditions);
- The actions and interactional strategies directed at managing or handling the phenomenon;
- The consequences of the actions/interactions related to the phenomenon.

Noteworthy was that the results of the study were context specific, that is, they cannot be generalised in the population (Leedy & Omrond, 2012). The data was categorised according to the research questions presented in Chapter 3. A content and frequency analysis was then performed on a Microsoft Excel Spreadsheet with all the pertinent themes that emerged under each research question.

Based on the Technology Acceptance Model a ranking of the top three positive factors and the top three negative factors affecting the adoption of EHR from subject matter experts and end-users were ascertained.

By applying weightings to the factors according to the ranked position of each factor for each respondent, and then dividing these by the number of respondents, an overall strength of effect was calculated. The overall strength of effect could then be ranked from strongest to weakest. This is termed a qualitative dominant mixed analyses according to Onwuegbuzie, Leech and Collins (2011), which involved the researcher taking a qualitative stance with respect to the research process and the analysis, while believing that the addition of quantitative data and analysis can help address the research question regarding EHR adoption to a greater extent.

The weightings that were applied were as follows:

- First mention or top rank (A) = weighting of 3
- Second mention or ranked second (B) = weighting of 2
- Third mention or ranked last (C) = weighting of 1.

The overall strength of effect was calculated as follows:

$$\text{Strength of effect} = \sum \left( \frac{(A \times 3) + (B \times 2) + (C \times 1)}{n} \right)$$

As EHR implementation is still in the pilot phase, an adequate number of responses was not generated for statistical analysis; thus the perceptions of end-users and implementers regarding the top three factors that influence adoption both negatively and positively was conducted.

#### **4.10 Ethical Considerations**

Ethical clearance was obtained as per University requirements (see Appendix 3); however further ethical clearance was required for conducting interviews in healthcare facilities from the Health Ethics committee. This was approved on the provision that permission letters were obtained from the healthcare facilities.

All participants in the study were informed prior to the interview that their participation was voluntary and were given the right of refusal to answer any question(s) and to take part in the study. Confidentiality and anonymity were assured. Permission to conduct research at the three health clinics was obtained from management. Informed consent was obtained both verbally and through signed informed consent forms (PICD 2).

#### **4.11 Limitations**

In a qualitative study, the results are context specific and generalisations are not possible, thus the context for this study is EHR in SA. Moreover, the study was limited to one region (Gauteng) due to limitations of geographic accessibility of the researcher and generalisation to the whole country is therefore not possible. Gaining ethical clearance to conduct interviews at all the primary healthcare clinics was not possible due to time constraints, therefore the researcher had focused on three non-governmental organisation (NGO) clinics. For wider coverage of data, more researchers and time are required for data collection.

The primary objective of qualitative research was to let participants express their feelings regarding any existing EHR systems. There are 42 different EHR systems in the market, thus their comments could be attributable to a specific EHR system at use in their clinic, which cannot be generalisable to all EHR systems. The generality of the results had to be restricted to these EHR systems.

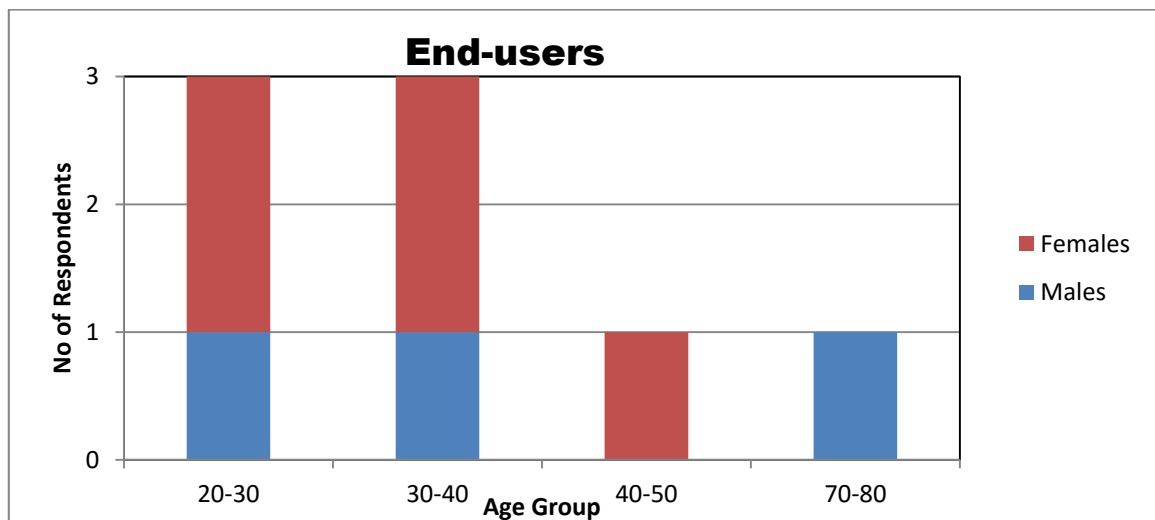
## CHAPTER 5: RESULTS

### 5.1 Introduction

The previous chapter explained the methodology used to explore the perceptions of two focus groups, namely end-users and SMEs, in order to establish answers to the research questions outlined in Chapter 3, namely the factors that affect adoption of HIT; the best practices for implementation; as well as the benefits that can be attained from a fully integrated EHR. This chapter will present the findings extracted from the 16 interviews conducted.

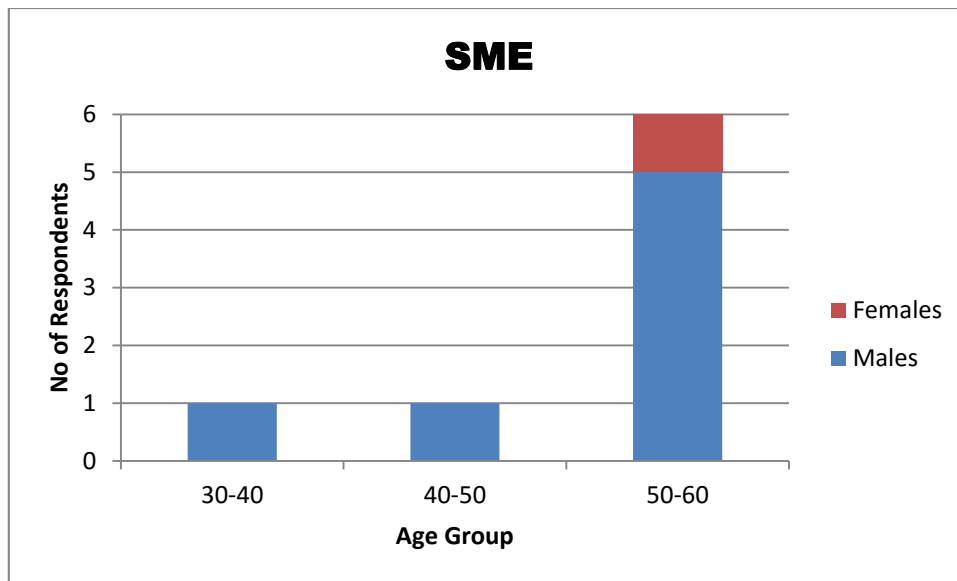
Respondents were a mix of males and females and ranged in age from 21 to 50+ years. The 16 respondents comprised eight end-users, one of whom was also a subject matter expert and an additional eight subject matter experts. One interview was not audio recorded, but was included in the analysis as copious notes had been taken during the interview. The end-users who were interviewed included senior nursing staff, care givers, a pharmacist, a data capturer and clinical associates see figure 6 below.

**Figure 6 Graph to illustrate no of end-users per age group**



The subject matter experts included medical personnel, project managers, SMEs, managers, a CEO and administration staff. These respondents were all males and in various age groups, with the majority being in the 51 to 60 year age group (see figure 7).

**Figure 7: Graph to illustrate the number of Subject Matter Experts per Age Group**



## 5.2 Findings for Research Question 1

### **Research Question 1: What are the key enabling factors or benefits associated with EHR in primary healthcare?**

Enabling factors associated with EHR are considered to be any factor that provides benefits and any successes that are achieved through the use of EHR. Inhibiting factors associated with EHR are considered to be any factor that creates challenges and any failures that occur through the use of her, which will be covered in the adoption section (Research Question 2). The respondents identified a number of enablers and inhibitors to EHR, through their answers to various questions that were posed to them. These responses have been grouped into overall factors (see Table 2), which will be discussed.

**Table 1: Enablers and Inhibitors Associated with HIT**

<b>ENABLERS (Benefits and Successes)</b>	<b>INHIBITORS (Challenges and Failures)</b>
• Improved patient care	• Cost and time inhibitors
• Improved service delivery	• Resources and infrastructure
• Skills training	• Users
• Reporting	• Legislation
• Information availability	• Security

• Cost, time and resource efficiencies	• Functionality
• Structures and protocol	• Adoption
• IT function and support	

The enablers were grouped into distinct codes and Table 2 indicates the frequency counts for each of the reported benefits. The findings of research question one will be discussed in distinct themes as follows: benefits of EHR for government, for facilities, for users and patients

**Table 2: Benefits of EHR**

Rank	Enablers of EHR	Frequency
1	Service Delivery	46
2	Patient care	23
3	Information availability	22
4	Reporting	14
5	Cost and time efficiencies	13
6	Resource efficiency	1

### 5.2.1 Benefits of the HIT system for government

The HIT systems are beneficial in being able to draw reports from medical facilities which could assist the government in managing the funds they allocate to various public healthcare facilities. The reports can provide information on the efficiencies of various facilities and can compare across facilities or within departments in the facilities. The government can use the reports for analysis of various things within the facilities. They can be informed when deciding on fair allocation of resources, to establish if any facility is lacking in resources or underperforming, monitoring stock and ensuring patient care.

“They can pull lots of useful reports from the system and for follow up purposes. When people come in for research, there is all sorts of information we can pull out” (Respondent 1).

“In primary healthcare, there are multiple legislations that come into effect, depending on what type of sub-primary healthcare job you operate in; for example, if you are in the retirement industry, then the Old Persons’ Act comes into effect, which basically says you are supposed to look after your patients and do everything in your power to make sure they are looked after properly, including managing the health, giving them their pills at the right time, making sure their

wounds are treated and so forth; failure to do that means you as a director of that retirement home can go to jail” (Respondent 13).

“You can compare the different efficiency levels between different divisions, between different clinics, different provinces; you can actually evaluate also whether the protocols are adhered to because if there are protocols, then if you go to health records, you can see whether it goes according to the protocol, all sorts of things, it is quicker to use actually” (Respondent 14).

“I think the strength of system, and there are so many, the ultimate aim is to improve the quality of care by having readily available information just stored electronically for proving and reducing the burden on hospitals, the volume of people who are becoming adverse to drugs because they are on too many antibiotics. There are all these benefits, which reduce the strain on the government” (Respondent 7).

### 5.2.2 Benefits of HIT system for facility

The main benefit of HIT for the healthcare facility is seen to be that it can be used as a hospital management tool with numerous functions. The respondents indicate that HIT systems can assist with efficiency of admissions, discharges and billing, with financial records and stock control and with the monitoring of patient throughput in consulting rooms.

*“...the systems will mainly be used for admissions, discharge and billing”  
(Respondent 10);*

*“...if you look at the patient flow on the EMR, it takes less than a minute to register a client or a patient the first time, so it is very quick for registration....The consultancy room, if you look on your computer, you can see there are six people sitting outside the consultancy room. So that is why I am saying it is a clinical management system. It is something useful and this is probably what they like about the system” (Respondent 6).*

The HIT system is described as offering many operational efficiencies to the facility through producing reports that can be analysed to identify cost centres of the facility or where there are shortages of resources, for example. The system is also seen to



enable compliance for government in managing the operations of the facility. An additional benefit is believed to be that it offers patient records for legal liability cases.

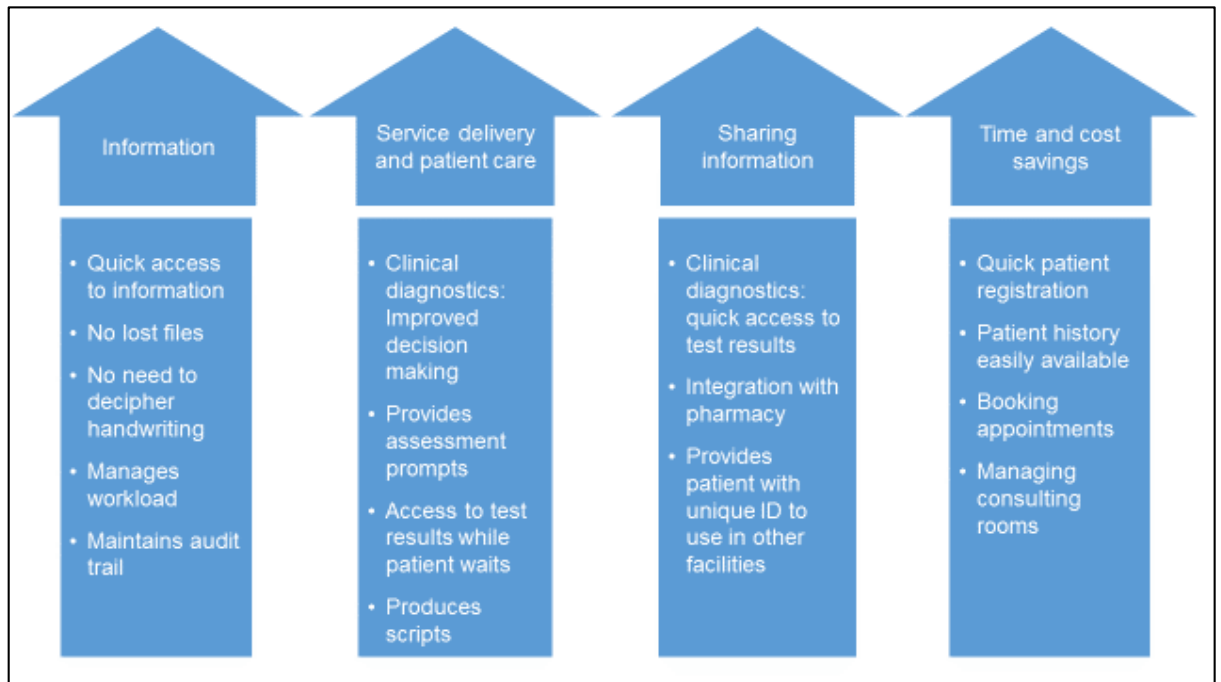
*“... so if your definition is strictly a clinical record then it is a tool to manage the clinical part of it, but if it is broader to include things like classification of diagnosis and billing information, financial information, then obviously it is different and you can use it in a wider sense” (Respondent 15).*

*“...a management system related to the whole operations of primary healthcare setting, so the operational efficiencies are straight forward, including continuity of care, compliance to both legislative as well as specialist if you like, so the actual facility rules and regulations as well as legal from a liability perspective to ensure that the patient was treated properly and it was done what was supposed to have been done and diagnosed correctly and so forth; so there are various elements that add an enormous benefit” (Respondent 13).*

### **5.2.3 Benefits of HIT system for users**

There are four main areas of benefits that the users of HIT systems could experience. These include benefits around information, service delivery and patient care, sharing of information, and time and cost savings (see Figure 8). These will each be discussed in turn.

**Figure 8: Benefits of HIT Systems for Users**



In terms of the benefits around information, the HIT system is described as providing a platform for easy access to information. The type of information that can be gathered is believed to be endless. For the healthcare workers, the information on patients would be hugely beneficial to have at their fingertips. It also ensures that there are no lost patient files as all the data is electronic and backed up, usually on the cloud.

*“I think the strength of system, there are so many, the ultimate aim is to improve the quality of care by having readily available information just stored electronically for proving and reducing the burden on hospitals” (Respondent 7).*

*“I have never lost anything permanently. That has been a huge advantage when it comes to lost files” (Respondent 1).*

*“...it stores the files, it stores them in the cloud, so even if your system would die, you would still have access to it if you go onto another system. It stores everything; you cannot lose patient files, as far as I know” (Respondent 9).*

Some users, such as nurses, find the HIT system to benefit them in gathering information because they do not have to try and decipher the handwriting of the

doctors. Respondent 4 states, *“I think it makes for accurate working, the system does not allow you to make mistakes, in the spelling of medication, in the abbreviation of medication. You do not have to decipher handwriting”*.

For the hospital management, the HIT system maintains an audit trail, which provides information to protect the facility and to identify any weaknesses in the operations of the facility such as training needs of the staff or excessive queues in a particular area. The audit trail is also seen to be beneficial in allowing one to go back and investigate any changes that were made. This is believed to be a useful tool for any legal matters pertaining to a patient’s care.

*“And we have a computer literacy training course that we run for them, that we do to strengthen there... So we keep a record of every health worker we train, what they were trained on, so that we keep an audit trail”* (Respondent 7).

*“In the audit trail function, they keep a record of the original values and the change to the values as well, so in the background the values that were put in in the past, will always be there, so you can actually go back and see what changes were made in this particular event”* (Respondent 12).

The users of the HIT system and the subject matter experts provide many examples of improved service delivery and patient care through use of the system. The improved service delivery aspects also result in time- and cost savings for the users and the facility. These savings will be discussed later in this section.

The clinical practitioners are able to improve service delivery to their patients through the use of the prompts in the system, which reminds them, which details to capture from the patient and what tests they should be performing. The clinical decision-making is also improved when the system is used as it provided guidelines for the carers when they are not sure what to do.

*“Because there are prompts, it improves things. Actually more than theoretically, things like it will not let you save it if you do not have height, weight, return date. By following the prompts, it improves service delivery. There are certain things that you simply cannot not do”* (Respondent 1).

*“If it was paper-based, you would write down what the patient needs to do, with this system we get an alert the minute you open it. There is no way that you can neglect something that needs to be done for the patient” (Respondent 3).*

*“And on the other side, it has a clinician’s portal where it has the latest updated guidelines for everything and you can just enter them in there. So when you are with a patient and you have absolutely no idea what you are supposed to do with this patient, then you can just go into the system and check what guidelines are there and what are the guidelines saying” (Respondent 9).*

*“...there is a theoretical possibility that they could be used for clinical facility-based information and decision support, but we do not see that happening very often” (Respondent 10).*

Since all the patient information is believed to be accessible easily and the history of the patient is available, certain functional processes can also be improved. An example is given in the pharmacy environment, where the pharmacists do not need to re-record chronic scripts because they can just ask the system to duplicate the previous information, resulting in the pharmacist being able to provide the patient with their medication far quicker. In addition, the script can be input into the system by the doctor and the pharmacy can access it and prepare the medication before the patient reaches the pharmacy for collection.

*“Previously, the culture has always been scripts manually written, so they write, enter and a script comes manually in the pharmacy, but it can also be an electronic thing that comes through, that we can pick up, that we can process, because if you have already captured a particular refill for the patient, you have captured it there, there is no need for us to be re-capturing the refill again, or just put instructions on there, literally it would take 5 minutes” (Respondent 11).*

This integration with the pharmacy is only one example of how the information is seen to be able to be shared among healthcare professionals. It is believed to benefit the pharmacy as the pharmacists save time because they do not need to duplicate work

previously done. The sharing of information could occur across varying functions, such as pathology and x-rays, amongst others.

*“So, a lot of people can have access to the same file at the same time. You never have to go looking for a file” (Respondent 9).*

*“Accessing results can be done during consultation, the patient does not have to go sit in another queue” (Respondent 2).*

Patient referrals are claimed to be made easier through the use of the HIT system. It is described as being useful in sharing information with other facilities so the patient history can be accessed by another healthcare practitioner when the patient goes to a different facility. The benefit for the user of the system is that they are aware of previous patient treatment and could treat the patient accordingly without re-assessing and re-diagnosing previous tests done for the patient.

*“Useful for when I am writing transfer letters to clinical physicians and it gives a list of illness history while the patient was here...which gives the vitals, the history, examination, any new diagnosis, prescriptions and then the plan. When we print it out, it prints out a summary” (Respondent 1).*

*“You can link information, if a patient has gone to Helen Joseph or if I refer a patient to Helen Joseph, the barcode assists Helen Joseph to track information. Patient care becomes better. There are patients that go to different institutions, it will be better if we have information on one system” (Respondent 1).*

The improved service delivery is also seen to be a function of the improved efficiencies that the HIT system brings to the facility, one being the hospital management element, as discussed previously, which results in time- and cost savings for the hospital and the staff.

As a result of the ease of access to information and the elimination or minimisation of paper files, the staff are not burdened with searching for patient records. There is far less duplication of work in the registering of patients because once they had registered once, their details are easily accessible and do not need to be re-recorded. Their

medical history and demographic profile are easily and quickly found on the HIT system.

*“We have an archive that is accessed quickly. Once a patient is registered, they stay registered. One does not have to go looking for the file” (Respondent 4).*

*“Previously, you had to look for the files...So here you know that even if they are still being seen by the clinical associate, you know that if you want the patient’s details, you just have to enter the patient’s surname and then it is going to be there...We have not had a situation whereby we have to open a new file for a patient because we lost the old one and I do not think that it is possible” (Respondent 9).*

*“So for example, if you register... if a patient comes back and scans his/her fingerprint or they give their ID number, you do not have to re-register that patient. The patient is already registered, so it comes up immediately” (Respondent 6).*

*“...you are going back, recall, duplicate whatever the patient got last time and then it saves time, as opposed to doing that same procedure again, re-write instructions, stickers, those kinds of things” (Respondent 11).*

The time that staff saves because they can access the information much more quickly, results in cost savings for the facility. They are also able to monitor and manage the consulting rooms more effectively so that time savings occur in the sense of knowing at all times how many patients are in the consulting rooms so that decisions can easily be made on how best to serve these customers. In addition, there are fewer requirements for printing any scripts or documents, which is also a cost saving.

*“It has decreased cost because we do not have a file and we are not printing, less paper” (Respondent 4).*

*“...there is a cost implication in integrating all the systems, but in the long run, the benefit will outweigh it, because whatever cost you would have spent, you would save time, because you are going to be more efficient” (Respondent 11).*

*“The consultancy room, if you look on your computer you can see there are six people sitting outside the consultancy room. So that is why I am saying it is a clinical management system. It is something useful and this is probably what they like about the system” (Respondent 6).*

#### **5.2.4 Benefits of HIT system for patients**

For patients, the HIT system is said to provide benefits similar to those it provides the users with, but from a different perspective. The HIT system assists the users to deliver quality service or patient care, within a quicker time frame. The patients therefore benefit from the better care and service they are receiving.

The amount of time a patient spends in a facility can be greatly reduced by the HIT, in numerous ways. Some of these have already been discussed as benefits for the users, but if the users save time, then generally patients also save time. The users mention that with HIT, the time to register patients is nullified because they only need to register the very first time and in follow-up visits, their details are readily available. Therefore, patients no longer have to wait for their files to be located and then to go through the whole process of providing all their details and medical history. This principle also applies to waiting times at the pharmacy because patients no longer have to wait for the pharmacy to capture the scripts and print stickers for chronic medication as they can just ask the system to duplicate the details from the previous script.

*“...but if you look at the patient flow on the EMR, it takes less than a minute to register a client or a patient the first time, so it is very quick for registration” (Respondent 6).*

*“This reduces waiting time for patients, while someone looks for their file. They can just print previous notes for them” (Respondent 2).*

*“And it also reduces waiting times at the pharmacy because when you get there it can be issued already – you just pick up your paper bag and you leave” (Respondent 6).*

The healthcare practitioners are believed to be better equipped with the HIT, and to be able to provide improved patient care as a result of the ease of access to relevant information about the patient. The patient’s medical history and treatments are available for any doctor or nurse who is treating the patient. So, if there is a different

doctor on duty or if the patient goes to a different facility, there is more information available for the doctor to work with. This reduces the risk of incompatible medication being prescribed or of treatment being given that did not work in the past.

*“So, systems allow you to have far better, meaningful information, reporting is more accurate and ultimately improving patient experience” (Respondent 7).*

*“... certain patients have died in the name of secrets, HIV, a person does not want to tell you, you are my doctor, you are not on duty that day, somebody else is coming to work in your place, in the name of patient security – whatever –, patient confidentiality, patients have died. Because if we know that we can pick up something that the doctor has not picked up, that patient by the way, even with this kind of problem, there is also drug interactions, if you give this drug you cannot give that, drug compatibilities, you understand” (Respondent 14).*

*“But then another significant benefit from the Electronic Medical Record System is that, remember you have your community and your primary healthcare and your hospital links, so you can actually track a patient through all three levels of healthcare. So what it means is that if a doctor diagnoses a patient, let us say with diabetes, and the doctor put in a note in the Electronic Medical System and that patient then goes to the primary healthcare, then that nurse in the primary healthcare can actually see the notes the doctor has made” (Respondent 6).*

Interactions with the patients are also described as being made more efficient with the HIT systems. Before the patient even reaches the consulting rooms, the doctor can be notified of the patients’ name, medical history and details. This enables the doctors to greet the patients by name, but more importantly, they already know what the patient’s complaint is and if previous treatment has been given. This kind of interaction builds better relationships with the patients as the doctors can spend more time focusing on the patient as opposed to trying to read their file to gather information.

Coupled with the access to information in the consulting rooms, while the patients are with the doctors, test results can be accessed while the patient waits and if a referral is



required, the doctor can just print out a patient summary for the patient to take to the referral doctor.

*“Like I have mentioned, the waiting time.... once we get notified, we have tablets in our rooms, it is already on the server. So when you open it, there you can already see this patient that has come in complained of a sore throat, cough or whatever and you know the name, date of birth, age. So once you come into the room, you already know the person’s name, you greet them so it makes it much more personal than having to sit in front of the patient and trying to figure out what is going on in the file “(Respondent 8).*

*“Useful for when I am writing transfer letters to clinical physicians and it gives a list of illness history while the patient was here.... which gives the vitals, the history, examination, any new diagnosis, prescriptions and then the plan. When we print it out, it prints out a summary” (Respondent 1).*

*“Accessing results can be done during consultation; the patient does not have to go sit in another queue” (Respondent 2).*

The HIT system can also be used to send chronic condition patients reminders of appointments or medication needed. SMS services and email services with these reminders can be generated automatically so that the patient is cared for as and when they need a follow up appointment or new script.

*“It is intended that the system, in the case of chronic and antenatal in terms of due date, will send a reminder to the patient onto their cell phone” (Respondent 4).*

Patient confidentiality, although mentioned as a concern by a few respondents, is generally accepted to be better using the HIT system. Each user of the system requires a unique log-in and password, which can only be obtained once the user registers as a genuine healthcare practitioner. In addition, the respondents feel that paper files and records can be accessed easily by anybody, but with the HIT, individuals can only gain access to patient files that are relevant to the function they perform. One of the respondents also mentions that sometimes, it is more beneficial for the doctors to have access to the ‘confidential’ information as it may be relevant to their treatment plan.

This mostly relates to the stigma of patients with HIV, TB or the like, where some patients tend to hide their conditions.

*“... even the patient confidentiality...because of the computer, but in a book someone can come and open the book and check, so in a computer it is confidential because we open with a password and no one knows my password, it is my secret” (Respondent 5).*

*“It [confidentiality] is maintained as much as there is no patient file, possibly better than a patient file. A patient file, anybody in the clinic could access it. But on the system, you need a password and depending on who you are you get access to the clinical files. So some sections are limited to certain people” (Respondent 1).*

### 5.3 Findings for Research Question 2

#### **What are the barriers that impact on adoption of HIT?**

Research question 2 required that the respondents are asked their opinion regarding the key factors that impact adoption of EHR in South Africa. The results are used to develop themes, which are summarised below.

#### 5.3.1 The phases of adoption

Implementation of HIT systems involves a whole process of activities, according to the respondents. There are various phases that the process has to go through which were coded from pre-implementation to post adoption. These phases are iterative, meaning that it is sometimes necessary to go back one phase and start again. The phases and frequency counts are included in Table 3 below.

**Table 3: Phases of Adoption**

Facilitation of Adoption	Frequency
Pre-adoption	17
Pre-implementation	11
Identifying training needs	19
Prepare staff	2
Implement	1
Post-implementation support	8
Reporting and feedback	8

### 5.3.2 Pre-adoption phase

The pre-adoption phase involves building credibility and getting initial buy-in to the system. The respondents indicate that government first needs to tender, but that they do not necessarily know what they should tender for. Therefore, it is up to the implementers to build credibility and respect through showing the current functionality of the system.

*“For us to establish credibility, government has to tender.... With all respect, I think government does not necessarily have all the answers of what they want either. It is all work and learn. We all learn. So we tend to say okay, we will do it for free. We do a lot of our work initially for free...it costs us a lot of money – for free, but we have established such credibility and respect. We are admired for our tenacity, and we do it because we know with systems there can be an impact” (Respondent 7).*

Initially, the system is set up in a ‘nerve centre’, where national and district level are invited to watch demonstrations of a small system in action, followed by an opportunity to work with the system themselves and provide comments and suggestions so that the system can be adapted according to the needs. This is often done free of charge to encourage buy-in to the system without having an initial capital outlay. The nerve centre also allows for workshopping and experimenting and can be used for training of the healthcare workers.

*“...we have what we call a nerve centre. The nerve centre is where you actually have the whole Electronic Medical Records set-up on different computers. It is like...obviously just on a smaller scale in one room, like the EMR that we are going to implement, with all the different modules and so on. And then we have people there and we have a register where people can write comments, and we have posters and manuals and all that stuff. So if it is at national or district level, so this is not at facility level as such, we then get people to come and we present it obviously and demo it, but we also get people then to come and visit the nerve centre to play with the system and get to know it and then write comments in the registers so we can use those comments if there’s any value in it and actually make changes to accommodate them” (Respondent 6).*

*“...in the district or in a regional hospital, we set up a nerve centre, which is a replication of the system in its entirety so that the health workers can familiarise themselves with the overall application so that we can train them as well at the nerve centre” (Respondent 7).*

*“More and more workshops, more and more experimenting” (Respondent 14).*

According to Respondent 12, there are two classes of customers, those who are open to adoption versus those who feel that an electronic system will not work for them. The implementers have to try to show the benefits of the system through other means as well and *“so obviously there is the presentation”* (Respondent 13) to address the different types of customers.

*“That is one of the difficult ones, so you have two classes of customers, you get those who do not think a lot about it and are excited about an electronic filing system and then those who step back and think carefully about it, then decide this is not going to work for me, whereas for the ones who say they really like this and are going to give it a shot, the usage is good, so those are the two scenarios that we often pick up” (Respondent 12).*

Once the national and district levels have agreed to the acquisition of EHR, it is then necessary to get buy-in from the facility itself. An introductory meeting is set up where the government authorities will introduce the EMR system and the implementers will accompany them to demonstrate the system and introduce the nerve centre to the users.

*“So the next step then is actually an introductory meeting where you are not actually introducing the EMR, you get the people at either the district office or the national office to... and obviously you will accompany them to introduce the EMR and the implementation of it at the facilities” (Respondent 6).*

### 5.3.3 Pre-implementation phase

According to the respondents, a change management approach is required for successful implementation of the system. There are two elements of the change

management that need focus, one is the implementation of the infrastructure, hardware and system and the other is establishing ownership of the system from the users, the softer side. The soft issues are a challenging task within both the private practitioner's space and the public sector.

*“The whole change management process is something that we need to take full ownership of. In a private practitioner's space it is difficult to do that, the doctors make the decision and then fall in line. In public health, primary healthcare says it is driving the whole process the same, and moving onto the electronic system, why are we doing this, how is this going to change our lives, what do we need to do, what are the next steps. It is doing it from end to end, ensuring that there is success, otherwise we are doomed to failure...poor management, more importantly, they are not absolutely certain why they need to embark on this” (Respondent 12).*

*“Yes, we use a project management approach to all the activities that we roll out and project management is really a certain approach, certain steps that one follows to get to a certain end, but as far as that approach, change management is a step or a stream in the project management approach where one focuses on the elements of change management that are required and the change management is levels. On the one end it is more the facility and the hardware of the actual infrastructure that needs to be managed to change, where other side, the softer side is the hearts and minds of the people that must buy in and take ownership of the system because if they perceive it as just being imposed on them and there is no ownership taken, then you may have much greater resistance. And so throughout that facilitation you get the buy in and the ownership or taking of ownership by the end-users” (Respondent 15).*

Engaging the end-users in dialogue, listening to their needs, building relationships with them and developing trust are critical functions in the change management process, which could take a number of months to realise. Often, it is found that the end-users do not even know what they need because there is so much happening without any current systems in place.

*“So there is a dialogue usually with the matron, the head nurse or the managers with regard to the challenges they are facing” (Respondent 13).*

*“No, it is extremely challenging and fraught with potholes along the way... But it takes time to build that confidence and that trust” (Respondent 7).*

*“One of the important ways to discern that is to actually listen to the potential end-users’ needs... so it would be, to some extent, an advocate of the end-user and to help the end-user to adjudicate certain solutions and to see if the solutions are really the right solutions for this” (Respondent 15).*

Setting up of the infrastructure, hardware and software is a relatively easy task and according to Respondent 15, *“...to set up hardware and implement the software can almost be done overnight, it can be days or at most a couple of weeks”*.

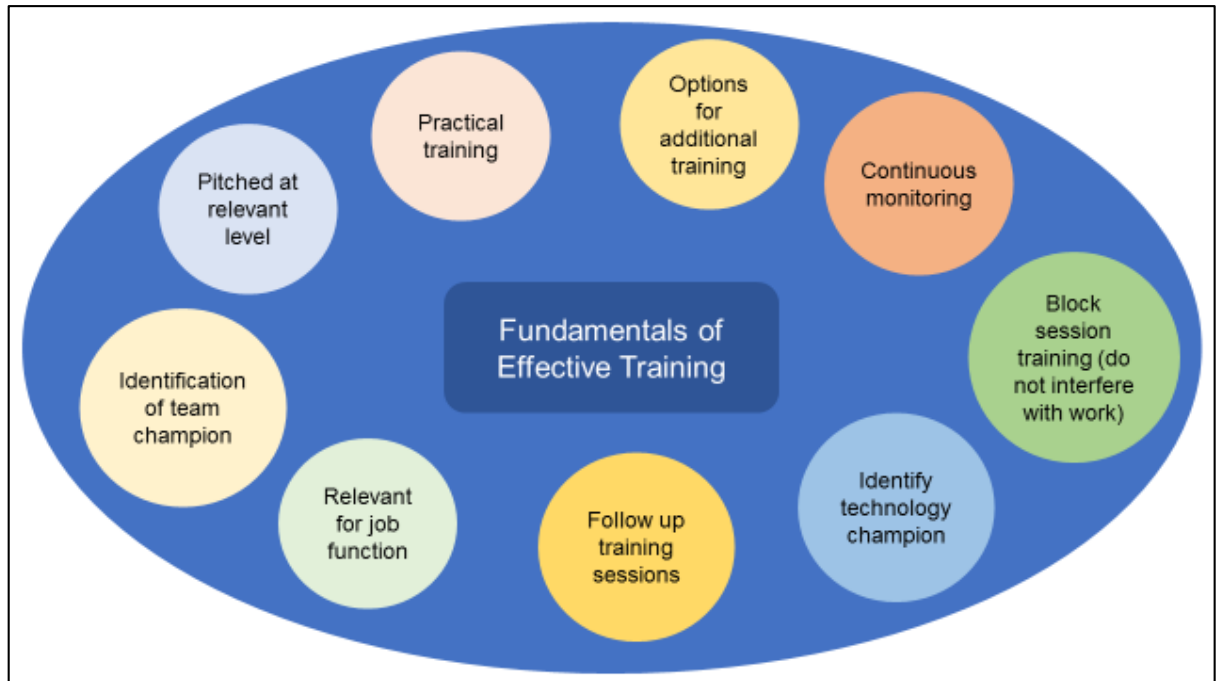
#### **5.3.4 Identify training needs**

It is prudent that before implementation of the system, the users are trained to use the system effectively. As such, it is necessary to identify the training needs of the staff and the resources required for efficiency. Basic computer literacy needs are addressed first, followed by training on the system. The system training is also conducted in two ways, the first being practical training where the trainer will take the users through the processes a number of times until they are able to do it themselves and they understand it. The second is online tutorials, which the users can do on their own and which takes their understanding and usage of the system to a higher level.

*“Training of the managers and all the users in the hospital. They first go through the basic computer literacy training and then the users’ training” (Respondent 6).*

*“There are typically two kinds of training, the one is hands-on, so a trainer will physically spend time with individuals and take them through the process and help them to repeatedly do the same set until they are familiar with it, and then we have short tutorials on the system, which once a person is reasonably comfortable using it and they want to learn more complex processes, electronic tutorials, like dummy cases built into the process, where they can then practice on a dummy case the more complex process, but you need the hands-on personal touch training, and then as a back-up online or electronic tutorials as the support mechanism” (Respondent 15).*

**Figure 9: Fundamentals of effective training**



There are some fundamentals that must be addressed during the training process (see figure 9). Firstly, the training must be relevant. There is no need to train more than what the user needs to know to effectively use the system. Some users may have no computer literacy and others may have extensive computer experience, so this needs to be identified to address the training at the right level for those being trained.

*“...so it is also the teaching of it in a way that is understandable and relevant, so there is no point in me teaching you about computer programming, you see the button what type of click it needs, go to that level, so double click, opens, you see now what does that record mean and use it from healthcare jargon, they will understand it immediately” (Respondent 13).*

*“...the extent of the training depends on the extent of the inherent abilities of that team. So in some cases the team do not even know where to switch on the computer, the training can take months, but if they are reasonably adapted to technology in general, the training may be much shorter” (Respondent 15).*



During the training process, champions of the system need to be identified. Firstly, within a group, the quickest learner must be identified and encouraged so that they can become the team champion and can teach and assist the others. From all the people being trained, it may be easy to identify someone who has a passion for technology and who understands or wants to learn more about the technology. This person can be appointed as the technology champion. In some instances, there may a user who is disruptive and does not believe in the system. The negativity that this person could instil in the other users can be limited or eradicated by allocating this person as a leader and champion of the system, thereby encouraging them to adopt the system.

*“...and then starting to maybe break it down into smaller groups and saying, ‘right, those three nurses always work together, who is the fastest learner of the three, let us focus attention to that one, all three, but that one particularly and that one will teach the other two” (Respondent 13).*

*“Train the trainer, I will train you, but you must once you are trained, you are then trainers yourselves, but you must know it” (Respondent 14).*

*“...this is a strategy we have learnt over the years as well, find somebody who loves technology on site, who is one of their team” (Respondent 13).*

*“That is one of the things [to identify a leader] especially the rebellious one, the rebellious one, they identify him, but in style” (Respondent 14).*

The training also needs to happen in sessions that minimise the impact on the user’s usual job. Usually, block sessions are effective where the consultations can still happen during the day as the users will only be tied up for a short training session each day. After an extensive two-week training programme, the consultants either remain on site for about a month or visit for regular follow up sessions. The head nurse also constantly monitors the use of the system and the correct usage of the system. This leads into the fact that after implementation, constant monitoring of the system will improve efficiencies and reports and evaluations can be presented.

*“I would come to you and say to you, you are a nurse, what is your practice, you do not do medicines, there is no point in teaching you that, let me teach you what you are interested in and usually can take between 30 minutes and an hour and a half and that time is usually found because once I have*



*done the rounds, or somebody can call by doing those rounds, we do not teach the whole staff in one and a half hours, we take it in blocks” (Respondent 13).*

*“I guess we probably have our approach, and that is the two-weeks preparation and training and go-live and then hand-holding and then moving away and providing more ad hoc support on request or make monthly visits or so. That is the approach” (Respondent 6).*

*“...but it is [monitoring] actually daily by the head nurse because she sees the records, now if she has got five nurses seeing patients every day and four of them have 12 appointments every day constantly and the one has one appointment every day, you can go to her and say what is going on, are you having problem cases?” (Respondent 13).*

### **5.3.5 Prepare staff and implement**

According to Respondent 6, *“...there is a two-week preparation first, where you set up the system, you train the users, and you do the basic computer training and also where you sort of tell the community about it, you know, radio talks and stuff. Then there is a specific go-live date”*. Respondent 14 agrees that it, *“...takes some time, there is investment, they must invest time, if you do not invest time on training, then your work is going to come out crappy”*.

During this period, the staff must also be alerted to any difficulties they may experience with the system and be advised that these challenges should dissipate in time as they learn more about the usage of the system and the system is adjusted to cater for their needs.

*“The move from paper to electronic is a difficult road, it is not easy and there are more failures than successes, so it is absolutely vital to manage these things, to plan effectively with a group of practitioners we have met, embarking on this project, to advise them and their staff well in advance of how this thing will pan out from when you use the system, the difficulty you are going to have, the frustration that you will have, to ensure that they are well prepared and that once they go through the pain, it becomes easier for them to use, so there are all sorts of preparation in terms of, from a change management perspective, to ensure that end-users effectively move across to electronic patient records” (Respondent 12).*

After all the training has been completed, the hardware and software has been set up, the systems are implemented, and the public has been informed, it is beneficial to have a launch day when the system goes live. This encourages further buy-in from the users, but creates an excitement for the patients who should benefit from the system.

*“The morning it is a big deal – people standing in front, hand out small little things to say ‘do not be scared’, whatever, just to explain it. So it is a big event to go live” (Respondent 6).*

### 5.3.6 Post implementation

The post implementation phase is a stage of monitoring, making changes if necessary and ensuring that staff have assistance readily available when and if required. The implementers will ensure that a consultant is on site for about a month, which will slowly taper off to where they will only come in for ad hoc queries. This period is also an ideal opportunity for relationship building and making the users own the system.

*“And then there is a month of hand-holding, where you have somebody on-site sort of nursing them through all the hiccups, and then after that it is more ad hoc reports” (Respondent 6).*

*“The first part is we have what I would call troops on the ground; we have people on the ground who are there to... and not all of them are technical – we have social workers working for us, so they are good with people. They are people-people. Their job is to work closely with these facilities, to nurture the relationships, turn it into an ‘our project’ rather than it is ‘your’ project. When I say yours and them looking at us and saying it is a VIP project. So the first part is, we are very operational. Operations are strong” (Respondent 7).*

Constant monitoring and reporting enables the implementers to assess if any adjustments are required to the system. The implementers can then make these adjustments as necessary. During this time, they also meet regularly with government and build their relationships with them. They maintain transparency of system failures and successes so that they can then adapt the system or the requirements in a partnership relationship.

*“The second part is, we are very aware of the need to consult at management level, so district, province – we have regular meetings, we have regular interaction, we have reporting, we work in a manner that if we do not put that effort in it will fail and internally within the government...and it is how we communicate, it is how we share information through a very transparent way; where the system is failing, we are transparent about that, where there are challenges, we are transparent about that because if you start hiding things and you are found out, you are doomed. So, we work in a very open and transparent manner, which I think has worked very well in our favour” (Respondent 7).*

### **5.3.7 Reporting and feedback**

The final phase is a reporting and feedback phase. This phase is beneficial to all stakeholders. For the implementers, it provides opportunities to understand how the system is being perceived, used and what changes are required. For government, it is an opportunity to obtain reports on what is happening in the clinics, and for the end-users, it is also an opportunity to monitor and evaluate themselves and the system.

*“By providing high quality information that helps them in their work.... I think by strengthening data use and providing information to the making information accessible at facility level” (Respondent 10).*

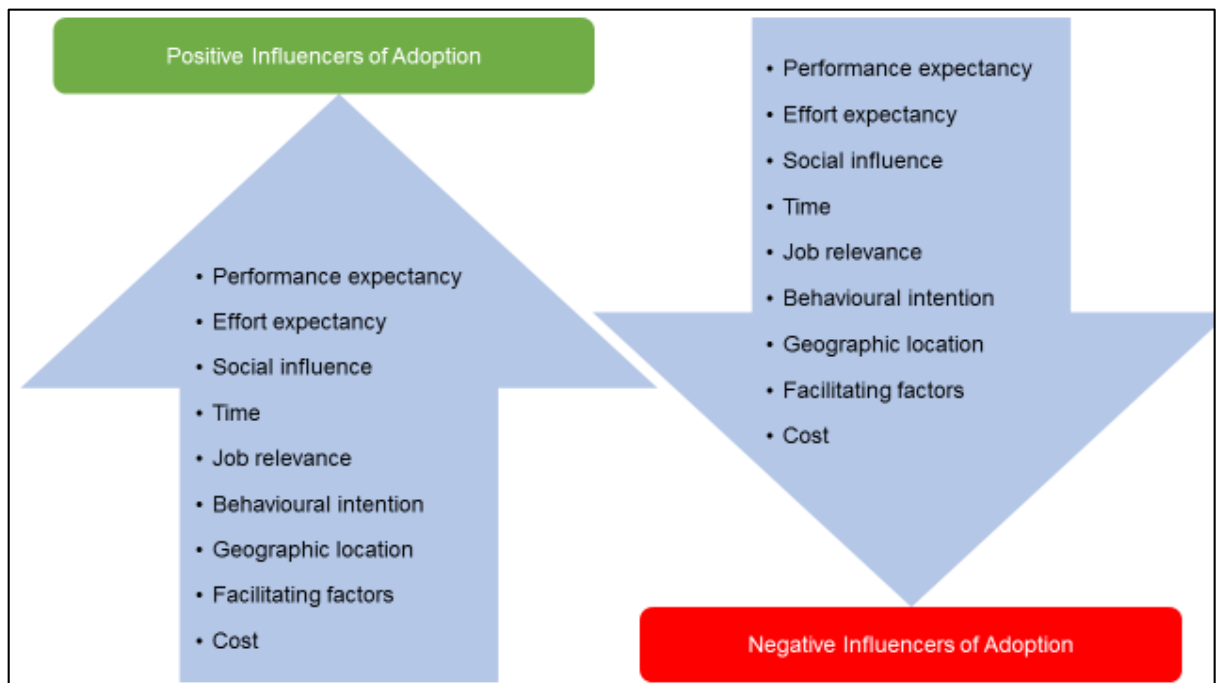
*“It is part of the process we are going through now in terms of introducing more... I do not want to use the word ‘formal’... better ways of monitoring and the reasons why, if they are not using it, why are they not using the system? So it is part of the SurveyMonkey approach. And the system will prompt them. If the system was down, why do you not use the system? What was the reason that you did not use it? So we are prompting them the whole time to keep feeding in to us.... and the donors are very interested in that, the donors want to know these answers – what was the effectiveness, what was the impact if they were not involved with the system? It is no good to get back to the facility in a month and there is no data captured. We have to know that these things are what they need to be” (Respondent 7).*

*“We interface data information from the EMR into the DHIS. That is a very important outcome, otherwise we have duplication of entry again –*

*aggregated data, but we capture it through... you know, the phase... we are rolling out” (Respondent 7).*

The interview respondents provide different views on the factors that affect the adoption of an EHR. Figure 10 indicates all the factors that are mentioned as positively influencing the adoption and all the factors that are mentioned as being negative influencers of adoption. The positive and negative factors as mentioned by the respondents are the same, just either seen as delivering to positive expectations or not delivering/delivering negative expectations.

**Figure 10: Positive and Negative Influencers of Adoption**



The overlap is a result of differing perceptions of elements within each of the factors that could affect the adoption of the EHR systems. In other words, one factor could be found to be positive by some respondents and the same factor could be seen as negative by other respondents due to the fact that each respondent identifies with the factor in a different way.

The respondents were asked to rank the top three positive factors and the top three negative factors affecting the adoption of EHR from their relative perspectives. The number of respondents who ranked each factor first, second or third are recorded in Table 5 and Table 6 below. By applying weightings to the factors according to the ranked position of each factor for each respondent, and then dividing by the number of

respondents (n=9), an overall strength of effect was calculated. The overall strength of effect was then ranked from strongest to weakest.

The weightings that were applied were as follows:

- First mention or top rank (A) = weighting of 3;
- Second mention or ranked second (B) = weighting of 2;
- Third mention or ranked last (C) = weighting of 1.

The overall strength of effect was calculated as follows:

$$\text{Strength of effect} = \sum \left( \frac{(A \times 3) + (B \times 2) + (C \times 1)}{n} \right)$$

Table 4 below indicates the ranking, overall strength of effect and overall ranking for the positive factors effecting adoption of the system. Table 5 below indicates the ranking, overall strength of effect and overall ranking for the negative factors effecting adoption of the system. The overall strength of effect for both the positive and the negative factors are then plotted on a graph for comparison (see Figure 11).

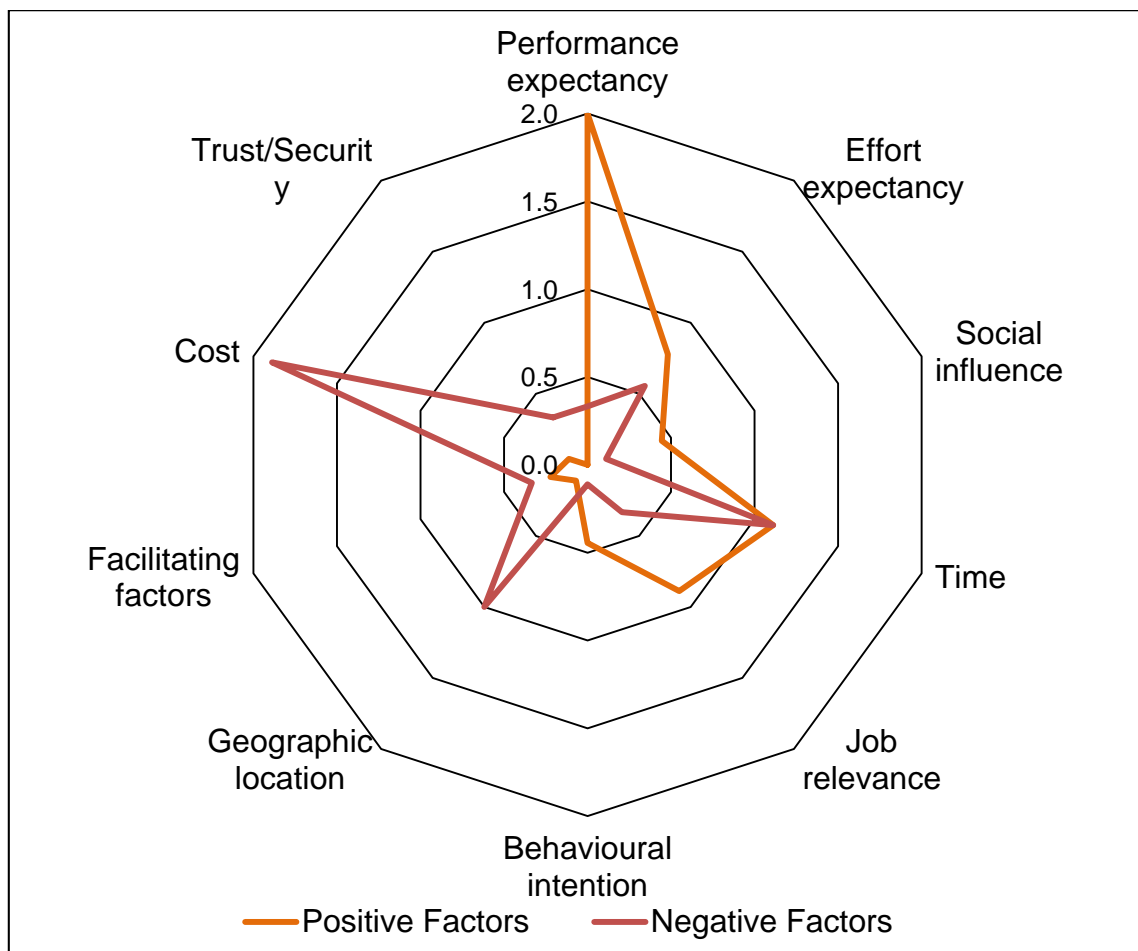
**Table 4: Positive Factors Effecting Adoption**

Positive Factors in Adoption (n=9)	Number of 1st mentions	Number of 2nd mentions	Number of 3rd mentions	Overall Strength of effect	Overall Ranking
Performance expectancy	4	3	0	2,0	1
Time	2	1	2	1,1	2
Job relevance	2	0	2	0,9	3
Effort expectancy	0	3	1	0,8	4
Social influence	0	2	0	0,4	5
Behavioural intention	1	0	1	0,4	5
Facilitating factors	0	1	0	0,2	6
Geographic location	0	0	1	0,1	7
Cost	0	0	1	0,1	7

**Table 5: Negative Factors Effecting Adoption**

Negative Factors in Adoption (n=9)	Number of 1st mentions	Number of 2nd mentions	Number of 3rd mentions	Overall Strength of effect	Overall Ranking
Cost	4	2	1	1,9	1
Time	3	0	1	1,1	2
Geographic location	0	3	3	1,0	3
Effort expectancy	0	2	1	0,6	4
Facilitating factors	0	1	1	0,3	5
Performance expectancy	1	0	0	0,3	5
Job relevance	0	1	1	0,3	5
Trust/Security	1	0	0	0,3	6
Social influence	0	0	1	0,1	7
Behavioural intention	0	0	1	0,1	7

**Figure 11: Comparison of the Strength of Positive and Negative Effects on Adoption of EHR**



From the spider graph in Figure 11, it becomes more apparent what the overall effect of each of the factors has on the adoption of EHR. Cost and geographic location are factors that overall have a negative effect on the adoption of the system; and performance expectancy has an overall positive effect on adoption.

### 5.3.8 The effect of costs on the adoption of Electronic Health Records

Costs were found to have a negative effect on the adoption of the electronic system when the start-up costs, the cost of owning the system and the costs of training are considered. On the other hand, the efficiencies that the system can create would lead to cost savings through increasing productivity and better control and governance of resources. Comments relating to the costs being a negative influencer of adoption include:

*“To just start up with all of the things you need to go electronic, like the laptops, or whatever you are going to use, I think it is quite an expensive thing to do at first” (Respondent 7).*

*“So negatively it would be cost....I would put 1 for cost, because these systems they do not come cheap” (Respondent 10).*

*“Yes, cost of ownership, we did the exercise, especially at the University of Pretoria, and the simple solution over a 5-year period, it is nothing under R800 000-R900 000 just for cost of ownership, that is really just maintenance and support and that is a small number of users as well, so the cost is huge” (Respondent 11).*

*“Cost is an issue, again the hardware is expensive, the software to run is a cost factor, if you bring hardware into a facility and you have to upgrade the security, both the physical security and the people security, otherwise the stuff just gets stolen, so the cost is not just the software of the technology, the cost is a whole infrastructure around it to get it in place and to protect it and make sure that it actually stays there where it should be, and if there is not a specific budget for it, then it is not going to happen” (Respondent 14).*

*“I am torn between on the cost side, so it is not the cost of the actual machine, but the cost of teaching people how to use it, training and the likes” (Respondent 12).*

Comments relating to the costs being a positive influencer of adoption include:

*“Drugs for example, you know, it costs the state a fortune, especially chronic, and you know, they run out of stock, they over-stock – it is just*

*complete inefficiencies and it is just down to bad practice and the practice in our minds is centred around the fact that there is not that governance, using systems where you can have a paper, literally a paper trail, but with an electronic system” (Respondent 6).*

*“The hope is that you would drive cost down by not repeating tests, by treating people more effectively and essentially on a very high level is improving the health of the nation and therefore increasing productivity and that sort of thing” (Respondent 9).*

### **5.3.9 The effect of time in the adoption of Electronic Health Records**

The time required for the training of people to use the system, and the time available to use the system are seen as detractors to adoption as well. The medical staff who would make use of the system have large workloads and are not willing to put aside a lot of time for training. In addition, if the internet connection is seen to be slow, patients are forced to wait for the system to work.

*“The problem is sitting, the staff do not have time, they are already overwhelmed just doing their day-to-day tasks, so there is very little time in their lives to adopt and get to grasp with new technology....there is literally no time for them to spend to learn those things, so they just leave them nicely and they carry on with work as normal, of course there is just so much work, so I think time is in my mind the biggest thing, in the settings where there is an enormous workload, which is the most primary healthcare setting” (Respondent 14).*

*“I am going to put time as well, but this is the converse. This is where people do not have time to use the system because they are overburdened, overloaded” (Respondent 6).*

*“...because we need faster wireless routers and also you know the devices themselves, they need to work faster. So if it is slow, then the patients are going to get unruly and irritated” (Respondent 8).*

On the positive side, the respondents believe that the system can save time because it can increase efficiencies and productivity. However, this has never been measured and



will not be the case in the beginning while the users are still learning how to use the system effectively.

*“Here on positive, number one, I would make time...because often, it becomes the biggest thing that your time is always limited...If this is going to save you time, it means you will increase productivity, it would probably expand your capacity” (Respondent 10).*

*“...and then also efficiency, my personal experience is that it is much more efficient than having the paper” (Respondent 7).*

*“It saves time, but not in the beginning.... Yeah. So it saves time actually everywhere except at the consultancy room where the doctor is” (Respondent 5).*

#### **5.3.10 The effect of geographical location in the adoption of Electronic Health Records**

The geographic location of the healthcare facility is considered to be a positive or negative influencer on adoption, depending on where the facility was located. Generally, facilities in the urban areas would find it far easier to adopt an electronic system than those in rural areas. The barriers, especially in the rural areas, are centred on access to and reliability of electricity supply as well as access to and speed of internet connections. In addition, maintenance and service of the system are challenges in some rural areas where the ease of access to the clinics is limited due to the non-existence of road networks.

*“The big issue is that you need connectivity, right. Connectivity – you need a local area network within the facility. Some people are using wireless. I do not like wireless because the wireless story... And then the other one that is definitely a big problem is the electricity. Ideally, you would like to have a UPS and also a generator” (Respondent 6).*

*“...you could have power cuts, if they have not got generators, most likely to happen in those remote areas, then you will not be able to access the systems, so location I think does play a big role... I would go with*

*geographic location as well because it is far easier in urban areas” (Respondent 11).*

*“...and then negative, geographic location, not all primary healthcare facilities have an infrastructure to get internet connection, get all these things delivered to them, for instance in the Eastern Cape, there are gravel roads and you have to climb over hills and all that, so I think geographical location” (Respondent 7).*

### **5.3.11 The effect of behaviour or intention on the adoption of Electronic Health Records**

The attitude of the users towards using an electronic system is very important in the adoption of such a system. The respondents indicate that the adoption will be successful where there is enthusiasm from those who will be using the system. In order to build enthusiasm, the users need to understand what the benefits of the system will be to them.

*“I think that it is absolutely cardinal, if you have a person who is absolutely negative... they will continue to obstruct and to confuse and delay change, whereas if you have an enthusiastic person, even if they know nothing about it, but they enthusiastically embrace it, and they want to learn and they want to adopt, then you will have very quick adoption” (Respondent 15).*

The biggest challenge, therefore, is in understanding of who among the target group is resistant to the EHR and why this is the case. The respondents indicate that usually the doctors are the ones who do not want the system implemented. There is a lot of speculation around the reasons for this, including the perception that the doctors often have other jobs and do not spend enough time in the healthcare facility looking after patients, as they should be doing, so they do not want a system that will monitor their work.

Another speculation is that healthcare workers do not want to learn to type data as this is not relative to their roles.

*“We find a lot of people with that attitude when they are expected to do more than what they are employed to do. So they will say, but I was never employed to work this system” (Respondent 6).*

The electronic system is also seen to be obtrusive by some of the health practitioners. They feel that with the paper files, they are able to engage with the patient, while they are taking notes. Having a computer in front of them creates a barrier or distance between the doctor or nurse and the patient. In addition, there are some who are concerned about the security of the system and who will be able to access patient records.

*“So, the biggest challenge obviously is getting the doctor or nurse to move away from paper-based and there are some legitimate issues around that, they say I have got the patient records next to my desk, I have got the patient in front of me, how do you want me to do it and some people argue that computer screen is a bit intrusive, so if you are the patient and I am the doctor and you are telling me about your problems and I am doing this, from some doctors’ perspective that is intrusive and you are not engaging with your patient” (Respondent 12).*

*“There might be some older healthcare providers that feel that it is not appropriate for them to get all the electronic stuff and you know people have fears of people hacking in and getting their records and we have had a question like that from a patient, so feeling safe from people who hack stuff and those types of things, so yes, cost, geographic location and behavioural intention” (Respondent 7).*

*“I do not know what the right word is, but I would argue the first one is trust in the data, security if you like, not that there is a breach from the outside, but that the right person has a right level of access, you do not want the receptionist to know the HIV status” (Respondent 12).*

### **5.3.12 The effect of facilitating conditions in the adoption of Electronic Health Records**

In order for the EHR to be adopted readily, consideration must be given to the facilitating factors for the healthcare facility. The system requires electricity to function.

Load shedding is seen as a problem as it will stop the healthcare practitioners from being able to work without electricity. Users of the system also need to be computer literate and know that they have an IT support structure. Facilities in outlying areas are generally harder to access and may have to wait a number of days for IT services. Lastly, the facility needs to provide adequate hardware so that each user has a computer and can work independently from other users.

*“You know, currently that is a big issue because of the electricity problems we have in South Africa and they realise that. I mean, people are really excited about the system when we put it in. They do use it, they definitely see the benefit, but then something happens like load shedding and they have lost... not lost data, but they cannot capture, so they do not know what to do now” (Respondent 6).*

*“It is things like establishing computer literacy” (Respondent 7).*

*“It plays a big role because remember, obviously you are trained in using medication, I have no training in IT, I learn those things through experience so meaning that if you do not have that support, you are not going to be able to conduct your work or even use it, only if someone from IT gives you that experience so that you can be able to carry on, so there has to be some degree of support otherwise it does not work” (Respondent 11).*

*“And then also, when there are problems with computers, because it is computers, you know, hardware. IT support does not really exist within the public health sector, so you have people that may be desperately will, but I mean, cities are so all over the place and it is difficult. It takes time for somebody to come and fix your computer” (Respondent 6).*

*“Yes, a nurse wants to, a nurse who does homecare, who wants to use electronic healthcare records has to use a laptop, so that laptop has to be provided, so if you do not provide the laptop there is no way that person can use it, hence I do not know if there can be a no answer, so the answer is yes, you need to know that there is a drive towards offering infrastructure, or make sure that the infrastructure is available otherwise you cannot use it” (Respondent 13).*

### 5.3.13 The effect of social influence on the adoption of Electronic Health Records

There are mixed feelings about the effect of social influences on the adoption of the system. It is clear that peer pressure drives adoption, but as much as it drives adoption, it can also hinder adoption. There are those groups that will take up the electronic system with open arms and drive it, and there are those that will sit back and watch what happens. The early adopters will be the guinea pigs for the others who will only consider the system once they have seen the benefits of it in use. From the public's perspective, the community will react to the system as a reflection of how the healthcare practitioners embrace it. They trust their local nurses and doctors and will not accept the system if these people do not show favour towards it.

*“In most situations, the adopters will drive usage, and I am not sure, but I think it has to do with the various role players and interest groups within that healthcare space that has prevented early adopters from driving the usage of this” (Respondent 12).*

*“Because I think people tend to adopt systems in that way, so especially I think new technologies, people do not want to invest their own time in something that everyone has had experience of things that are hard to learn and which subsequently become discontinued or no longer used, so I think people before they devote time to learning a new technology, not just technology, but any number of things, they first look around what others are doing and if other people are using it, then that is a good sign that it is going to be worth the effort” (Respondent 10).*

*“Now the date that you go live, the local staff are the ones actually doing all the typing. So you do not have any outsiders and the community trust the local staff obviously. So they know that if the local staff, the people that they know well, that sort of live in the same area where they live, if they... I just think so” (Respondent 6).*

## 5.4 Findings for Research Question 3

### **Research Question 3: How can the use of an integrated HIT network be beneficial to primary healthcare in SA?**

The respondents provide their opinions on the benefits of HIT systems for the users of the system, the healthcare facilities, the patients and even government. Numerous benefits are discussed, indicating that HIT systems are beneficial for the healthcare

industry. An integrated HIT network would link all healthcare facilities in the country to each other.

It can be postulated that by linking all healthcare facilities to each other that the benefits already perceived to occur with HIT systems, would still apply, but to a larger degree. This implies that improved patient care and service delivery, cost savings, time efficiencies and the sharing of information would all become even bigger benefits.

*“[HIT] should improve the patient experience. So you should see patients with smiles. So if you have to draw a picture I would say a hospital full of staff and patients all smiling – that is sort of what I see...it should improve the quality of care” (Respondent 6).*

*“I think the demographics, I think the details of the encounter, like the date and time, etc., the chief complaints, the details of the diagnosis, perhaps a coding system, that will facilitate coding to NHI standards, providing lab results, the ability to generate or to interface with the pharmacy system, scheduling of follow-up visits and appointments, and generating alerts and reminders” (Respondent 10).*

For government, the access to information on an aggregated level would be beneficial for monitoring and control of healthcare services. It would provide details on the throughput of patients and the occurrences of diseases. It would allow government to monitor the efficiencies of the various facilities and would alert government to any trends in the public health that may need further attention. With the aggregated data and reports, government will be able to plan resources for the existing facilities, in the most effective manner. In addition, new facilities may be needed to address the size of the population and the reporting from the system will provide relevant information for government to make the right decisions on where to place these facilities and resources.

*“So, all the data that the boss wants at the district office will automatically come from the EMR system” (Respondent 6).*

*“...down the line, one of the advantages of having the information electronically is to do research so to have the data and the accessible database, where one can actually look at large populations and look at*

*certain things that happened to that population for research purposes, so it is that accessibility of the data in terms of groups and not only of the individual, because it is one thing to have individual-based records, but then that information must also be able to be looked at as far as the population” (Respondent 15).*

*“...it is going to be an indication of patterns and trends and how many people die” (Respondent 10).*

Besides being able to plan better, the integrated IT system would allow for better monitoring and control of facilities. Through trending data, government can assess if there are underperforming facilities that require further investigation. These facilities may be in need of additional resources or new additions. However, with an integrated HIT system, cost and time efficiencies should occur so all facilities should be able to service more customers than before.

*“Yes, I think it is important to understand what is the definition or what definition do you attach to electronic patient records, is it only the clinical record or is it the whole record including financial information and other information, which then of course has other benefits if you can allocate financial values to certain diagnoses and so on, so if your definition is strictly a clinical record, then it is a tool to manage the clinical part of it, but if it is broader to include things like classification of diagnosis and billing information, financial information, then obviously it is different and you can use it in a wider sense” (Respondent 15).*

Stock management and control is another advantage of an integrated system. The reports will indicate where the facilities are short stocked to address this for the benefit of the patients. The management of stock, such as medication, will also ensure that the usage of medication is not abused.

*“...capturing aggregate data for facility management from a national level” (Respondent 10).*

In essence, an integrated HIT system will improve patient care, with the ability to put more patients through the facilities due to time efficiencies, and to supply additional resources due to cost savings.

## 5.5 Conclusion

The findings of the research have shown that there can be no doubt to the many actual and perceived benefits of an EHR system. These systems are able to bring about efficiencies, improved service delivery, effective hospital management, shared information, and reports required as per legislation. An integrated EHR system can contribute not only operationally, but also to the administration and management of healthcare facilities, which would inflate these benefits for all stakeholders. The challenges, however, need to be addressed if an HIT system is to be successful. The process of effective implementation of an HIT system should address all challenges through a stepped process from development of the software to final implementation. These challenges do not refer to the actual system alone, but also to the typical South African environment of load shedding, limited or slow access to the internet, widely dispersed rural facilities with poor road access, with the latter influencing potential challenges of technical support and continuity of the system.



## CHAPTER 6: DISCUSSION OF RESULTS

### 6.1 Introduction

The previous chapter presented the results from the research interviews based on three research questions derived from literature on the benefits and adoption of EHR. This chapter will discuss the findings in relation to previous research on the benefits and adoption of EHR.

Each of the three research questions tested was broadly supported by data, with certain themes and sub-themes emerging more strongly than others. The results were mostly concurrent with the literature, but did surface new findings. Each of the research questions will be discussed below with diagrams/tables to illustrate where the data overlapped and departed from previous research. At the end of the discussion, a descriptive model presenting an overview of the process to effective implementation of an integrated EHR system will be presented.

### 6.2 Discussion for Research Question 1

#### **What are the enabling factors or benefits associated with EHR?**

Enabling factors associated with HIT logically are seen to be any factor that provides benefits and any successes that are achieved through the use of HIT as well as the necessary resources that are needed. Inhibiting factors associated with HIT logically are seen to be any factor that creates challenges and any failures that occur through the use of HIT, with the major factor being adoption, which will be covered in research question 2.

#### 6.2.1 Key Benefits Associated with EHR

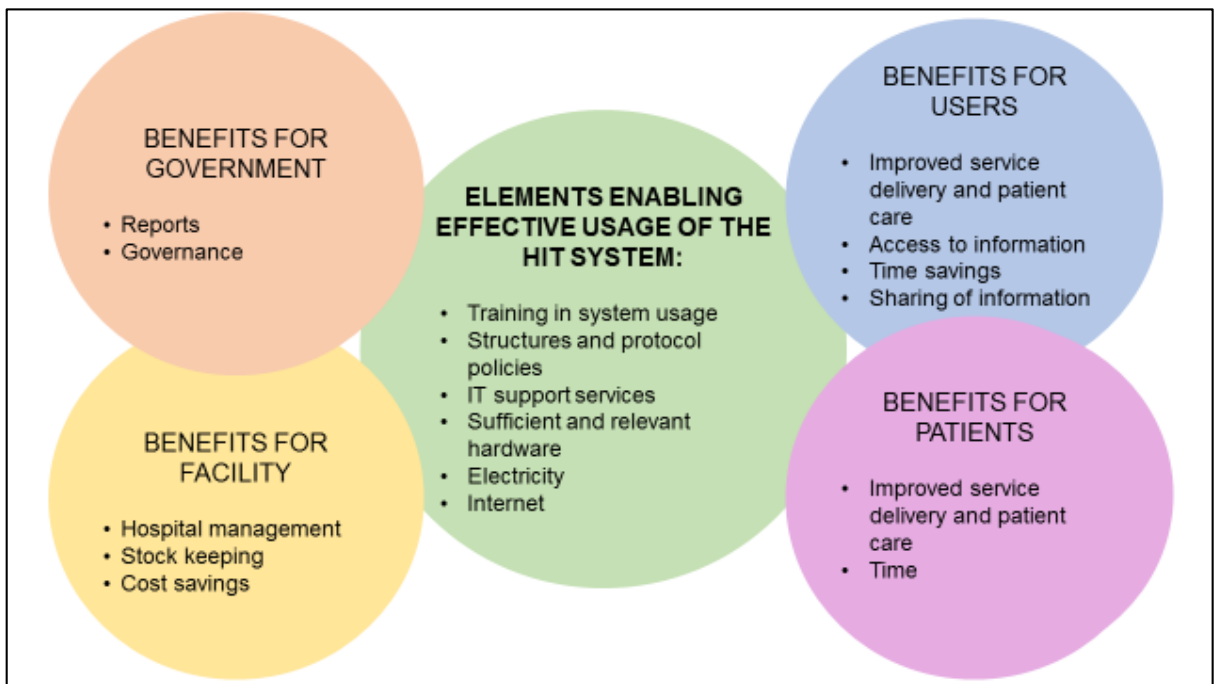
Freymann Fontenot, (2014) argued that the benefits of HIT are savings for patients, physicians, disease, community and the wider population. This is concurrent with the findings of the research as it has been categorised into benefits for government, for facilities, for end-users and for the patient. The transition to HIT, the paperless healthcare system facilitates the transformation of the patient ultimately into a healthier citizen incurring lower healthcare costs. This shows the cost-benefit to the patients. Furthermore electronic health records allow for better accessibility of patient records, which indicates the benefit to physicians. Noteworthy, with adoption of widespread technology in both the private and public sector, sharing of patient information between

healthcare workers becomes possible and allows for reductions in time spent and wasteful expenditure on unnecessary lab tests.

The data corroborates with Fontenot's literature (2014) associated with HIT. There were many benefits associated with using an HIT system and the success stories as a result of its usage. However, before an HIT can be used, a number of factors need to be addressed that will enable the effective usage of the system.

The benefits that enable the users to perform their functions better can be grouped into benefits for the different stakeholders. These include the benefits to government, the healthcare facility, the healthcare practitioners who use the system and ultimately the benefits for the patients see figure 12 below.

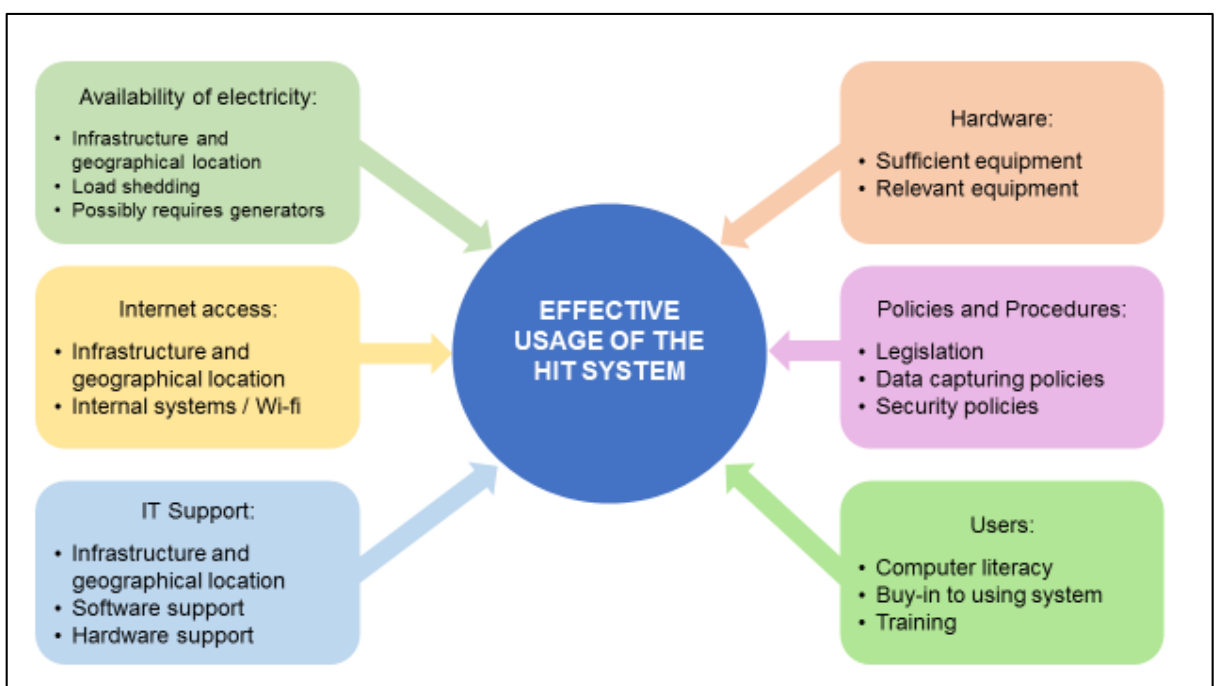
**Figure 12: Key enablers of Usage and Benefits of EHR System**



### 6.2.2 Elements enabling effective usage of an EHR system

Before a HIT system can be used effectively, it is imperative that all the elements that enable the usage of the system are addressed (see Figure 13). The system itself needs to be installed, resources need to be made available and the individuals who will be using the system must know how to use it, otherwise these may be seen as factors that impact adoption. However, EHR and technology initiatives should be introduced in an economically sustainable way that would not consume clinic resources that should go toward patient care (Salmon et al., 2013).

**Figure 13: Elements enabling effective usage of EHR system**



First and foremost, the facility that will be making use of the EHR system needs to be assessed for infrastructure challenges. The HIT system requires continuous access to electricity and the internet. If the facility is in a rural area, these infrastructure elements may not be accessible, despite the fact that particularly rural facilities would benefit most from such systems in the long run.

Coupled with the use of IT systems, it is vital that there is readily available IT support for the users. An IT help desk on site is helpful because it provides easy access to the IT people and issues, whether big or small, can be resolved quickly. For facilities in outlying areas, where there is no help desk, it could take a few days for an IT service provider to get there, causing severe downtimes and problems for users to access or update the system.

In terms of the software, the EHR system must be flexible so that changes can be made to the software, as needed by the users.

Policies and protocol for using the system and the hardware are highly important for the system to be efficient. These policies should provide clear standards and outline what has to be captured on the system, and how the system should be used and treated. The users play a large role in this and relevant and practical training of system usage will assist the users to use the equipment and system correctly. Basic computer literacy skills training may be required before training on the system is introduced.

### **6.2.2 Benefits of HIT System for Government**

The HIT systems are beneficial in being able to draw reports from medical facilities, which could assist government in managing the funds they allocate to various public healthcare facilities. The reports can provide information on the efficiencies of various facilities and can compare across facilities or within departments in the facilities. Government can use the reports for analysis of various aspects within the facilities, creating extra opportunities for governance measures, forecasts and other data. They can be informed when deciding on fair allocation of resources, to establish if any facility is lacking in resources or underperforming, monitoring stock and ensuring patient care. This is the premise proposed by Haskew et al. (2015), which is based on the assumption that the EHR is the cloud-based model of EHR that can provide access to anonymised data beyond the clinic level to inform decision-making, which plays a key role in socio-economic and organisational development as noted by Farias and Unb (2012).

### **6.2.3 Benefits of HIT system for facility**

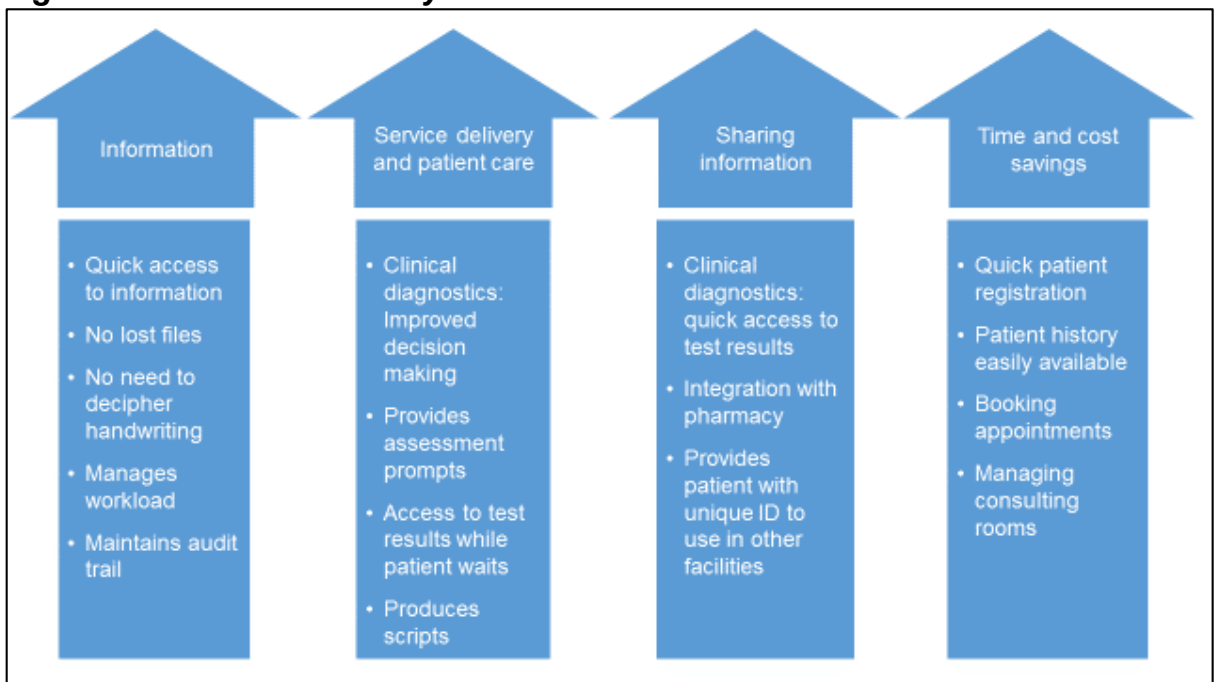
The main benefit of EHR for the healthcare facility is that it can be used as a hospital management tool with numerous functions. The respondents indicated that HIT systems can assist with efficiency of admissions, discharges and billing, financial records and stock control like a stock visibility solution for the pharmacy and with the monitoring of patient throughput in consulting rooms. This stock visibility solution has not been covered in the literature as an integral part of the EHR system and is thus a new finding that can be used to enhance the current functionalities of EHR systems. The other benefits were noted by Farias and Unb (2012) and Lee, Mccullough and Town (2013).

The EHR system offers operational efficiencies to the facility through producing reports that can be analysed to identify cost centres of the facility or where there are shortages of resources, for example. The system also enables compliance for government in managing the operations of the facility. An additional benefit is that it offers patient records for legal liability cases.

#### 6.2.4 Benefits of HIT system for users

There are four main areas of benefits that the users of HIT systems can experience. These include benefits around information, service delivery and patient care, sharing of information, and time and cost savings (see Figure 14). These will each be discussed in turn.

**Figure 14: Benefits of HIT Systems for Users**



The cloud-based model of EMR can provide access to anonymised data beyond the clinic level to inform decision-making (Haskew et al., 2015). In terms of the benefits around information, the HIT system provides a platform for easy access to information. The type of information that can be gathered is endless. For the healthcare workers, the information on patients is hugely beneficial to have at their fingertips. It also ensures that there are no lost patient files as all the data is electronic and backed up, usually on the cloud.

Some users, such as nurses, find the HIT system to benefit them in gathering information because they do not have to try and decipher the handwriting of the doctors. For the hospital management, the HIT system maintains an audit trail, which provides information to both protect the facility and identify any weaknesses in the operations of the facility, such as training needs of the staff or excessive queues in a particular area. The audit trail is also beneficial in allowing one to go back and investigate any changes that were made to data. This is a useful tool for any legal matters pertaining to a patient's care.

The users of the HIT system and the subject matter experts provided many examples of improved service delivery and patient care through the use of the system. The improved service delivery aspects result in time- and cost savings for the users and the facility. These savings will be discussed later in this section.

The clinical practitioners are able to improve service delivery to their patients through the use of the prompts in the system, which remind them what details to capture from the patient and what tests they should be performing. In addition, clinical decision-making is also improved when the system is used as it provides guidelines for the carers when they are not sure what to do.

Since all the patient information is easy accessible and the history of the patient is available, certain functional processes can also be improved. An example is in the pharmacy, where the pharmacist does not need to re-record chronic scripts because they can just ask the system to duplicate the previous information, resulting in the pharmacist being able to provide the patient with their medication far quicker. In addition, the script can be input into the system by the doctor and the pharmacy can access it and prepare the medication before the patient reaches the pharmacy for collection of the medication.

This integration with the pharmacy is only one example of how the information can be shared among healthcare professionals. To date, investments into eHealth made by the Department of Health have not created the desired 'network effect' due to lack of interoperability or compatibility between various IT systems (Kotze, 2014). However, the system benefits the pharmacy as they save time because they do not need to duplicate work previously done. The sharing of information can occur across varying functions, such as pathology and x-rays, amongst others.

Patient referrals are made easier through the use of the HIT system. It is also useful in sharing information with other facilities so the patient history can be accessed by another healthcare practitioner when the patient goes to a different facility. The benefit for the users of the system is that they are aware of previous patient treatment and can treat the patient accordingly without re-assessing and re-diagnosing previous tests done for the patient.

The improved service delivery is also a function of the improved efficiencies that the HIT system brings to the facility, one being the hospital management element, as discussed previously, which results in time- and cost savings for the hospital and the staff.

As a result of the ease of access to information and the elimination or minimisation of paper files, the staff are not burdened with searching for patient records. There is far less duplication of work in the registering of patients because once they have registered once, their details are accessible easily and do not need to be re-recorded. Their medical history and demographic profile are found easily and quickly on the HIT system.

The time that staff save because they can access the information much more quickly, results in cost savings for the facility. They are also able to monitor and manage the consulting rooms more effectively so that time savings occur in the sense of knowing at all times, how many patients are in the consulting rooms so that decisions can be made easily on how best to serve the patients. In addition, there are fewer requirements for printing, which is also a cost saving.

#### **6.2.5 Benefits of HIT system for patients**

For patients, the HIT system provides benefits similar to those it provides the users with, but from a different perspective. The HIT system assists the users to deliver quality service or patient care, within a quicker timeframe. Therefore, patients benefit from the improved care and service they are receiving. However, a quantifiable study would need to be conducted to measure if waiting times actually have been reduced.

The amount of time a patient spends in a facility can be greatly reduced by the HIT, in numerous ways. Some of these have been discussed as benefits for the users, but if the users save time, then generally patients also save time. The users mentioned that with HIT, the time to register patients is nullified because they only need to register the

first time and in follow up visits, their details are readily available. Therefore, patients no longer have to wait for their files to be located and then to go through the whole process of providing all their details and medical history again. This principle also applies to waiting times at the pharmacy because patients no longer have to wait for the pharmacy to capture the scripts and print stickers for chronic medication as they can just ask the system to duplicate the details from the previous script.

The healthcare practitioners are better equipped with the HIT, to provide improved patient care as a result of the ease of access to relevant information about the patient. The patient's medical and treatment history is available for any doctor or nurse that is treating the patient. So, if there is a different doctor on duty or if the patient goes to a different facility, there is ample information available for the doctor to work with. This reduces the risk of incompatible medication being prescribed or of a treatment being given that has not worked in the past.

Interactions with the patients can be made more efficient with the HIT systems. Coupled with the access to information in the consulting rooms, while the patients are with the doctors, test results can be accessed while the patient waits, which – assuming the EHR is integrated with pathology and if a referral is required – the practitioner can just print out a patient summary for the patient to take to the referral practitioner.

The HIT system can also be used to send chronic condition patients reminders of appointments or medication needed via SMS services and email services and these reminders can be automatically generated so that the patient is cared for as and when they need a follow-up appointment or new script. This becomes relevant for patients who are non-compliant with their medication and which has the potential to reduce the mortality and morbidity rates in SA.

Patient confidentiality, although mentioned as a concern by a few respondents, was generally accepted to be better using the HIT system. Each user of the system required a unique log-in and password, which can only be obtained once the user registers as a recognised healthcare practitioner. In addition, respondents felt that paper files and records could easily be accessed by anybody, but with the HIT, individuals can only gain access to patient files, which are relevant to the function they perform. It was also mentioned by one of the respondents that sometimes it is more beneficial for the doctors to have access to the 'confidential' information as it may be relevant to their



treatment plan. This mostly relates to the stigma of patients with HIV, TB or similar, where patients try to keep their conditions to themselves.

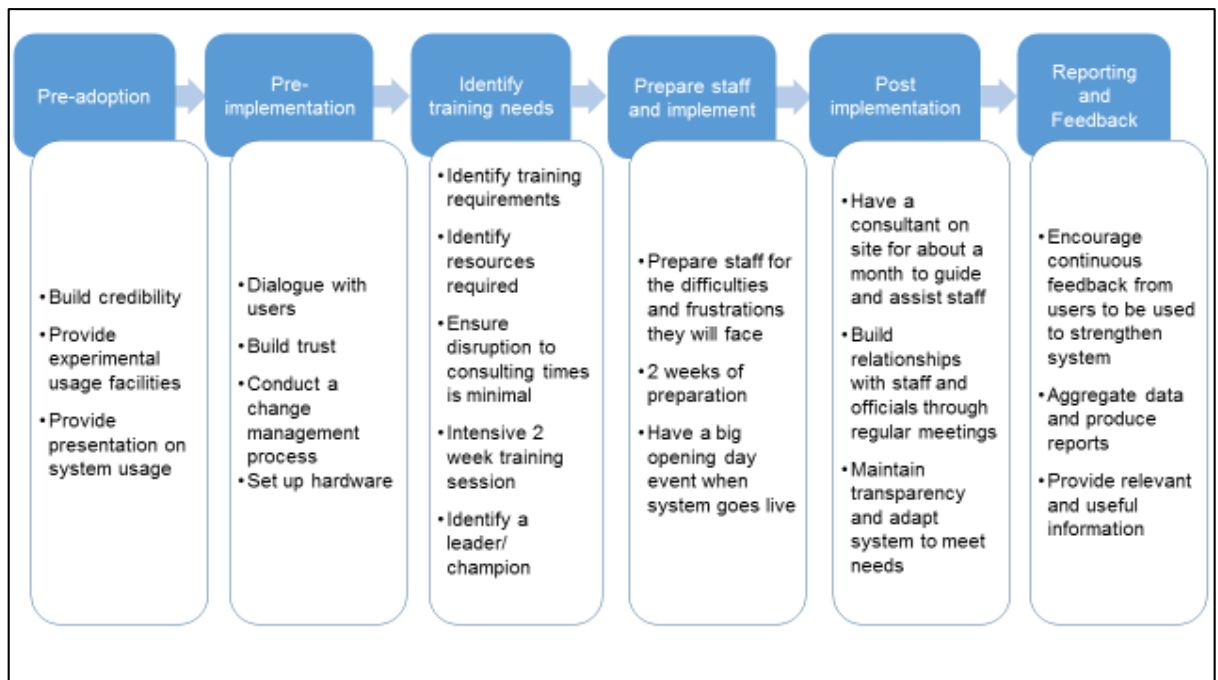
### 6.3 Discussion for Research Question 2

#### **What are the barriers that impact adoption of HIT?**

As discussed in Chapter 2, the contagion effect is the basis for EHR adoption. The underlying base in the contagion effect is the assumption that, at any time, all individuals in the network who are yet to adopt the technology are uniformly exposed to the same amount of influence from current adopters. In addition, absorptive and disseminative capacities are built upon the theory of knowledge transfer, whereby certain actors are more likely to adopt technologies because they have accumulated sufficient related knowledge or because their peers possess the capacity to impart related knowledge (Peng et al., 2014).

The data and literature are concurrent that EHR adoption is contingent not only on removing barriers, but addressing the change processes involved (McAlearney et al., 2015).

**Figure 15 The adoption process**



The above figure illustrates the adoption process derived from the interviews with SMEs. The data concurred broadly with the literature regarding change management

both at government level and a facility/institutional level. However, the literature pointed toward identifying so-called ‘problem children’ and the data points toward identifying champions for change. Some respondents believed that potentially disruptive or negative users (problem children?) be converted into champions, which would negate their disruptive intent – if conversion is successful. Doubtful or negative rumours related to the efficiency and adequacy of EHR should be dealt with timeously. Generally, the most powerful resisters who diligently work against you may become your best allies once they see the full spectrum of benefits that EHR may bring (Wu et al., 2010). A key point of difference to note was that the adoption framework was not a one-size-fits-all approach, as each facility had unique difficulties and obstacles to overcome.

The pre-adoption phase involves building credibility and getting initial buy-in to the system. The respondents indicated that government first needs to tender, but that they do not necessarily know what they should tender for and the lack of government-backed drive to implement health information technologies was cited in the literature review as a factor that impacts adoption (Mostert-Phipps et al., 2013). It is, therefore, up to the implementers to build credibility and respect through showing the current functionality of the system.

Once the national and district levels have agreed to the EHR, it is then necessary to get buy-in from the facility itself. An introductory meeting is set up where the government authorities will introduce the EMR system and the implementers will accompany them to demonstrate the system and introduce the nerve centre to the users. This was corroborated by (Kotze, 2014) on the Health National Standards Framework where SA is currently moving between stages I and II and thus efforts to create an enabling environment to make the case for eHealth, awareness and establishing a foundation for investment, workforce education and adoption of eHealth is a priority.

According to the respondents, a change management approach is required for successful implementation of the system. Engaging the end-users in dialogue, listening to their needs, building relationships with them and developing trust are critical functions in the change management process, which is corroborated by Kotter’s change management framework (Ramakrishnan, 2014), which was discussed in the literature review in Chapter 2 and could take a number of months to realise. Often, end-

users do not even know what they need because there is so much developing around them without any current systems in place

It is prudent that before implementation of the system, the users are trained to become enabled to use the system effectively. As such, it is necessary to identify the training needs of the staff and the resources required for efficiency. Basic computer literacy needs are addressed first, followed by training on the system. The literature (Wirtz et al., 2012) and (Mostert-Phipps et al., 2013) supported this notion as they identified insufficient training to be a major factor that impacts adoption of end-users. This will help the conversion of explicit knowledge into tacit knowledge and will facilitate the adoption process.

After all the training has been done, the hardware and software set up, the systems implemented, and the public informed, it is beneficial to have a launch day where the system goes live. This encourages further buy-in from the users, but creates an excitement for the patients who should benefit from the system.

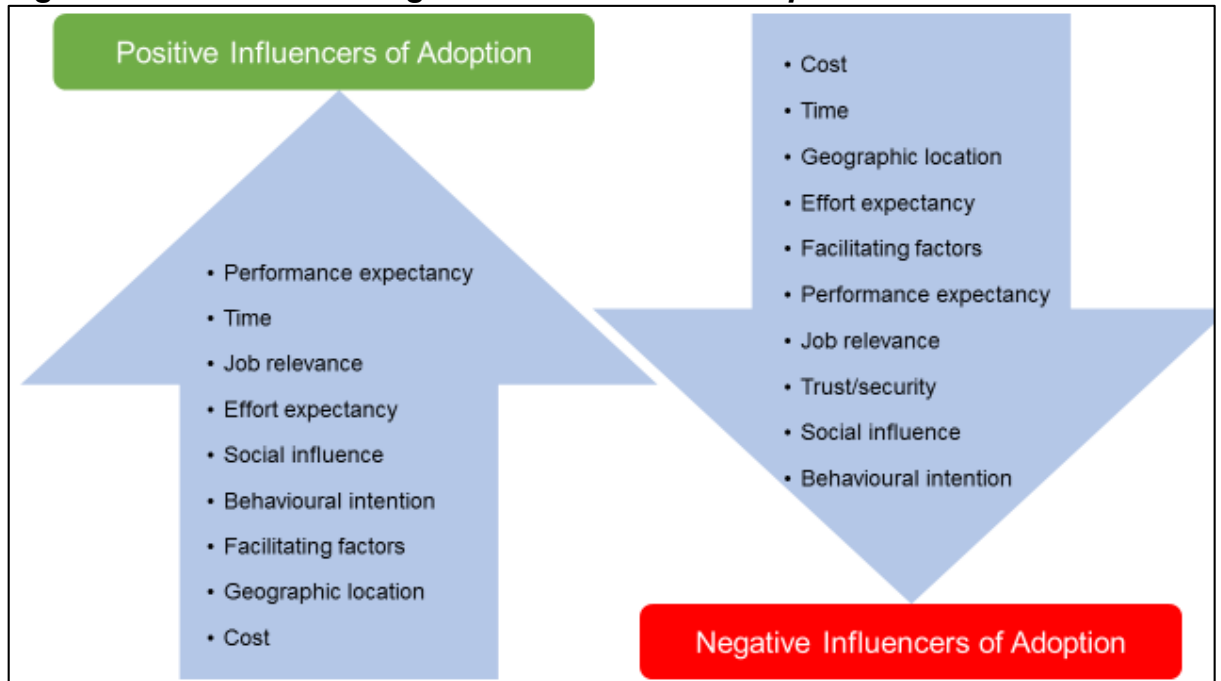
Constant monitoring and reporting is able to assess if any adjustments are required to the system. The implementers can then make these adjustments as necessary. During this time, they also meet regularly with government and build positive relationships with them. They maintain transparency of system failures and successes so that they can then adapt the system or the requirements in a partnership relationship.

The final phase is a reporting and feedback phase. This phase is beneficial to all stakeholders. For the implementers, it provides opportunities to understand how the system is being perceived, used and what changes are required. For government, it is an opportunity to obtain reports on what is happening in the clinics, and for the end-users it is also an opportunity to monitor and evaluate themselves and the system.

### **6.3.1 Factors effecting the adoption of Electronic Health Records**

Literature highlights the disparities in adoption of EHR based on geographic location, resource constraints, organisational complexity, a less favourable business case for adoption and lack of expertise necessary to integrate EHR into practice workflow (King et al., 2013). This notion was shared by the SMEs and end-users; however, other constructs pertinent in the technology acceptance model came to light such as performance expectancy.

**Figure 16: Positive and Negative Influencers of Adoption**



The overlap that was apparent was found to be as a result of differing perceptions of elements within each of the factors that could affect the adoption of the EHR systems. In other words, one factor could be found to be positive by some respondents and the same factor could be seen as negative by other respondents as each respondent identified with the factor in a different way. Cost and geographic location are factors that overall have a negative effect on the ease of adoption of the system and performance expectancy has an overall positive effect on adoption.

The geographic location of the healthcare facility was considered potentially to be a positive or negative influence on adoption, depending on where the facility was located. Generally speaking, facilities in the urban areas would find it far easier to adopt an electronic system than those in rural areas, which again speaks to the contagion effect. The barriers, especially in the rural areas, are centred on access to and reliability of continuous electricity supply as well as access to and speed of internet connections. In addition, maintenance and service of the system are challenges in some rural areas where the ease of access to the clinics is limited due to the non-existence of road networks.

The attitude of the users towards using an electronic system was considered to be highly important in the adoption of such a system. The respondents indicated that the adoption will be successful where there is enthusiasm from those who will be using the

system. In order to build enthusiasm, the users need to understand what the benefits of the system will be to them.

The biggest challenge, therefore, is in understanding who is resistant to the EHR and why this is the case. The respondents indicated that usually the doctors are the ones who do not want the system implemented. This was corroborated by literature done by (Wirtz et al., 2012). There was a lot of speculation around the reasons for this, including the perception that the doctors often have other jobs and do not spend enough time in the healthcare facility looking after patients, as they should be doing, so they do not want a system that will monitor their work. Another speculation is that healthcare workers do not want to learn to type or capture data as this is not relative to their original roles.

The electronic system potentially could be obtrusive as believed by some of the health practitioners. They feel that with the paper files, they are able to engage with the patient while they are taking notes. Having a computer in front of them creates a barrier or distance between the doctor or nurse and the patient. In addition, there are some who are concerned about the security of the system and who will be able to access patient records.

There were mixed feelings about the effect of social influences on adoption of the system. It was clear that peer pressure drives adoption, but as much as it drives adoption, it can also hinder adoption. There are those groups that will take up the electronic system with open arms and drive it; and there are those that will sit back and watch what happens. From the public's perspective, the community will react to the system as a reflection of how the healthcare practitioners embrace it. They trust their local nurses and doctors and will not accept the system if these people do not show favour towards it.

#### **6.4 Discussion for Research Question 3**

##### **Research Question 3: How can the use of an integrated HIT network be beneficial to primary healthcare in SA?**

The respondents provided their opinions on the perceived benefits of HIT systems for the users of the system, the healthcare facilities, the patients and even government. Numerous benefits were discussed, indicating that HIT systems are believed to be

beneficial for the healthcare industry. An integrated HIT network would link all healthcare facilities in the country to each other.

It can be postulated that by linking all healthcare facilities to each other the benefits already perceived to occur with HIT systems, would still be the case, but to a larger degree. This implies that improved patient care and service delivery, cost savings, time efficiencies and the sharing of information would all become even bigger benefits.

For government, the access to information on an aggregated level would be beneficial for monitoring and control of healthcare services. It would provide details on the throughput of patients and the occurrences of diseases. It would allow government to monitor the efficiencies of the various facilities. It would alert government to any trends in the public health area that may need further attention. With the aggregated data and reports, government will be able to plan resources for the existing facilities, in the most effective manner. In addition, required new facilities may be needed to address the size of the population and the reporting from the system will provide relevant information for government to make the right decisions on where to place these facilities and resources. Besides being able to plan better, the integrated IT system would allow for better monitoring and control of facilities. Through trending data, government can assess if there are underperforming facilities that require further investigation. These facilities may be in need of additional resources or new additions. However, with an integrated HIT system, cost- and time efficiencies should occur so all facilities should be able to service more patients than before.

Stock management and control is another advantage of an integrated system. The reports will indicate where the facilities are short stocked so as to address this for the benefit of the patients. The management of stock, such as medication, will also ensure that the usage of medication is not abused. In essence, an integrated HIT system will improve patient care, with the ability to put more patients through the facilities due to time efficiencies, and to supply additional resources due to cost savings.

**Figure 17: Diagram to illustrate the process flow to effective implementation of HIT/EHR**

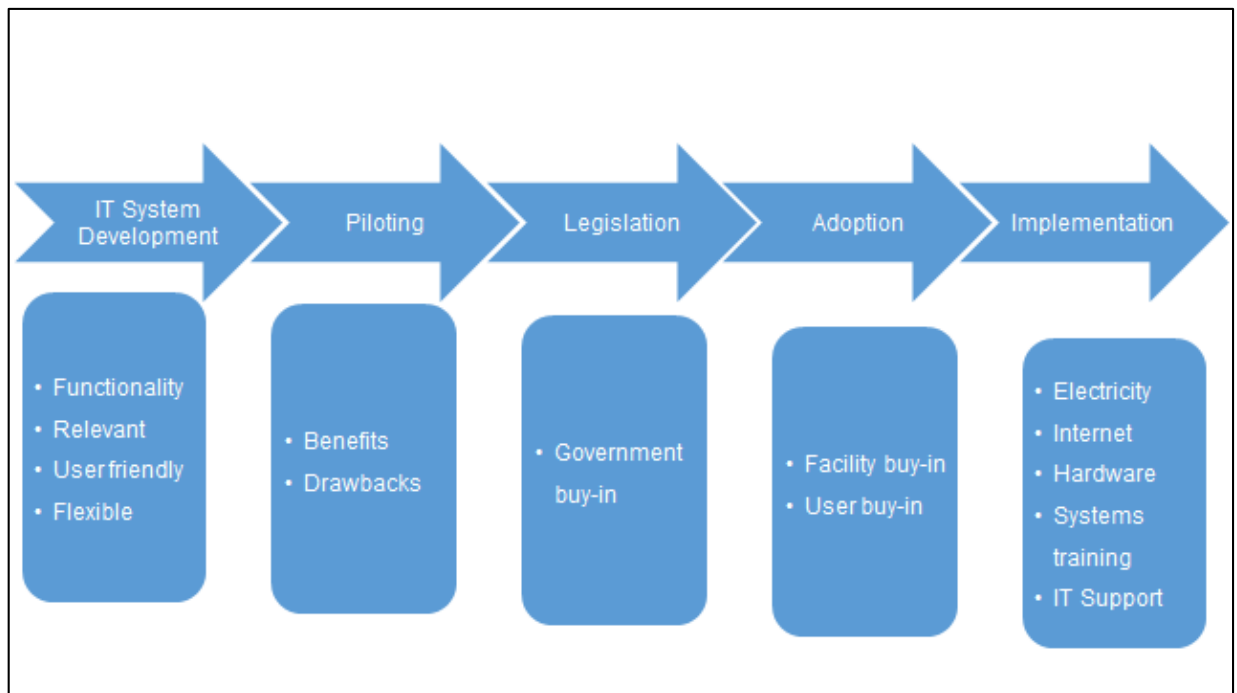


Figure 17 above presents a process flow diagram to aid the implementation of EHR in primary healthcare facilities which was created from the findings of the interviews in chapter 5. Effective implementation of EHR requires firstly the necessary IT system development (hardware and software). The content of the EHR should be functional, relevant (with built in prompts), user friendly (health experts are not IT experts) and flexible (to allow for tweaks or changes to the system). The next phase is piloting the EHR in a few facilities to test if the system is compatible with the primary healthcare facility. During this phase someone should be present at the facility to assess the benefits and drawbacks of using the system. Should any challenges be encountered at this stage it is important to go back to phase one. Phase three involves getting government buy-in to legislate the use of the system. There are various systems in the market and it is important that the systems talk to one another. Once phase three has been signed off the adoption phase kicks in which requires facility buy-in and user buy-in. It is crucial to involve them in the decision making process as this may cause a lack of adoption. Thereafter is the implementation phase, in this phase the facility must be assessed to check if adequate resources are in place (electricity, internet, hardware and IT support) furthermore implementation requires adequate training and incentivisation (intrinsic and or extrinsic) of staff to adopt.

## CHAPTER 7: CONCLUSION

### 7.1 Introduction

This study explored the end-user and SME perspective of EHR in primary healthcare. The previous chapter discussed the research findings in the context of existing literature on Electronic Health Records, the key benefits, adoption factors and implementation as well as how and why an integrated EHR system can be beneficial. This chapter will briefly review the background to the research problem and objectives set at the outset of the project, before summarising the main findings, outlining some recommendations, considering the limitations of the research and implications for future research and providing a conclusion to the research report.

### 7.2 Research Background and Objectives

The state, private companies and non-governmental organisations are examining means of improving healthcare delivery within their constrained resources. If technology can be deployed to reduce time-consuming tasks, this will allow medical practitioners to focus their efforts on patient care. Electronic Health Records (EHR) is one such initiative that promises to utilise technology to reduce the human workload needed to deliver efficient care.

The main aim of the study is to establish the end-user perspective of EHR as well as the subject matter experts' perspective regarding implementation of EHR in order to suggest best practices for adoption and implementation of EHR in the primary healthcare system of South Africa.

The specific objectives of this research are to investigate:

- (i) The end-users' and subject matter experts' opinions on the perceived benefits of EHR in primary healthcare;
- (ii) The end-users' and subject matter experts' opinions on the perceived barriers to adoption of EHR in primary healthcare;
- (iii) If the use of an integrated HIT network would be beneficial to primary healthcare in SA;
- (iv) If there is any alignment between SME and end-user perspectives of EHR in primary healthcare.



### 7.3 Main Findings

Sixteen in-depth interviews were conducted which were broken into eight interviews with end-users from three NGO clinics and eight interviews with subject matter experts (SMEs) from five different companies. The interviews were conducted to test research questions that were derived from the literature review.

The results show that the benefits of EHR, which could be classified into benefits for government, end-users, patients and SMEs build a solid case for broad-scale implementation of EHR in primary healthcare facilities. It is thus legitimate to view the EHR as a strong, non-human super-actor that brings various stakeholders in engagement. To this extent collaboration and the Network Theory, which were discussed in Chapter 2, become pertinent. However, the true benefits of EHR were not demonstrated to end-users as there was some lack of understanding of all benefits to end-users. The findings show that end-users perceived it to double their work time because of the necessity to have to implement and learn a new system. This may be attributed to the fact that EHR is in the pilot phase and paper-based records have to be run concurrently with EHR for some time, thus the time saved can only be realised once the transition to EHR as the sole mode of record keeping has been implemented.

With regards to adoption the top three factors which impacted adoption positively was the performance expectancy- that it will help an individual attain gains in performance, time- this perception is that a good EHR should save the end-user time in order for them to adopt it and lastly it should be relevant to their job. The top three factors which impacted adoption negatively were the cost of using the system (too expensive), time- the negative perception was that it can double the workload to deliver care and geographic location of the facility, where rural clinics lacked infrastructure and accessibility which tied to facilitating factors and this was seen to affect adoption negatively.

Overall there was favourable alignment between the SME and end-user perspectives regarding adoption as the one SME stated: "The end goal is to see a happy smiling patient." This shows that the prerogative of both end-users and SME's is the patient. However, a misalignment between the 2 groups was the issue of training- SMEs believed that they implement effectively and follow a hand-holding process to guide the end-user to use the EHR and end-users believed that they were dumped with a system with no training or guidance as to how to use the system.

### 7.3.1 Implications for management

The results may be helpful for management seeking to implement EHR, which should be informed by the macro context and micro-context of each individual clinic. The macro-context would be the policies and guidelines regarding eHealth such as the National Health Normative Standards Framework governing inter-operability and compatibility in eHealth. The micro context would be taking into account stakeholder needs. Management should also be cognisant of the role of EHR as part of an interacting system that can bring various stakeholders together in engagement and should attempt to align the stakeholder goals around the technology systems for rapid adoption and impact.

Inadequate training of staff is a major barrier to adoption, and training needs to occur through a step-wise approach by first assessing the needs of each facility. A one-size-fits-all approach for implementation is not possible. Furthermore, end-users lacked administrative knowledge and often computer literacy and wished to remain with their sole focus on their own 'real' job. Thus, change management structures need to evolve for implementation of EHR. All stakeholders require long-term commitment and a change in organisation structure may be required.

Effective EHR implementation is a lengthy process and it is therefore important to engage in the on-going assessment of users to investigate if the full impact of EHR is being derived. This will prompt well-timed interventions to address gaps or barriers to adoption.

### 7.3.2 Implications for academia

Today the role of ICT in various disciplines is understood; Farias and Unb (2012) stated that technology plays a key role in socio-economic and organisational development. To this effect, healthcare is no exception. This research adds to the body of research regarding adoption of EHR (Mostert-Phipps et al., 2013) with the extension into primary healthcare. This study adds to the literature (Cucciniello et al., 2015) (Ramtohul, 2015) by examining how using the resource-based view, actor-Network Theory and the Technology Acceptance Model as an interpretative framework can help to shed light on some of the challenges through which systems and processes come to be adopted

## 7.4 Recommendations for Future Research

The perception of one interviewed expert was that the poor adoption of EHR by doctors can be attributed to the fact that it leaves an audit trail and that doctors will be held

accountable for hours worked, medicines prescribed and number of patients seen. This is a potential area for future investigation and research.

Once the EHR has been rolled out, various quantifiable studies as to the perceived benefits of EHR can be conducted where, for example, actual original and reduced waiting times can be measured or a quantitative cost-versus-benefit analysis can be measured.

There was lack of knowledge and awareness by public sector end-users of the value chain involved in healthcare. Outside medical training individuals require administrative training, otherwise the full spectrum of healthcare will be poorly understood, for example how does healthcare contribute to the economy. Furthermore administrative training could be incorporated into the training/curriculum that healthcare workers across the spectrum receive.

#### **7.4.1 Healthcare facilities/clinics**

Clinics need to start engaging with patients for ongoing monitoring and feedback purposes, one such initiative was the MOMCONNECT application, which is a mobile application for pregnant mothers. The system generates prompts, which then automatically send reminders to patients for their next appointment. The same can be applied to EHR and the system can then send reminders to patients on their next appointment/follow-up visit. This has the potential to transform the health of patients as compliance of medication can be monitored, and from the patient perspective, they feel more cared for when they are engaged.

#### **7.4.2 Government**

For government, the access to information on an aggregated level would be beneficial for monitoring and control of healthcare services. It would provide details on the throughput of patients and the occurrences of diseases. It would allow the Department of Health to monitor the efficiencies of the various facilities. It would alert government to any trends in the public health arena that may need further attention. With the aggregated data and reports, government will be able to plan resources for the existing facilities, in the most effective manner. In addition, required new facilities may be needed to address the size of the population, and the reporting from the system will provide relevant information for the government to make the right decisions on where to place these facilities and resources.

Currently, various disparate systems of eHealth exist in various clinics. Government should set the policy and standards surrounding eHealth so that the various systems are interoperable and compatible. This allows for information transfer and exchange between various systems, which has the potential to lower the cost of healthcare in the country and the true potential of EHR will be realised.

#### 7.4.4 Subject matter experts

SMEs' perception is that they have their patient in mind; whilst this may be true; the SME should also keep the end-user in mind and how improvement initiatives to the end-user impact the patient of primary healthcare facilities. A happy and well-looked after (recorded) patient leads to better health outcomes.

The knowledge of end-users at the grass-roots level in terms of HIT is poor, training efforts should thus be to educate the end-users on the possible benefits the system can have if implemented correctly, getting buy-in from end-users and involvement of end-users in the decision-making process, as most end-users felt that the SMEs just dump a new system on them and expect them to cope, despite their workload, limited resources and infrastructure challenges.

#### 7.5 Limitations of Research

The primary objective of qualitative research is to let participants express their feelings regarding any existing EHR systems. There are 42 different EHR systems in the market; thus, their comments could be attributable to a specific EHR system at use in their clinic, which cannot be generalisable to all EHR systems. Thus, the generality of the results has to be restricted to these EHR systems. The different EHR systems should thus be investigated separately in a quantitative methodology to gain specific insights. Furthermore:

- EHR is still in its pilot phase;
- The sample size was too small to research the technology acceptance of EHR. Thus, data validity and reliability cannot be established, being limited to individual perceptions. This leads to the suggestion for future research;
- Ethical clearance caused limited access to public health facilities.

In a qualitative study, the results are context specific and generalisations are not possible, thus the context here is EHR in SA. However, the study is limited to one region (Gauteng) due to limitations of geographic accessibility of the researcher, and generalisation to the whole population is not possible. Gaining ethical clearance to

conduct interviews at all the primary healthcare clinics was not possible due to time constraints, so the researcher had focused on three non-governmental organisation (NGO) clinics. For wider coverage of data, more researchers and a lot more time are required for data collection.

Whilst conducting interviews with end-users, it became obvious that there was a lack of understanding by end-users of the administrative roles required of them, which could be achieved through EHR.

Conducting personal interviews is disadvantageous in some instances as there is a chance of personal bias and furthermore the informants may not answer some personal questions. Future studies could thus look at a quantitative approach to explore and validate the findings of this research in large samples. Furthermore, data collected within a limited timeframe could result in biased information that is dependent on managements' perceptions at a single point in time. This limitation could be overcome if further research is to be conducted over a lengthier future period. The researcher employed purposive/judgemental sampling so that the sample is representative of SMEs and end-users of HIT, but limited in size, thus also limited in its representativeness and reliability.

## 7.6 Conclusion

This study added depth to the importance of Electronic Health Records, a form of ICT, which can be utilised to address some of the key challenges plaguing healthcare workers in primary healthcare facilities. Critical to the success of EHR is the full adoption and change competence of managers within facilities. This study added to literature through the empirical research and provided valuable insights into effective implementation of EHR systems. Furthermore, this study has highlighted some of the major challenges faced by healthcare workers with regard to lack of inter-operability of EHR systems and suggestions regarding a pharmacy component/stock visibility solution to be integrated into EHR systems. Implementers/SMEs should always address the needs of end-users and involve them in the design lay-out and decision-making process. If co-operation between various stakeholders in the value-chain exists, value measured as positive health outcomes can be generated.

The results from this research were presented in the process model of effective implementation of EHR systems, which offers a conceptual framework to management

during times of change, and stressed the importance of ongoing monitoring and feedback. The research findings have contributed to providing a more detailed impression of addressing training needs of end-users when implementing EHR systems and provided a progressive view of change and its impact on organisations.

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## APPENDIX 1: Semi-structured interview schedule for SMEs

<b>Original Date:</b>
<b>Dates Revised:</b>

### INTERVIEW SCHEDULE

All questions contained in this questionnaire are strictly confidential and will become part of the research.

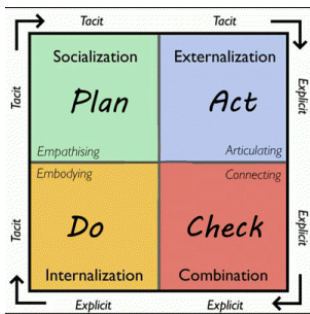
<b>Gender</b>	<input type="checkbox"/> M <input type="checkbox"/> F	<b>Age category:</b>
<b>Job Category:</b>	Medical <input type="checkbox"/> Administration <input type="checkbox"/> Management <input type="checkbox"/> Subject Matter Expert <input type="checkbox"/> Other <input type="checkbox"/> Please Specify:	
<b>Level of IT experience:</b>	Beginner <input type="checkbox"/> Intermediary <input type="checkbox"/> Expert <input type="checkbox"/>	

#### ELECTRONIC HEALTH RECORD

<b>In your opinion what are the operational efficiencies associated with EHR?</b>		
Which 3 factors do you think impact EHR adoption in primary healthcare positively	<input type="checkbox"/> performance expectancy	<input type="checkbox"/> Behavioural intention
	<input type="checkbox"/> effort expectancy	<input type="checkbox"/> geographic

		location
	<input type="checkbox"/> Social influence	<input type="checkbox"/> facilitating factors
	<input type="checkbox"/> time	<input type="checkbox"/> cost
	<input type="checkbox"/> job relevance	Other (specify):
Which 3 factors do you think impact EHR adoption in primary healthcare negatively	<input type="checkbox"/> performance expectancy	<input type="checkbox"/> Behavioural intention
	<input type="checkbox"/> effort expectancy	<input type="checkbox"/> geographic location
	<input type="checkbox"/> Social influence	<input type="checkbox"/> facilitating factors
	<input type="checkbox"/> time	<input type="checkbox"/> cost
	<input type="checkbox"/> job relevance	Other (specify):

**Could you elaborate on any formal training you implement as to how to use Electronic Health Records?**



**What are some of the challenges/barriers of EHR and the implementation thereof?**

<p><b>Do you feel that EHR has led to the desired performance expectancy in primary healthcare?</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"> <input type="checkbox"/> Yes         </td> <td style="width: 50%; text-align: center;"> <input type="checkbox"/> No         </td> </tr> </table> <p><b>Why?</b></p>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Yes	<input type="checkbox"/> No	
<p><b>Do you feel that EHR has led to the desired effort expectancy in primary healthcare?</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"> <input type="checkbox"/> Yes         </td> <td style="width: 50%; text-align: center;"> <input type="checkbox"/> No         </td> </tr> </table> <p><b>Why?</b></p>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Yes	<input type="checkbox"/> No	
<p><b>To what extent does social influence play a role in EHR adoption?</b></p>		
<p><b>To what extent does the geographical location play a role in EHR adoption?</b></p>		
<p><b>To what extent does the behavioural intention play a role in adoption?</b></p>		
<p><b>To what extent do facilitating factors play a role in adoption?</b></p>		
<p><b>What is important for you as a subject matter expert for a EHR to capture?</b></p>		
<p><b>Do you feel that the implementer and end-user perspectives are aligned?</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"> <input type="checkbox"/> Yes         </td> <td style="width: 50%; text-align: center;"> <input type="checkbox"/> No         </td> </tr> </table> <p><b>Why?</b></p>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Yes	<input type="checkbox"/> No	

**As an SME, how do you facilitate the adoption of EHR in primary healthcare?**



**Do you have any closing remarks that you believe will contribute to the research findings?**



## **Interview schedule for end-users:**

### Proposed Interview Questions:

1. Can you tell me a bit about your background?
2. What is important for you as an end-user for an Electronic Health Record to capture?
3. Could you elaborate on any formal training you received as to how to use the system?
4. Based on your experiences, do you feel that IT systems such as Electronic Health Records and Electronic Medical Records have reduced patient waiting times? Was this measured? On what basis have you given this answer?
5. In your opinion, has EHR improved decision making?
6. In your opinion what determines the failure of EHR?
7. Which system/software package are you currently using? Can you take me through the system? (Measured by time to complete task, error rates)

Given the nature of the research, the author is cognisant of the need to be tactful, sensitive and respectful in the approach. It will also be vital to actively listen to responses and be aware of the respondent's body language in order to facilitate follow up / probing questions during the interview process

## APPENDIX 2: Thematic Analysis

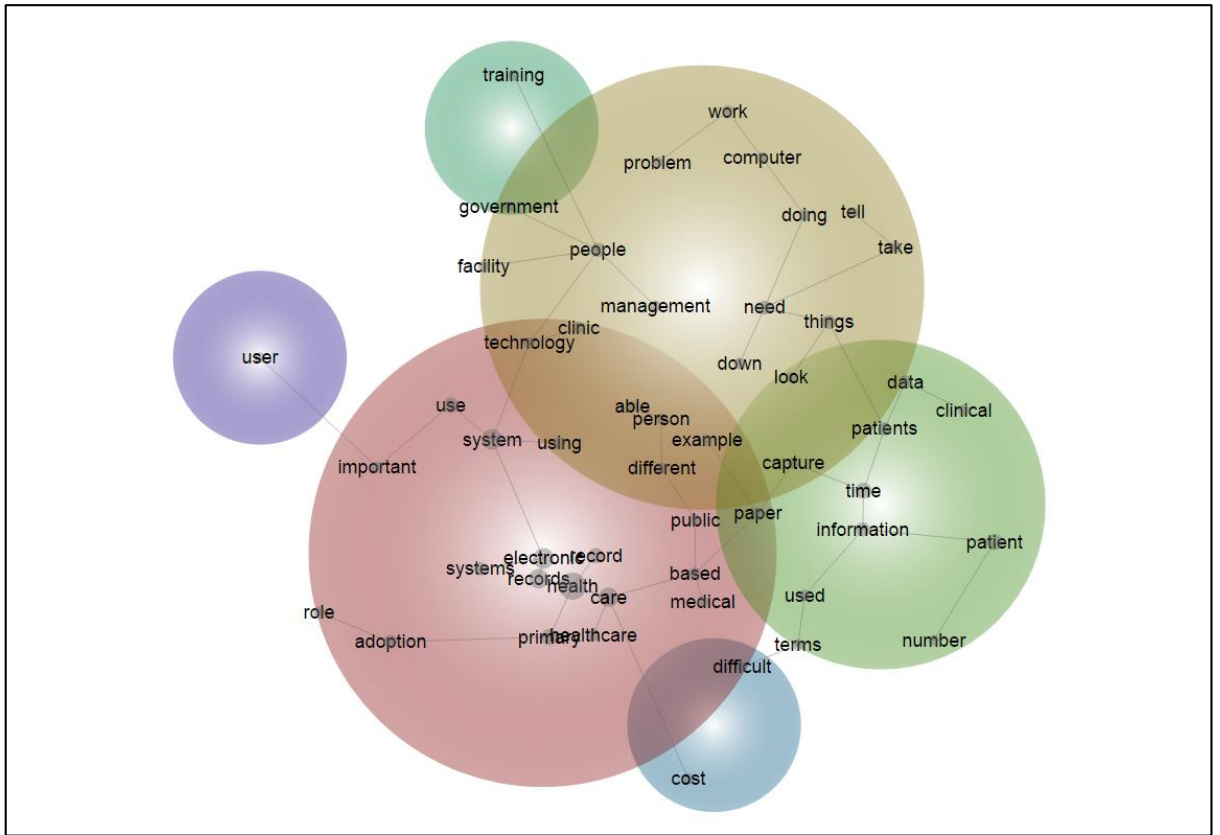
### Themes and related concepts

Below are the most important themes and their connectivity<sup>1</sup> (Table 1), together with a list of the concepts contained in this research study (Table 2).

Table 1

100% theme display		75% theme display		50% theme display		25% theme display	
Theme	Connectivity	Theme	Connectivity	Theme	Connectivity	Theme	Connectivity
<a href="#">health</a>	100%	<a href="#">health</a>	100%	<a href="#">health</a>	100%	<a href="#">health</a>	100%
<a href="#">patient</a>	56%	<a href="#">patient</a>	44%	<a href="#">time</a>	45%	<a href="#">system</a>	34%
<a href="#">training</a>	07%	<a href="#">training</a>	02%	<a href="#">patient</a>	27%	<a href="#">time</a>	31%
		<a href="#">government</a>	01%	<a href="#">facility</a>	11%	<a href="#">paper</a>	25%
				<a href="#">role</a>	07%	<a href="#">information</a>	23%
				<a href="#">training</a>	02%	<a href="#">terms</a>	19%
						<a href="#">adoption</a>	14%
						<a href="#">patient</a>	13%
						<a href="#">people</a>	12%
						<a href="#">work</a>	11%
						<a href="#">problem</a>	06%
						<a href="#">systems</a>	06%
						<a href="#">take</a>	05%
						<a href="#">training</a>	03%
						<a href="#">cost</a>	03%
						<a href="#">government</a>	02%
						<a href="#">user</a>	02%

### Concept Map of all pertinent codes



## APPENDIX 3: Ethical clearance approval letters

### **Gordon Institute of Business Science** University of Pretoria

Dear Susan Thomas

Protocol Number: **Temp2015-01966**

Title: **The role of Healthcare Information Technologies in cost containment and total quality improvements in a NHI era**

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

Please ensure that the faculty of Health Sciences also provides approval before data collection commences.

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

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 20 Oct 2016.
- IRB 0000 2235 IORG0001762 Approved dd 22/04/2014 and Expires 22/04/2017.



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YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Comm

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### Endorsement Notice

**Ethics Reference No.: Temp2015-01966**

**Title:** The role of Healthcare Information Technologies in cost containment and total quality improvements in a NI era

Dear Susan Thomas

The **New Application** as supported by documents specified in your cover letter for your research received on the 5/10/2015, was approved, by the Faculty of Health Sciences Research Ethics Committee on the 8/10/2015.

Please note the following about your ethics approval:

- Please remember to use your protocol number (**Temp2015-01966**) 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, request 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

**Dr R Sommers**; MBChB; MMed (Int); MPharMed.

**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 2004 (Department of Health).*

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